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INDEX TO VOLUME XV

(1) INDEX TO SUBJECTS

* For an index to their principal genera, see pages 101-102.

(2) INDEX TO AUTHORS

DATES OF PUBLICATION

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E R R A T U M S L I P

The title of the paper by -

L. R. Richardson, appearing in the

Australian Zoologist, Vol. xiv. Part 3.

should read :-

"OBSERVATIONS ON THE AUSTRALIAN LAND-LEECH
CHTONOBDELLA LIMBATA" (Grube 1866)

THE AUSTRALIAN ZOOLOGIST

VOL. XV PART I

A CHECK-LIST OF THE FISHES RECORDED FROM THE NEW ZEALAND REGION

By Gilbert P. Whitley

(Figures 1-2)

> *An accurate and complete illustrated catalogue of the New Zealand fishes is the most urgent zoological want of this country.*—G. M. Thomson and T. Anderton, *Bull. N.Z. Board of Science and Art* ii, 1921, p. 67.

> *An up-to-date check list of the New Zealand fishes is urgently required. One has only to attempt a paper of this kind to find out the confusion that exists at present.*—Maxwell Young, "Marine Fauna of the Chatham Islands", *Trans. N.Z. Inst.* lx, 1929, p. 138.

In any mapping of the world's resources, the fish-fauna claims its share of attention. The first step in understanding the fishes of a region is to list the known species in order of scientific classification; after that, descriptive and illustrated catalogues can be prepared. The older countries have long ago reached the latter stage, but Australasia lags behind in this stocktaking. The fishes of the waters to the north of Australia (many of which may enter our warmer seas) were dealt with in Weber & Beaufort's *Fishes of the Indo-Australian Archipelago,* started in 1911 and recently terminated. Papuan fishes have been catalogued by Munro (*Papua N. Guin. Agric. J.,* x, 1958, p. 97) and keyed and illustrated in his *The Fishes of New Guinea* (1967). The vast area of Oceania was covered by H. W. Fowler (*Mem. Bishop Mus.,* Honolulu, x, 1928, and later supplements). McCulloch (*Austr. Mus. Mem.* v, 1929-30) supplied a check-list of the fishes recorded from Australia and a later name-list was provided by the present writer (*Proc. Linn. Soc. N.S.Wales* lxxxix, 1964, p. 32). Several papers by Waite dealt with the fishes of the outlying Lord Howe and Norfolk Islands. The Antarctic fish-fauna was marshalled into order by Norman (*Discovery Rept.* xviii, 1938) and is presently under active review by American and Russian scientists. Thus, if the Australasian gap can be filled, we shall have a fair idea of what fishes are known from quite a large area of the globe.

Many of Australia's species of food- and other fishes were first discovered in New Zealand, so one fauna cannot reasonably be studied without reference to the other. Sometimes New Zealand and Australian biologists have independently investigated life-histories without realizing that, in their insularity, they were dealing with the same kind of fish; e.g. the spawning and young stages of the Porae of New Zealand and the commercially valuable Morwong of Australia have been treated as if the two were almost families apart, whereas they belong to the same species, *Nemadactylus douglasii,* a synonymy independently arrived at by Moreland in Wellington and myself in Sydney.

An excellent bibliography of New Zealand fishes was written by W. J. Phillipps (*N. Zeal. Mar. Dept. Fisher. Bull.,* i, 1927). In later years, so many fresh species have come to light, notably from deep sea expeditions, and have been recorded in such scattered publications, and there have been so many nomenclatural modifications, that a modern list became imperative. A

preliminary name-list appeared as an appendix in the second edition (1956) of D. H. Graham's *Treasury of New Zealand Fishes,* without references to literature.

The present paper lists all the known salt- and freshwater fishes of New Zealand, the Kermadecs, Campbells, Auckland and Chatham Islands and Macquarie Island, so as to bridge the gap on the "map" of the fish-fauna foreshadowed in the first paragraph. Introduced and fossil fishes have been excluded. The style follows very closely that of McCulloch's Australian check-list. The original reference to every genus and species is given with as exact a date of publication for each as can be determined. The type-locality of every species and the type-species of each genus is stipulated. Only New Zealand synonyms are included, because long extralimital synonymies would only overburden the list, but an exception is occasionally made in the case of a synonym of special importance, such as one not previously reported. Families, genera and species are listed under Classes. Ordinal and subordinal groups have been omitted to save superfluity; these can be obtained, if required, from Jordan's (1923), Berg's (1940), Golvan's (1962) or Norman's (1966) well-known Classifications of Fishes and the phyletic studies of Greenwood *et al.* (*Bull. Amer. Mus. Nat. Hist.* cxxxi (4), 1966).

Diacritical marks have been omitted for simplicity.

I was privileged to see at the British Museum (Natural History) the zoological manuscripts and drawings made during Cook's voyages to New Zealand. Most of these are still unpublished though they deal with the type-material of classic authors such as Forster, Gray and Richardson. As this goes to press, the announcement has been made that forty of the drawings of fishes from Captain Cook's Voyages are to be published by the Trustees of the British Museum (Journ. Roy. Austr. Hist. Soc. liv, 2, 1968, p. 213). The librarians of the Australian Museum and the Mitchell Library, Sydney, made accessible many volumes, some of them very rare books. When opportunity offered, specimens from New Zealand were examined and several enjoyable visits were made to New Zealand for field and laboratory experience. There is still much work to be done, not only in identifying and recording new species from the Dominion but in confirming the records of past authors. Phillipps' 1927 *Bibliography* dealt with 306 New Zealand and subantarctic species. The present list exceeds 500. Part of the increase is due to the larger area covered, but more especially to the recent development of our knowledge of deepsea and pelagic fishes as a result of oceanographical expeditions, and dredging by Professor L. R. Richardson's associates, and of littoral forms found and photographed by skin-divers. Research on freshwater fishes (*Galaxias, Retropinna* and *Gobiomorphus*) has also disclosed new forms in latter years. It will be noticed that, in this list, there are recorded from New Zealand many marine species whose type-localities are European. Even in Europe, subspecies of some of these species are recognized, so critical comparison of New Zealand and Old World specimens might reveal differences sufficient to justify nomenclatural separation.

Gerhard Krefft of Hamburg (grand-nephew, by the way, of his namesake who discovered the Queensland Lungfish) has pleaded for a more modern approach by European ichthyologists to the taxonomy and nomenclature of the marine fishes of Europe and suggests the preparation of an up to date check-list of European sea fishes (Krefft, *Archiv fur Fischereiwiss.*, vi, 1955, pp. 1-10). Such a work would be of much interest to us in the Antipodes.

Difficulty has been experienced in tracing the results of Russian, Japanese and other scientific expeditions visiting New Zealand waters in recent years. Sometimes, neozelanic records are hidden amongst masses of localities referred to by station-numbers or by latitudes and longitudes, which must be laboriously plotted by anyone anxious to keep the New Zealand list

constantly up to date. I am not so sanguine as to expect that I have netted all these records and would be glad to learn of any omissions.

No new names have been proposed in this Check-list, but the following items may be noteworthy:

(1) *Logotypes* (i.e. designations of type-species of genera):
Emissola (*Squalus mustelus*).
Somnolentus (*Somniosus brevipinna*).
Polyprionum (*Amphiprion americanus*).

(2) *New synonyms* (the second item in each equation is the valid name):
Somnolentus = *Somniosus.*
Raia areata = *Arhynchobatis asperrimus.*
Muraenichthys breviceps halituna = *M. b. acus.*
Trachurus novaezelandiae = *T. clupeoides.*
Benthodesmus = *Scarcina.*
Ophioclinus venusta = *Ericentrus ruber.*

(3) *Species newly recorded* from the New Zealand region:
Myctophum phengodes, Lepidion microcephalus, Anthias pulchellus, Scepterias lenimen, Parma microlepis, Yerutius phasis and *Liosaccus aerobaticus,* apart from some unidentified or unnamed species.

(4) Several refinements in the exactitude of *type-localities* of some species or their synonyms will be evident, and there are several new *combinations.*

ACKNOWLEDGMENTS

My acknowledgments for assistance are gratefully tendered to the librarians of the British Museum (Natural History), London, the Australian Museum, the Linnean Society of New South Wales and the Mitchell Library, Sydney, the National Library, Canberra, and the Royal Society of South Australia, Adelaide, for access to books and scientific papers. In New Zealand, the Public Libraries of Wellington and Christchurch, the Museums of Auckland, Wellington, Christchurch and Dunedin; the Alexander Turnbull Library, Wellington; the Edward Percival Marine Laboratory at Kaikoura and the Portobello Aquarium have yielded valuable information, for which I thank them. Miss June Paul, formerly of the Australian Museum, and Mrs. M. Frewer kindly typed most of the manuscript.

Phylum CHORDATA
Section ACRANIA
Class LEPTOCARDII
Family EPIGONICHTHYIDAE
Genus ZEAMPHIOXUS

Zeamphioxus Whitley, Austr. Zool. vii, 3, Sept. 15, 1932, p. 264. Orthotype, *Heteropleuron hectori* Benham.

ZEAMPHIOXUS HECTORI
Lancelet

Heteropleuron hectori Benham, Trans. N.Z. Inst. xxxiii, July 1901, p. 121, pl. i. East Coast, North Island of New Zealand.

Section CRANIATA
Class MARSIPOBRANCHII
Family EPTATRETIDAE
Genus EPTATRETUS

Eptatretus Cloquet, Dict. Sci. Nat. (Levrault) xv, 1819, p. 135. Logotype, *Gastrobranchus dombey* Latreille, Nouv. Dict. Hist. Nat., ed. 1, xxiv, 1804, Poiss., p. 73 (the earliest latinization of Lacepede's vernacular). Genus also spelt *Heptatretus,* etc. by authors.

Homea Fleming, Philos. Zool. ii, May 1822, p. 374. Haplotype, *H. banksii* Fleming, based on "Animal from the South Seas" of E. Home, Philos. Trans. Roy. Soc. Lond. 1815, p. 258, pl. xii, fig. 1.

Heptatrema Voigt, Thierreich (Cuvier) ii, 1832, p. 529, *ex* Dumeril, MS. Haplotype, *Myxine* (*Heptatrema*) *dombey* Voigt = *dombey* Latreille. Also spelt *Heptatremus* by Swainson, 1839.

Bdellostoma Muller, Vergl. Anat. Myxin. 1835, pp. 2 & 16. Logotype, *B. hexatrema* Muller.

Hexabranchus Schultze, Isis (Oken) 1836, p. 757. Haplotype, *H. lichtensteinii* Schultze, *fide* Sherborn, Index Anim. Preoccupied in Mollusca by *Hexabranchus* Ehrenberg, 1831.

EPTATRETUS CIRRHATUS
Hagfish, Blind Eel

Petromyzon cirrhatus Bloch & Schneider, Syst. Ichth. 1801, p. 532. "Ex mari alluente insulam australem novae Zeelandiae" (Forster).

Homea banksii Fleming, Philos. Zool. ii, May 1822, p. 375. South Seas (Banks); based on "Animal of the South Seas" Home, Philos. Trans. Roy. Soc. Lond. 1815, p. 258, pl. xii, fig. 1. "South Seas" [= New Zealand].

Bdellostoma heptatrema Muller, Vergl. Anat. Myxinoiden 1835, p. 7. New Zealand.

Bdellostoma forsteri Muller, Vergl. Anat. Myxin. 1835, p. 16; Arch. Naturg. ii, 2, 1836, p. 249. Based on *Petromyzon cirrhatus* Bloch & Schneider, New Zealand.

Family MYXINIDAE
Genus NEOMYXINE

Neomyxine L. R. Richardson, Trans. Roy. Soc. N. Zeal. lxxxi, Dec. 1953, p. 379. Orthotype, *Myxine biniplicata* Richardson & Jowett.

NEOMYXINE BINIPLICATA
Hagfish

Myxine biniplicata L. R. Richardson & Jowett, Zool. Publ. Vict. Univ. Coll. (Wellington) no. 12, 1951, p. 1, figs. 1-3. Cook Strait.

Genus NEMAMYXINE

Nemamyxine L. R. Richardson, Trans. Roy. Soc. N. Zeal. lxxxv, May 1958, p. 283. Orthotype, *N. elongata* L. R. Richardson.

NEMAMYXINE ELONGATA

Nemamyxine elongata L. R. Richardson, Trans. Roy. Soc. N. Zeal. lxxxv, May 1958, p. 283, figs. 1-8. Kaituna River, Bay of Plenty.

Family GEOTRIIDAE
Genus GEOTRIA

Geotria Gray, List. Spec. Fish. Brit. Mus. i, Chondropt, prefaced July 25, 1851, pp. 137 & 142. Haplotype, *G. australis* Gray.

GEOTRIA AUSTRALIS
Lamprey; Korokoro, Piharau kanakana (S. Island)

Geotria australis Gray, List. Spec. Fish. Brit. Mus. i, Chondropt., pref. July 25, 1851, p. 142, pl. ii. "River Inkar pinki, South Australia". Type in British Museum.

Geotria allporti Gunther, Proc. Zool. Soc. Lond., June-Dec. 1871, p. 675, pl. lxx. Tasmania. Type in British Museum.

Geotria saccifera Regan, Ann. Mag. Nat. Hist. (8) vii, Feb. 1, 1911, p. 196 Otago. Type in British Museum.

Subphylum PLAGIOSTOMATA
Class ELASMOBRANCHII
Family HETERODONTIDAE
Genus HETERODONTUS

Heterodontus Blainville, Bull. Soc. Philom. viii, Aug. 1816, p. 121. Haplotype, *Squalus philippi* Bloch & Schneider.

HETERODONTUS PORTUSJACKSONI
Port Jackson Shark

Squalus portusjacksoni Meyer, Zool. Entdeck., 1793, p. 71. Port Jackson, New South Wales.

Heterodontus portusjacksoni Moreland, Rec. Domin. Mus. iii, 1956, p. 9.

Family HEPTRANCHIIDAE
Genus NOTORYNCHUS

Notorynchus Ayres, Proc. Calif. Acad. Sci. i, 1855, p. 73; ed. 2, 1873, p. 77. Haplotype, *N. maculatus* Ayres.

NOTORYNCHUS CEPEDIANUS
Seven-gilled Shark

Squalus cepedianus Peron, Voy. Austr. i, 1807, p. 337 and Voy. Terres Austr., ed. 2, ii, 1824, p. 218. Adventure Bay, Tasmania (Baudin's Exped.).

Genus HEPTRANCHIAS

Heptranchias Rafinesque, Caratt. n. gen. sp. Sicil., 1810, p. 13. Haplotype, *H. cinereus* (Lacepede) = *perlo* Bonnaterre.

HEPTRANCHIAS DAKINI
One-finned Shark

Heptranchias dakini Whitley, Austr. Zool. vi, 1931, p. 310. Off Cape Everard, Victoria.

Genus HEXANCHUS

Hexanchus Rafinesque, Caratt, n. gen. sp. Sicil., 1810, p. 14. Haplotype, *Squalus griseus* Lacepede = Bonnaterre.

HEXANCHUS GRISEUS
Six-gilled Shark

Squalus griseus Bonnaterre, Tabl. Encycl. Meth. Ichth., 1788, p. 9. Mediterranean. *Id.* Gmelin, Syst. Nat. (Linn.), ed. 13, i, 1789, p. 1495.

Family SCYLIORHINIDAE
Genus CEPHALOSCYLLIUM

Cephaloscyllium Gill, Ann. Lyc. Nat. Hist. N. York vii, 1862, pp. 407 & 412. Orthotype, *Scyllium laticeps* Dumeril.

CEPHALOSCYLLIUM ISABELLA
Swell Shark, Draughtsboard Shark; Carpet Shark.

Squalus isabella Bonnaterre, Tabl. Encycl. Meth. Ichth., 1788, p. 6. "La Mer du Sud" = New Zealand.

Scyllium ? lima Richardson, Rept. 12th. meet. Brit. Assn. Adv. Sci. 1842 (1843), p. 29. Ex *Squalus lima* Parkinson, MS. Eaheenomauwee [i.e. North Island of] N.Z.

?Scyllium chilense Steindachner, Denkschr. K. Akad. Wiss. Wien, lxx, 1900 (1901), p. 519. French Pass. Not of Guichenot in Gay, Chili (Peces), 1849, p. 362, from Chile.

Family GALEORHINIDAE
Genus NOTOGALEUS

Notogaleus Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 310. Orthotype, *Galeus australis* Macleay.

NOTOGALEUS RHINOPHANES
School Shark, Tope.

Squalus rhinophanes Peron, Voy. Austr. i, 1807, p. 337; Voy. Terres Austr. ed. 2, ii, 1824, p. 218. Adventure Bay, Tasmania.

Galeus australis Macleay, Proc. Linn. Soc. N.S.Wales vi, 2, Sept. 12, 1881, p. 354. Port Jackson.

Family TRIAKIDAE
Genus TRIAKIS

Triakis Muller & Henle, Mag. Nat. Hist. (Charlesworth) ii, 1838, p. 36. Logotype, *T. scyllium* Muller & Henle.

TRIAKIS ATTENUATA
Slender Smooth Hound Shark

Triakis attenuata Garrick, Trans. Roy. Soc. N.Z. 3, Nov. 1954, p. 695, figs. 1-2. Off Kahu Rocks, N.E. of Cape Palliser; 120 faths.

Family GALEIDAE
Genus GALEOLAMNA

Galeolamna Owen, Descr. Cat. Osteol. Roy. Coll. Surg. i, 1853, p. 96, no. 427. Haplotype, *G. greyi* Owen.

Galeolamnoides Whitley, Mem. Qld. Mus. x, 4, June 30, 1934, pp. 185 and 191. Orthotype, *Carcharias macrurus* Ramsay and Ogilby.

GALEOLAMNA MACRURUS
Whaler

Carcharias macrurus Ramsay and Ogilby, Proc. Linn. Soc. N.S.Wales (2), ii, 1887-1888, pp. 163 and 1024, Port Jackson, N.S.Wales.

Note: Probably this is the species recorded under various names from N.Z. by early authors: *melanopterus, maou, carcharias,* &c.

GALEOLAMNA BRACHYURUS
Bronze Whaler

Carcharias brachyurus Gunther, Cat. Fish. Brit. Mus. viii, 1870, p. 369. N.Z. (Sir J. Ross); "Antarctic Expedition" and "Australia".

Genus PRIONACE

Prionace Cantor, Journ. Asiat. Soc. Bengal xviii, 2, 1849-50, p. 1381. Logotype, *Squalus glaucus* Linne.

PRIONACE MACKIEI
Blue Shark

Prionace mackiei Phillipps, N.Z. J. Sci. Tech. xvi, 4, Jan. 1935, p. 238 fig. 2. Lyall Bay, near Wellington, N.Z.

Genus GALEOCERDO

Galeocerdo Muller and Henle, Ber. Verh. K. Pr. Akad. Wiss. Berlin, 1836 (1837), pp. 114 and 115. Logotype, *Squalus arcticus* Faber, Naturg. Fische Iss. 1829, p. 17.

GALEOCERDO CUVIER
Tiger Shark

Squalus cuvier Lesueur, J. Acad. Nat. Sci. Philad. ii, Nov. 1822, p. 351. [N.W. Australia].

Galeocerdo rayneri Macdonald and Barron, Proc. Zool. Soc. London, 1868, p. 368, pl. xxxii, Australian coasts (H.M.S. "Herald").

Family SPHYRNIDAE
Genus SPHYRNA

Sphyrna Rafinesque, Indice Ittiol. Sicil., May 1810, pp. 46 & 60. Tautotype, *Squalus zygaena* Linne.

SPHYRNA LEWINI
Hammerhead Shark; Mangopare

Zygaena lewini Griffith, Anim. Kingdom (Cuvier) x, 1834, p. 640, pl. 1. South coast of New Holland.

SPHYRNA ZYGAENA

Squalus zygaena Linne, Syst. Nat., ed. 10, 1758, p. 234, *ex* Artedi. Europe & America.
Note: Recorded from New Zealand by C. Gilbert, 1967.

Family EMISSOLIDAE
Genus EMISSOLA

Emissola Jarocki, Zoologiia iv, 1822, p. 448. Logotype, *Squalus mustelus* Linne, by present designation.

EMISSOLA ANTARCTICA
Gummy; Manga; Spotted Estuary Dogfish; Smooth hound

Squalus mustelus Forster, Voy. World Resolution i, 1777, p. 181. Dusky Bay, N.Z. Not *Squalus mustelus* Linne, 1758.

Mustelus antarcticus Gunther, Cat. Fish. Brit. Mus. viii, 1870, p. 387. Antarctic Expedition (Lords of the Admiralty) and "Southern Pacific".

Mustelus lenticulatus Phillipps, N.Z. J. Sci. Tech. xiii, 4, Feb. 1932, p. 226. Wellington, N.Z. Type in Dominion Museum.

Family ALOPIIDAE
Genus ALOPIAS

Alopias Rafinesque, Caratt. gen. spec. Sicil. 1810, p. 12. Type, *A. macrourus* Rafinesque.

ALOPIAS CAUDATUS
Thresher Shark

Alopias caudatus Phillipps, N.Z. J. Sci. Tech. xiii, 4, Feb. 1932, p. 226, fig. Victoria (McCoy).

Family HALSYDRIDAE
Genus HALSYDRUS

Halsydrus Fleming, Scots Mag. 1809, p. 7; Edinb. Encycl. (Brewster) xi, 1817, p. 713; and Philos. Zool. ii, 1822, p. 380. Haplotype, *H. pontoppidiani* Fleming (= *Squalus maximus* Linne).

HALSYDRUS MAXIMUS MACCOYI
Basking shark; Reremai

?Squalus maximus Linne, Syst. Nat. ed. 12, 1766, p. 400. Arctic Ocean.
Tetroras maccoyi Barrett, Sun Nature Book iv, "Water Life", 1933, p. 13, *ex* Whitley and Phillipps, MS. Victoria, Australia.

Family ISURIDAE
Genus LAMNA

Lamna Cuvier, Regne Anim. ed. 1, ii, "1817" = Dec. 1816, p. 126. Haplotype, *Squalus cornubicus* Bloch and Schneider = Gmelin, 1789.

LAMNA WHITLEYI
Porbeagle

Lamna whitleyi Phillipps, N.Z. J. Sci. Tech. xvi, 4, Jany. 1935, p. 239, fig. 3. Wellington and Nelson, N.Z.

Genus ISUROPSIS

Isuropsis Gill, Ann. Lyc. Nat. Hist. N. York, vii, 1862, pp. 397 and 398. Orthotype, *Oxyrhina glaucus* Muller and Henle.

ISUROPSIS OXYRINCHUS
Blue Pointer; Mako

Isurus mako Whitley, Rec. Austr. Mus. xvii, 3, June 27, 1929, p. 101. N.Z. = *Isurus oxyrinchus* Rafinesque, Caratt. gen. spec. Sicil., April 1, 1810, p. 11, pl. xiii, fig. 1. Sicily.

Family CARCHARODONTIDAE
Genus CARCHARODON

Carcharodon Muller & Henle, Mag. Nat. Hist. (Charlesworth) ii, Jan. 1838, p. 37, *ex* Smith, MS. Haplotype *C. capensis* (Smith) = *C. carcharias* (Linne).

CARCHARODON ALBIMORS
Great White Shark; White Pointer; White Death; Mango-tuatini

Carcharodon albimors Whitley, Austr. Zool. ix, 3, Dec. 12, 1939, p. 240, N.S.W.

Family ECHINORHINIDAE
Genus ECHINORHINUS

Echinorhinus Blainville, Bull. Soc. Sci. Philom. Paris, Aug. 1816, p. 121. Type, *Squalus spinosus* Gmelin.
Rubusqualus Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 311. Orthotype, *Echinorhinus* (*Rubusqualus*) *mccoyi* Whitley.

ECHINORHINUS COOKEI

Echinorhinus cookei Pietschmann, Anz. Akad. Wiss. Wien. lxv, 1928, p. 297; Bish. Mus. Bull. lxxiii, 1930, p. 3, pl. 1 & text-fig. 1. Kauai, Hawaiian Islands. Type destroyed. Neotype from New Zealand in Dominion Museum, Wellington, designated by Garrick, Trans. Roy. Soc. N.Z. lxxxviii, May 1960, p. 105.

ECHINORHINUS (RUBUSQUALUS) MACCOYI
Bramble Shark; Spinous Shark

Echinorhinus (*Rubusqualus*) *mccoyi* Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 311. Portland, Victoria. Holotype in National Museum, Melbourne, figured by McCoy, Prodromus Zool. Vict. (2), xv, 1887, p. 165, pl. 144.

Family OXYNOTIDAE
Genus OXYNOTUS

Oxynotus Rafinesque, Ind. Ittiol. Sicil., May 1810, p. 60. Haplotype *Squalus centrina* Linne.

OXYNOTUS BRUNIENSIS
Spiny Dogfish; Prickly Dogfish

Centrina bruniensis Ogilby, Rec. Austr. Mus. ii, 5, Sept. 1893, p. 62. *Ex* Morton, MS. Bruni Island, Tasmania.

Family SQUALIDAE (including "DALATIIDAE")
Genus KOINGA

Koinga Whitley, Austr. Zool. ix, 3, Dec. 12, 1939, p. 242. Orthotype, *Squalus whitleyi* Phillipps.

KOINGA LEBRUNI
White-spotted or Spined Dogfish; Okeoke; Koinga

Squalus canis Forster, Voy. World. Resolution, i, 1777, p. 181 Dusky Bay, N.Z. *Nomen nudum.* Not *Squalus canicula* Linne 1758.

Acanthias maculatus Richardson, Trav. N.Z. (Dieffenbach), ii, Jan. 1843, p. 227 and Rept. 12th meet. B.A.A.S. 1842, (late 1843) p. 29. *Nomen nudum,* ex *Squalus maculatus* Parkinson, MS. Aeakeenomauwee.

Squalus maculatus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 227. *Nom. nud., ex* Parkinson, MS. N.Z.

Acanthias lebruni Vaillant, Miss. Sci., Cap Horn vi, 1888, Zool., Poiss., p. 13, pl. i, fig. 2. Orange Bay, Punta Arenas, South America.

Squalus kirki Phillipps, N.Z. J. Sci. Tech. xii, 6, June 25, 1931, p. 361. Cook Strait, Wellington, N.Z. New name for *S. fernandinus* of authors, not of Molina, Sag. stor. nat. Chile (1782) p. 229.

Genus FLAKEUS

Flakeus Whitley, Austr. Zool. ix, 3, Dec. 12, 1939, p. 242. Orthotype, *Squalus megalops* Macleay.

FLAKEUS GRIFFINI
Griffin's Dogfish

Squalus griffini Phillipps, N.Z. J. Sci. Tech. xii, 6, June 1931, p. 360. Hauraki Gulf, N.Z.

Genus EUPROTOMICRUS

Euprotomicrus Gill, Proc. Acad. Nat. Sci. Philad, 1864, p. 264. Haplotype, *Scymnus labordii* Muller and Henle.

EUPROTOMICRUS BISPINATUS

Scymnus bispinatus Quoy & Gaimard, Voy. Uranie (Zool.) 1824, p. 197, pl. xliv, figs. 1-2. Mauritius.

Scymnus (*Laemargus*) *labordii* Muller and Henle, Syst. Plagiost (2) 1839, p. 94. Mauritius and Bourbon.

Scymnus mauritianus Muller and Henle. Syst. Plagiost. (2) 1839, p. 94, in synon. Mauritius.

Note: Recorded from New Zealand by Hutton on the basis of jaws which have since been lost. But Hutton, Trans. N.Z. Inst. v, 1873, p. 271 later believed that the jaws "really belonged to a young specimen of *Carcharias brachyurus*". However, Waite (Subantarc. Iss. N.Z. 1909, p. 585) records *Euprotomicrus bispinatus* from Campbell Island, and Mr. Moreland has shown me a New Zealand specimen. Modern accounts of the species and its distribution will be found in Parin, Trudy Akad. Nauk SSSR Okeanol. lxxiii, 1964, p. 163, figs. 2-4 and in Hubbs, Iwai and Matsubara, Bull. Scripps Inst. Oceanogr. x, 1967, pp. 1-64, pls. i-viii.

Genus SCIMNUS

Scymnus Cuvier, Regne Anim. ed. 1, ii "1817" = Dec. 1816, p. 130. Logotype, *Squalus americanus* Gmelin. Preocc. by *Scymnus* Kugelmann, a genus of beetles.

Scimnus S.D.W., Analyst, 1837, p. 214. Emendation for *Scymnus,* preocc. Logotype, *Squalus americanus* Gmelin.

Scymnorhinus Bonaparte, Cat. Metod. Pesci Europ. 1846, p. 16. Logotype, *Squalus licha* Bonnaterre.

SCIMNUS PHILLIPPSI
Black Shark

Scymnorhinus phillippsi Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 310. Great Australian Bight.

Genus SCYMNODALATIAS

Scymnodalatias Garrick, Trans. Roy. Soc. N. Zeal. lxxxiii, 3, p. 555. Orthotype, *Scymnodon sherwoodi* Archey.

SCYMNODALATIAS SHERWOODI
Sherwood's Shark

Scymnodon sherwoodi Speight, 48th. Ann. Rept. Canterb. College, 1920 (June 27, 1921), p. 32. *Nomen nudum. Id.* Archey, Trans. N.Z. Inst. liii, Aug. 31, 1921, p. 195, pl. xxxix & text-figs. 1-2. New Brighton.

Scymnodolatias sherwoodi Garrick, Trans. Roy. Soc. N.Z. lxxxiii, 3, 1956, p. 564, figs. 1, A-L and 2, A-E.

Genus CENTROSCYMNUS

Centroscymnus Bocage & Capello, Proc. Zool. Soc. Lond. 1864, p. 263. Orthotype, *C. coelolepis* Bocage & Capello.

Centroselachus Garman, Mem. Mus. Comp. Zool. Harvard xxxvi, 1913, p. 206. Orthotype, *Centrophorus crepidater* Bocage & Capello.

Proscymnodon Fowler, Proc. Acad. Nat. Sci. Philad. lxxxv, 1933 (1934), p. 239. Orthotype, *Centrophorus plunketi* Waite.

CENTROSCYMNUS CREPIDATER

Centrophorus crepidater Bocage & Capello, Proc. Zool. Soc. Lond. 1864, p. 263. Off Portugal.

Centrophorus jonssonii Saemondsson, Vidensk. Med. Dansk. Foren lxxiv, 1922, p. 192, pl. v, figs. 1-2. Ex Jensen, MS. Iceland.

"Jonsson's Dogfish" Richardson, N.Z. Listener 35, 903, Nov. 23, 1956, p. 6, fig.

Centroscymnus crepidater Bigelow & Schroeder, Bull. Mus. Comp. Zool. Harvard 117, 1957, pp. 11 & 85-96, figs. 1 d & 12 a-d. Includes N.Z. record, *ex* Garrick, MS.

CENTROSCYMNUS OWSTONII

Centroscymnus owstonii Garman, Bull. Mus. Comp. Zool., Harvard xlvi, 11, Jan. 1906, p. 207. Suruga Gulf & Sagami Bay, Japan.

Genus SCYMNODON

Scymnodon Bocage & Capello, Proc. Zool. Soc. Lond., 1864, p. 263. Type-species, *S. ringens* Bocage & Capello.

SCYMNODON PLUNKETI
Lord Plunket's Shark

Centrophorus plunketi Waite, Proc. N.Z. Inst. 1909, iv, May 11, 1910, p. 109 and Trans. N.Z. Inst. xiii, June 1, 1910, p. 384, pl. xxxvii and text-fig. Off Kaikoura; deep water.

Centrophorus waitei Thompson, Rec. Canterb. Mus. iii, 4, March 18, 1930, p. 277, pl. xliv, figs. a-b. Off Kaikoura; deep water. Type re-figured by Garrick, Trans. Roy. Soc. N.Z. lxxxiii, 1955, p. 227, figs. 1-2, as *Centroscymnus.*

Scymnodon plunketi Garrick, Trans. Roy. Soc. N.Z. lxxxvii, 1959, p. 271, figs. 1-3.

Genus CENTROPHORUS

Centrophorus Muller & Henle, Ber. Verh. K. Pr. Akad. Wiss. Wien 1836 (1837), p. 115; Arch. Naturges. (Wiegmann) iii, 1, 1837, p. 398; Mag.

Nat. Hist. (Charlesw.), (n.s.) ii, 1838, p. 89. Orthotype, *Squalus granulosus* Bloch & Schneider.

Somnispinax Whitley, Fish. Austr. i, July 20, 1940, pp. 146 & 274. Orthotype, *Centrophorus nilsoni* Thompson.

CENTROPHORUS SQUAMOSUS
Nilson's Deepsea Dogfish

Squalus squamosus Bonnaterre, Tabl. Encycl. Meth., Ichth., 1788, p. 12. Europe.

Centrophorus foliaceus Gunther, Ann. Mag. Nat. Hist. (4) xx, Nov. 1, 1877, p. 433; Challenger Rept., Zool., xxii, 1887, p. 5, pl. ii, fig. A. Off Inosima, Japan; 345 faths.

Centrophorus nilsoni Thompson, Rec. Canterb. Mus. iii, 4, March 18, 1930, p. 276, pl. xliii, figs. a-i. Off Kaikoura; deep water.

Scymnodon foliaceus L. Richardson, N.Z. Listener xxxv, 903, Nov. 23, 1956, p. 7, fig.

Centrophorus foliaceus Bigelow & Schroeder, Bull. Mus. Comp. Zool. cxvii, 1957, pp. 45, 65 et seq., espec. 78 et seq. & 83, figs. 7 f-i and 8a.

Genus ETMOPTERUS

Etmopterus Rafinesque, Car. n. gen., 1810, p. 14. Haplotype, *E. aculeatus* Rafinesque.

ETMOPTERUS BAXTERI

Etmopterus baxteri Garrick, Bull. Mus. Comp. Zool. Harvard 116, 3, April 1957, p. 171, figs. 1 & 2. South of Kaikoura; 500 faths. Type in Dominion Museum, Wellington.

ETMOPTERUS ABERNETHYI

Etmopterus abernethyi Garrick, Bull. Mus. Comp. Zool. Harvard 116, 3 April 1957, pp. 171 & 181, figs. 3 & 4. South of Kaikoura; 100-200 faths. Holotype in Dominion Museum, Wellington; paratype in Mus. Comp. Zool., Harvard, U.S.A.

Note: According to Krefft (Arch. Fischereiwiss. (Hamburg) xix, 1968, p. 13), *Etmopterus abernethyi* is synonymous with the Japanese *E. lucifer* Jordan & Snyder, 1902.

Genus DEANIA

Deania Jordan & Snyder, Proc. U.S. Nat. Mus. xxv, 1902, p. 80. Orthotype, *D. eglantina* Jordan & Snyder.

Nasisqualus Smith, Proc. U.S. Nat. Mus. xli, Feb. 8, 1912, pp. 677 & 681, *ex* Smith & Radcliffe, MS. Orthotype, *N. profundorum* Smith.

DEANIA KAIKOURAE
Thompson's Deepsea Dogfish

Centrophorus kaikourae Whitley, Mem. Qld. Mus. x, 4, June 30, 1934, p. 199, no. 67. Kaikoura. New name for *C. calceus* Thompson, Rec. Canterb. Mus. iii, 4, March 18, 1930, p. 275, pl. xlii, figs. a-i, not *Acanthidium calceus* Lowe, Proc. Zool. Soc. Lond. vii, Oct. 1839, p. 92, from Atlantic Ocean.

Family SOMNIOSIDAE
Genus SOMNIOSUS

Somniosus Le Sueur, Journ. Acad. Nat. Sci. Philad. i, 9, May 1818, p. 222 Haplotype, *S. brevipinna* Le Sueur.

Somnolentus (as a subgenus of *Centrina*) Swainson, Nat. Hist. Fish. Amphib. Rept. i, 1838, p. 146. Genus caelebs, overlooked by nomenclators. Type-species (logotype), by present designation, *Somniosus brevipinna* Le Sueur. Thus *Somnolentus* is a new synonym of *Somniosus*.

SOMNIOSUS ANTARCTICUS
Sleeper Shark

Somniosus antarcticus Whitley, Austr. Zool. ix, 3, Dec. 12, 1939, p. 242. Macquarie Island.

Family TORPEDINIDAE
Genus NOTASTRAPE

Notastrape Whitley, Rec. Austr. Mus. xviii, 6, April 20, 1932, p. 327. Orthotype, *N. macneilli* Whitley.

NOTASTRAPE FAIRCHILDI
Electric Ray; Whai Repo; Whai ngenge

Torpedo fairchildi Hutton, Fish. N.Z., Feb. 1872, p. 83, pl. xii, fig. 134. Napier harbour.

Torpedo fusca Parker, N.Z. J. Sci. i, 9, May 1883, p. 479 and Trans N.Z. Inst. xvi, May 1884, p. 281, pl. xxii. Purakanui, near Dunedin.

Genus TYPHLONARKE

Typhlonarke Waite, Rec. Canterb. Mus. i, 2, July 13, 1909, p. 131. Orthotype, *Astrape aysoni* Hamilton.

TYPHLONARKE AYSONI
Torpedo-ray

Astrape aysoni Hamilton, Trans. N.Z. Inst. xxxiv, July 1902, p. 224, pls. x-xii. Foveaux Strait.

TYPHLONARKE TARAKEA

Typhlonarke tarakea Phillipps, N.Z. J. Sci. Tech. xi, 1929, p. 101, fig. 3. Island Bay.

Note: Another Electric Ray has been noted in a New Zealand newspaper but not yet named.

Family RAJIDAE
Genus ZEARAJA

Zearaja Whitley, Austr. Zool. ix, 3, Dec. 12, 1939, p. 254. Orthotype, *Raja nasuta* Muller and Henle.

ZEARAJA NASUTA
Skate; Waewae, Pakaurua, Whai (The egg is called Hau)

Raja nasuta Muller and Henle, Syst. beschr. Plagiost (3), 1841, p. 150, *ex* Banks MS. "Sudsee" = Totaeranue, N.Z., *fide* Richardson, Trav. N.Z. (Dieffenbach), ii, Jan. 1843, p. 227.

Genus SPINIRAJA

Spiniraja Whitley, Austr. Zool. ix, Dec. 12, 1939, p. 251. Orthotype, *Raja* (*Spiniraja*) *ogilbyi* Whitley, from Manly, New South Wales.

SPINIRAJA RICHARDSONI
Spiny Skate

Raja richardsoni Garrick, Trans. Roy. Soc. N.Z. lxxxviii, 4, Feb. 1961, p. 745, fig. 1. South of Cape Palliser; 1,300 faths.

Genus ARHYNCHOBATIS

Arhynchobatis Waite, Rec. Cant. Mus. i, 2, July 13, 1909, pp. 131 and 150. Haplotype, *A. asperrimus* Waite.

ARHYNCHOBATIS ASPERRIMUS
Longtailed Skate

Arhynchobatis asperrimus Waite, Rec. Canterb. Mus. i, 2, July 13, 1909, pp. 131 and 150, pl. xx. Bay of Plenty; 66-94 faths.

Raia areata Beaglehole, Endeav. Journ. Jos. Banks ii; 1962, p. 7, footnote 6, *ex* Banks, MS. New Zealand, 1770.

Family DASYATIDAE
Genus BATHYTOSHIA

Bathytoshia Whitley, Rec. Austr. Mus. xix, Aug. 2, 1933, p. 61. Orthotype, *Dasyatis thetidis* Waite, 1899, from N.S.Wales.

BATHYTOSHIA BREVICAUDATA
Smooth Stingaree; Whai Repo.

Raia rostrata Taylor, Te Ika a Maui, ed. 1, 1855, p. 412. *Nomen nudum* N.Z. Not *R. rostrata* Risso, 1826, from Europe.

Trygon brevicaudata Hutton, Ann. Mag. Nat. Hist. (4) xvi, Nov. 1875, p. 317 and Trans. N.Z. Inst. viii, May 1876, p. 216. Dunedin Harbour.

BATHYTOSHIA THETIDIS

Dasyatis thetidis Waite, Mem. Austr. Mus. iv, 1, Dec. 23, 1899, p. 46, *ex* Ogilby, MS. New South Wales.

Family AETOBATIDAE
Genus AETOBATUS

Aetobatus Blainville, Bull. Sci. Soc. Philom. Paris (July 1816), p. 120, *fide* Sherborn. Logotype, *Raia aquila* Linne, designated by Bory, Dict. Class. Hist. Nat. i, 1822, p. 129.

*Myliobatis** Cuvier, Regne Anim. ed. 1, ii, '1817' = Dec. 1816, p. 137. *Ex* Dumeril, MS. Logotype, *Raia aquila* Linne, selected by Bosc, Nouv. Dict. Hist. Nat. ed. 2, xxi, 1818, p. 530.

AETOBATUS TENUICAUDATUS
Eagle Ray

Raia macrocephala Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 227, *ex* Banks, MS. *Nomen nudum*. N.Z.

Myliobatis tenuicaudatus Hector, Trans. N.Z. Inst. ix, May 1877, p. 468, pl. x. Wellington Harbour.

Class HOLOCEPHALI
Family CHIMAERIDAE
Genus PHASMICHTHYS

Phasmichthys Jordan and Hubbs, Mem. Carneg. Mus. x, 2, June 27, 1925, p. 119. Orthotype, *Chimaera mitsukurii* Jordan and Snyder, 1904.

PHASMICHTHYS NOVAEZELANDIAE
Ghost Shark; Chimaera

Chimaera monstrosa var. *australis* Hector, Trans. N.Z. Inst. xxxiv, July, 1902, p. 239. Wairau bar, N.Z. Preoccupied by *Chimaera australis* Shaw, Gen. Zool. v, 1804, p. 368, a species of *Callorynchus*.

Chimaera novaezelandiae Fowler, Proc. Acad. Nat. Sci. Philad. lxii, 3, Jan. 14, 1911, p. 603. New name for *C. monstrosa australis* Hector, preoccupied.

Family CALLORYNCHIDAE
Genus CALLORYNCHUS

Callorynchus Meuschen, Index Zoophylac. Gronov. pt. iii, 1781. *Ex* Gronow, non-binomial. Tautotype, *Chimaera callorhychus* Linne, 1758.

CALLORYNCHUS MILII
Elephant-fish; Elephant Shark; Reperepe

Callorynchus milii Bory de St. Vincent, Dict. Class Hist. Nat. iii, Dec. 1823, p. 62, pl. cxiii, fig. 1. "Western Australia" [?? may be Bruni Island, Tas. (Peron)].

Callorhynchus tasmanius Richardson, Proc. Zool. Soc. London viii, Aug. 1840, p. 29. Murderer's Bay, "Tasmania" (i.e. New Zealand); Jan. 16, 1770 (Solander) and Port Arthur, Tasmania.

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* Fowler has quoted *Myliobatis* as of Geoffroy St. Hilaire, 1809, with *M. bovina* G.S.H. as type-species, but the date, according to Sherborn, is 1827, not 1809, and thus *Myliobatis* Cuvier is earlier; but this again is a synonym of *Aetobatus* Blainville, 1816, as restricted by Bory de St. Vincent.

Callorhynchus australis Owen Descr. Cat. Comp. Anat. Mus. Roy. Coll. Surgeons, ed. 2, i, 1852, p. 51 (Tasmania). Anticipated by *Chimaera australis* Shaw, 1804, which is a *Callorynchus*.

?Callorhynchus peronii Dumeril, Hist. Nat. Poiss. i, 2, 1865, p. 694. Terres australes (F. Peron) and South America.

Callorhynchus dasycaudatus Colenso, Trans. N.Z. Inst. xi, May 1879, p. 298, pl. xvii. Poverty Bay, N.Z.

Family RHINOCHIMAERIDAE
Gen. et sp. indet.
Long-nosed Chimaera

Note: A male long-nosed Chimaera, whose genus and species have not yet been determined, was trawled 80 miles east of Timaru in between 200 and 300 fathoms. Specimen in Otago Museum, Dunedin.

Subphylum PISCES
Class ACTINOPTERI
Family SACCOPHARYNGIDAE
Genus EURYPHARYNX

Eurypharynx Vaillant, Comptes Rendus Acad. Sci. Paris xcv, 1882, p. 1226. Orthotype, *E. pelecanoides* Vaillant.

EURYPHARYNX PELECANOIDES
Gulper

Eurypharynx pelecanoides Vaillant, Comptes Rendus Acad. Sci. Paris xcv, 1882, p. 1226. Off the coast of Morocco; 2,300 metres.

Family ENGRAULIDAE
Genus AUSTRANCHOVIA

Austranchovia Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 311. Orthotype, *Atherina australis* White.

AUSTRANCHOVIA AUSTRALIS
Anchovy; Korowhawha

Atherina australis White, Voy. New South Wales, 1790, p. 296, pl. lxiv, fig. 1. Botany Bay district, N.S.Wales.

Engraulis encrasicholus var. *antipodum* Gunther, Cat. Fish. Brit. Mus. vii, 1868, p. 386. Van Diemen's Land and N.Z. (Haslar Collection).

Family CLUPEIDAE
Genus SARDINOPS

Sardinops Hubbs, Proc. Calif. Acad. Sci. (4) xviii, 11, 1929, p. 264. Orthotype, *Meletta caerulea* Girard, 1854.

SARDINOPS NEOPILCHARDUS
Pilchard; Picton Herring; Mohimohi

Clupea lata Richardson, Trav. N.Z. (Dieffenbach) ii, 1843, p. 221. *Nude name ex* Solander MS. Tolago Bay, N.Z.

Clupea neopilchardus Steindachner, Denkschr. Akad. Wiss. Wien. xli, 1, 1879, p. 12. Hobson's Bay, Victoria.

Genus MAUGECLUPEA

Maugeclupea Whitley, Rec. Austr. Mus. xviii, 6, April 20, 1932, p. 332. Orthotype, *Clupea bassensis* McCulloch 1911, from Bass Strait, Tasmania.

MAUGECLUPEA ANTIPODUM
Sprat; Kupae

Clupea sprattus var. *antipodum* Hector, Notes Edib. Fish. in Hutton, Cat. Fish. N.Z. Feb. 1872, p. 133* Foveaux Strait, N.Z. Also spelt *antipodarum* in Trans. N.Z. Inst. xi, May 1879, p. 572.

Clupea mulleri Klunzinger, Sitzb. Akad. Wiss. Wien. lxxx, 1, 1879, p. 416. N.Z. Distinct, *fide* Regan, Ann. Mag. Nat. Hist. (8) xix, 1917, p. 228.

Clupea holodon Regan, Ann. Mag. Nat. Hist. (8), xviii, July 1, 1916, p. 5. Stewart Island, N.Z. (C. Traill).

Family GONORYNCHIDAE
Genus GONORYNCHUS

Gonorynchus Scopoli, Intr. Hist. Nat., 1777, p. 450. *Ex* Gronow, non-binomial. Tautotype, *G. gonorynchus* Meuschen.

Rhynchana Richardson, Zool. Voy. Erebus & Terror, Fish, 1845, p. 44. Haplotype, *R. greyi* Richardson.

GONORYNCHUS FORSTERI
Sandfish

Gonorrynchus forsteri Ogilby, Ann. Qld. Mus. x, Nov. 1, 1911, p. 34. Seas of N.Z.

Gonorhynchus gayi Benham, Otago Univ. Mus. Ann. Rept. 1918 (1919), p. 8. Portobello. Not *Rhynchana greyi* Richardson, 1845, from south-western Australia.

Family ARGENTINIDAE
Genus ARGENTINA

Argentina Linne, Syst. Nat. ed. 10, 1758, p. 315; ed. 12, 1766, p. 518. Haplotype, *A. sphyraena* Linne.

ARGENTINA ELONGATA
Silverside

Argentina elongata Hutton, Ann. Mag. Nat. Hist. (5) iii, Jan. 1, 1879, p. 53. Cape Campbell (C. H. Robson).

Argentina decagon Clarke, Trans. N.Z. Inst. xi, May 1879, p. 296, pl. xiv. Hokitika.

Family RETROPINNIDAE
Genus RETROPINNA

Retropinna Gill, Proc. Acad. Nat. Sci. Philad. 1862, p. 14. Orthotype, *Argentina retropinna* Richardson.

Richardsonia Steindachner, Sitzb. Akad. Wiss. Wien .liii, 1866, p. 469. Haplotype, *Argentina retropinna* Richardson.

RETROPINNA OBTUSIROSTRIS
Southland Smelt

Retropinna obtusirostris Stokell, Rec. Canterb. Mus. iv, 7, Sept. 10, 1941, p. 367, pl. lvii. Lake Henry, near Lake Te Anau, Southland. Holotype in Canterbury Museum. Paratype in Dominion Museum.

RETROPINNA OSMEROIDES
Large-toothed Smelt

Retropinna osmeroides Hector, Trans. N.Z. Inst. iii, May 1871, p. 134, pl. xix, fig. 1. Kaduka River, Otago.

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* Strictly speaking, Hutton's Catalogue & Hector's Notes thereto should be quoted as Colon. Mus. & Geol. Surv. Dept. Publ. xviii. 1,000 copies were issued in Feb. 1872 and the publication was out of print by 1878 (12th Ann. Rept. Col. Mus.).

RETROPINNA RETROPINNA
Common Smelt; Paraki

Argentina retropinna Richardson, Zool. Voy. Erebus and Terror Ichth. 1848, p. 121, pl. lii, figs. 1-3. Bay of Islands, N.Z., taken in a net.

Retropinna richardsonii Gill, Proc. Acad. Nat. Sci. Philad. 1862, p. 14. Based on *Argentina retropinna* Richardson.

Retropinna richardsonii var. *elongata* Klunzinger, Sitzb. Akad. Wiss. Wien lxxx, 1, 1879, p. 413. N.Z.

RETROPINNA LACUSTRIS
Rotorua Smelt

Retropinna lacustris Stokell, Trans. Roy. Soc. N.Z. lxxiii, 3, Dec. 1943, p. 172. Ohau channel, near Lake Rotorua. Type in Canterbury Museum.

RETROPINNA CHATHAMENSIS
Chatham Islands Smelt

Retropinna chathamensis Stokell, Rec. Canterbury Mus. v. 4, Nov. 14, 1949, p. 206, pl. xliii. Chatham Islands.

RETROPINNA ABBREVIATA

Retropinna abbreviata McDowall, Rec. Dom. Mus. v. (13), 1965, p. 89, fig. 1. Lake Omapere.

RETROPINNA spp. nov.
Canterbury Smelt

Retropinna spp. nov. (not yet named) Stokell, Fresh water Fishes of N.Z., 1955, p. 15. Several localities, freshwater and estuarine.

Genus STOKELLIA

Stokellia Whitley, Austr. Zool. xii, July 18, 1955, p. 110. Orthotype, *Retropinna anisodon* Stokell.

STOKELLIA ANISODON
Stokell's Smelt

Retropinna anisodon Stokell, Rec. Canterb. Mus. iv, 7, Sept. 10, 1941, p. 371, pl. lv, fig. 2 and text-fig. 1. Waiau River, Southland. Holotype in Canterbury Museum, paratype in Southland Museum.

Family GALAXIIDAE
Genus GALAXIAS

Galaxias Cuvier, Regne Anim., ed. 1, ii, "1817" = Dec. 1816, p. 182. Virtual haplotype, *G. truttaceus* Cuvier, from Agnes River, Tasmania (*vide* Scott, Proc. Roy. Soc. Tas. 1935 (1936), p. 89).

GALAXIAS ARGENTEUS
Giant Galaxias, Black Kokopu, Mountain Trout

Esox argenteus Gmelin, Syst. Nat. (Linne), ed. 13, i, 3, 1789, p. 1393. Based on *Esox* sp., Forster, Voy. World Resolut. i, 1777, p. 159. Dusky Bay, south island of N.Z. April 18, 1773. Not *Esox argenteus* Forster, ibid. ii, 1777, p. 282, a nude name for the West Indies "Tenpounder" (*Elops saurus*).

Esox alepidotus Bloch & Schneider, Syst. Ichth., 1801, p. 395, *ex* Forster, MS. Southern Island of N.Z. [= Dusky Bay].

Galaxias forsteri Cuvier & Valenciennes*, Hist. Nat. Poiss. xviii, 1846, ed. 1, p. 351; ed. 2, p. 261. New name for *Esox alepidotus* Forster, MS. Freshwater lakes of N.Z. [= Dusky Bay].

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* I have followed the conventional practice of quoting Cuvier and Valenciennes' "Histoire Naturelle des Poissons" under both those author's names (Cuv. & Val.), but those who prefer to do so may attribute the new names in that great publication to either Cuvier *or* Valenciennes according to the table provided by R. M. Bailey, Copeia 1951, 3, p. 251, and by the International Commission of Zoological Nomenclature.

Galaxias grandis Clarke, Trans. N.Z. Inst. xxxi, June 1899, p. 82. Westland. Preoccupied by *G. grandis* Haast, 1873.
Galaxias kokopu Clarke, Trans. N.Z. Inst. xxxi, June 1899, pp. 82 and 84, pl. iv. Westland.

GALAXIAS FASCIATUS
Banded Galaxias, Barred Trout; Kokopu, Para

Galaxias fasciatus Gray, Zool. Miscell. June 1842, p. 73. River Thames.
Galaxias fasciatus Cuv. & Val., Hist. Nat. Poiss. xviii, 1846, p. 350; ed. 2, p. 260. Bay of Islands, N.Z. (Independently of Gray).
Galaxias brocchus Richardson, Zool. Erebus and Terror. Fish (1848) p. 76, pl. xliii, figs. 8-13. Auckland Islands [? = Auckland].
?*Galaxias reticulatus* Richardson, Zool. Erebus and Terror, Fish 1848, p. 76, pl. xlii, figs. 7-12. Auckland Islands (Type) & N.Z. [? = Auckland].
Galaxias abbreviatus Clarke, Trans. N.Z. Inst. xxxi, 1899, pp. 80, 83 & 90. Taranaki.

GALAXIAS POSTVECTIS
Short-jawed Kokopu

Galaxias postvectis Clarke, Trans. N.Z. Inst. xxxi, June 1899, p. 84, pl. v, fig. (3). Westland.
Galaxias charlottae Whitley & Phillipps, Trans. Roy. Soc. N.Z. xlix, 2, Sept. 1939, p. 230, pl. xxi, fig. 2. Queen Charlotte Sound.

GALAXIAS GRACILIS

Galaxias gracilis McDowall, Breviora 265, April 6, 1967, pp. 4-7, figs. 2-5. Upper Lake Rototuna, Kaipara Harbour, North Auckland.

GALAXIAS USITATUS

Galaxias usitatus McDowall, Breviora 265, April 6, 1967, pp. 4-7, figs. 2, 3, 4 & 6. Lake Waiparera, North Auckland.

GALAXIAS BREVIPINNIS
Lowland Galaxias, Taiwharu; Kokopu

Galaxias brevipinnis Gunther, Cat. Fish. Brit. Mus. vi, 1866, p. 213. N.Z. (Capt. Stokes).
Galaxias grandis Haast, Trans. N.Z. Inst. v, May, 1873, p. 278. Lake Ellesmere (type) and Lake Hall, S. Island. Not *Galaxias grandis* Clarke.
Galaxias robinsonii Clarke, Trans. N.Z. Inst. xxxi, June 1899, pp. 81 & 89, pl. v, fig. [2]. Taranaki (several localities).
Galaxias bollansi Hutton, Trans. N.Z. Inst. xxxiv, July 1902, p. 198. Southern Islands of New Zealand.

GALAXIAS CAMPBELLI
Campbell Island Galaxias

Galaxias campbelli Sauvage, Bull. Soc. Sci. Philom. (7) iv, 1880, p. 229. Campbell Island. *Id.* Stokell, Cape Exped. Bull. ix, 1950, p. 6 and plate. Distinct species according to Woods, Freshw. Fishes, 1963, p. 32.

GALAXIAS LYNX
Cold Lakes Galaxias or Lynx; Maehae

Galaxias lynx Hutton, Trans. N.Z. Inst. xxvii, June 1896, p. 317. Lake Coleridge, Lake Wakatipu.

GALAXIAS PAUCISPONDYLUS
Alpine Galaxias

Galaxias paucispondylus Stokell, Rec. Canterbury Mus. iv, 4, March 31, 1938, p. 203, pl. xxv, fig. 2. Rakaia and Waimakariri valleys and tributaries, South Island; over 1,700 feet.

GALAXIAS PROGNATHUS
Long-jawed Galaxias

Galaxias prognathus Stokell, Trans. Roy. Soc. N.Z. lxix, 4, March 1940, p. 422, pl. lvii, figs. 1-3. Wilberforce River, Canterbury; over 2,000 feet.

GALAXIAS CASTLEAE

Galaxias castleae Whitley & Phillipps, Trans. Roy. Soc. N.Z., lxix, 2, Sept. 1939, p. 229, pl. xxi, fig. 1. Lake Waikaremoana.

GALAXIAS VULGARIS
Common River Galaxias

Galaxias vulgaris Stokell, Trans. Roy. Soc. N.Z. lxxvii, 1949, p. 473, pl. lv, fig. 8. Rubicon River, Canterbury; 1,500 feet alt.

GALAXIAS ANOMALUS
Strange Galaxias

Galaxias anomalus Stokell, Trans. Roy. Soc. N.Z. lxxxvii, Nov. 1959, p. 265, pl. xxi, fig. 1. Ophir, Clutha basin, Otago.

GALAXIAS DIVERGENS
Dwarf Galaxias

Galaxias divergens Stokell, Trans. Roy. Soc. N.Z. lxxxvii, Nov. 1959, p. 266, pl. xxi, fig. 2. Maruia, Buller basin, Nelson.

GALAXIAS HUTTONI
South Island Galaxias or Koaro

Galaxias huttoni Regan, Proc. Zool. Soc. London 1905, ii, April 5, 1906, pp. 366 and 373, pl. x, fig. 2. Lake Rainiera, N.Z. Types in British Museum.

GALAXIAS KOARO

Thermal Lakes Galaxias, N. Island Koaro; Miroiti (young), Koaro

Galaxias koaro Phillipps, Fish. N.Z. i, 1940, p. 35, fig. 20. Lakes Rotopounamu and Rotoaira = Whitley and Phillipps, Trans. Roy. Soc. N.Z. lxix, 2, Sept. 1939, p. 230 (virtually nomen nudum).

Genus AUSTROCOBITIS

Austrocobitis Ogilby, Proc. Linn. Soc. N.S.Wales xxiv, Aug. 1899, p. 158. Orthotype, *Mesites attenuatus* Jenyns.

AUSTROCOBITIS ATTENUATUS
Whitebait; Minnow; Inanga; Hiwi

Mesites attenuatus Jenyns, Zool. Voy. Beagle, Fish. 1841, p. 121, pl. xxii, fig. 5. Bay of Islands, N.Z.

Genus SAXILAGA
Subgenus LIXAGASA

Saxilaga Scott, Proc. Roy. Soc. Tas. 1935 (Aug. 17, 1936), p. 106. Orthotype, *Galaxias cleaveri* Scott.

Lixagasa Scott, Proc. Roy. Soc. Tas. 1935 (Aug. 17, 1936), p. 110. Orthotype, *Galaxias burrowsius* Phillipps.

SAXILAGA (LIXAGASA) BURROWSIUS
Canterbury Mudfish; Mud Galaxias

Galaxias burrowsius Phillipps, Nature, April 3, 1926, p. 485 and Trans. N.Z. Inst. lvi, July 12, 1926, p. 531, pl. lxxxviii. West Oxford, South Island of N.Z. Type in Dominion Museum.

Genus NEOCHANNA

Neochanna Gunther, Ann. Mag. Nat. Hist. (3) xx, Nov. 1867, p. 306. Haplotype, *N. apoda* Gunther.

NEOCHANNA APODA
Brown Mudfish; Haukau; Waikaka

Neochanna apoda Gunther Ann. Mag. Nat. Hist. (3) xx, Nov. 1, 1867, p. 306, pl. vii. Hokitika, N.Z.; "at a depth of 4 feet from the surface, in a stiff clay imbedding roots of trees. The locality is 37 feet above the level of the Hokitika River, and three miles from the sea, and has at one time been a backwater of the river during floods . . . they occur enclosed in hollows in the clay."

NEOCHANNA DIVERSA
Black Mudfish

Neochanna diversus Stokell, Trans. Roy. Soc. N.Z. lxxvii, 1949, p. 473, pl. lvii, fig. 12.

Family APLOCHITONIDAE
Genus PROTOTROCTES

Prototroctes Gunther, Cat. Fish. Brit. Mus. v, 1864, p. 382. Haplotype, *P. maraena* Gunther.

PROTOTROCTES OXYRHYNCHUS
Grayling; Upokororo

Prototroctes oxyrhynchus Gunther, Proc. Zool. Soc. Lond., June 2, 1870, p. 152. Freshwaters of the mountainous interior of N.Z. (Westland Nat. Soc.).

Retropinna upokororo Hector, Trans. N.Z. Inst. iii, May 1871, p. 134, pl. xix, fig. 2. Matai River, Nelson. Also as *Coregonus upokororo* on pl. xviii, figs. 4a & b of the same volume.

Family SEARSIDAE
Genus PERSPARSIA

Persparsia Parr, Amer. Mus. Novit. 1531, July 24, 1951, p. 17. Orthotype, *P. taaningi* Parr.

PERSPARSIA KOPUA
Baldfish

Bathytroctes kopua Phillipps, Rec. Domin. Mus. i, Sept. 4, 1942, p. 49, pl. xvi, fig. 1. Cook Strait; 100 fathoms, from stomach of groper.

PERSPARSIA TAANINGI

Persparsia taaningi Parr, Amer. Mus. Novit. 1531, 1951, p. 18. Off Cape Colony. *Id.* Parr, Dana Report li, 1960, p. 50, etc., figs. 35-36. Near Kermadec Islands ("Dana" Station 3630)—doubtful rec. (Parr, 1960).

Family MICROSTOMIDAE
Genus HALAPHYA

Halaphya Gunther, Rept. Voy. Challenger, Zool. xxxi, prefaced Jan. 23, 1889, p. 38. Haplotype, *H. elongata* Gunther.

HALAPHYA ELONGATA
Sea Foam Smelt

Halaphya elongata Gunther, Rept. Voy. Challenger, Zool. xxxi, pref. Jan. 23, 1889, p. 39, pl. vi, fig. c. "At the surface, in the open sea on the passage from Sydney to Wellington."

Family ALEPOCEPHALIDAE
Genus BATHYTROCTES

Bathytroctes Gunther, Ann. Mag. Nat. Hist. (5) ii, Sept. 1, 1878, p. 249. Logotype, *B. microlepis* Gunther.

BATHYTROCTES ANTIPODIANA

Bathytroctes antipodiana Parrott, Rec. Canterbury Mus. v, 3, Feb. 27, 1948, p. 143, pl. xxxi, fig. 3. Kaikoura.

Family ASTRONESTHIDAE
Genus ASTRONESTHES

Astronesthes Richardson, Zool. Voy. Sulphur i, Ichth., 1845, p. 97. Haplotype, *A. nigra* Richardson.

ASTRONESTHES BOULENGERI
Eater of Stars

Astronesthes boulengeri Gilchrist, Mar. Invest. S. Afr. ii, 1902, p. 103, pl. vi. Off Cape Point and East London, S. Africa; 360-490 faths.

Note: An African species recorded from New Zealand by Bussing, Biol. Antarctic Seas ii, 1965, Antarct. Res. Series 5, Amer. Geophysic. Union Publ. 1297, p. 198, fig. 5, *ex* Gibbs, MS.

Genus NEONESTHES

Neonesthes Regan & Trewavas, Dana Exped. Ocean. Rept. v, 1929, pp. 5 & 30. Haplotype, *N. macrolychnus* Regan & Trewavas.

NEONESTHES CAPENSIS

Astronesthes capensis Gilchrist & von Bonde, Deep Sea Fishes, Fisher. & Mar. Biol. Surv. Rept. iii, Spec. Rept. vii, 1924, p. 5. Off Table Bay, South Africa.

Neonesthes macrolychnus Regan & Trewavas, Dana Exped. Ocean. Rept. v, 1929, p. 30, pl. vi, fig. 2. North Atlantic.

Family CHAULIODONTIDAE
Genus CHAULIODUS

Chauliodus Bloch & Schneider, Syst. Ichth., 1801, p. 430. Haplotype, *C. sloani* Bloch & Schneider.

CHAULIODUS DANNEVIGI
Viper Fish

Chauliodus dannevigi McCulloch, Biol. Res. Endeavour iv, Oct. 31, 1916, p. 179, pl. lii. Off Cape Everard, Victoria.

Family GONOSTOMIDAE
Genus CYCLOTHONE

Cyclothone Goode & Bean, Bull. Mus. Comp. Zool. Harvard x, 1883, p. 221. Haplotype, *C. lusca* Goode & Bean.

CYCLOTHONE MICRODON
Roundmouth

Gonostoma microdon Gunther, Ann. Mag. Nat. Hist. (5) ii, Aug. 1, 1878, pp. 175 & 187. Atlantic and Pacific Oceans; 500-2,900 faths.

CYCLOTHONE BRAUERI

Cyclothone braueri Jespersen & Taning, Rept. Danish. Oceanogr. Exped. 1908-1910, no. 9, 1926, p. 7. Mediterranean Sea and Atlantic Ocean.

CYCLOTHONE PSEUDOPALLIDA

Cyclothone pseudopallida Mukhacheva, Trudy Inst. Okeanol. Akad. Nauk. SSSR, lxxiii, 1964, p. 104, fig. 7a. Pacific Ocean.

Note: Compare Rass, Acad. Sci. USSR, Biol. Pacif. Ocean iii, 1967, pp. 195-197, maps.

Genus PHOSICHTHYS

Phosichthys Hutton, Fish. N.Z., Feb. 1872, p. 55. Haplotype, *P. argenteus* Hutton. Emended to *Photichthys* by Gunther.

PHOSICHTHYS ARGENTEUS
Lighthouse Fish

Phosichthys argenteus Hutton, Fish. N.Z., Feb. 1872, p. 56. Cook Straits; thrown on shore after heavy gales.

Genus NAROOMA

Narooma Whitley, Rec. Austr. Mus. xix, 4, Sept. 19, 1935, p. 215. Orthotype, *N. benefica* Whitley.

NAROOMA RAOULENSIS
Porthole Fish

Gonostoma raoulensis Waite, Trans. N.Z. Inst. xlii, 1910, p. 373, pl. xxxv, fig. 1. Raoul Island, Kermadecs.

Family MAUROLICIDAE
Genus TRIARCUS

Triarcus Waite, Proc. N.Z. Inst. 1909, iv, May 11, 1910, p. 109 and Trans. N.Z. Inst. xlii, June 1, 1910, p. 386. Haplotype, *Maurolicus australis* Hector.

TRIARCUS AUSTRALIS
Southern Pearlside

Maurolicus australis Hector, Trans. N.Z. Inst. vii, June 1875, p. 250, pl. ii, fig. 90d. Milford Sound and Cuttle Cove, Preservation Inlet (type). Earlier as a *nomen nudum* in Hector, 9th Ann Rept. Colon. Mus. 1874, p. 10.

Family STERNOPTYCHIDAE
Genus ARGYROPELECUS

Argyropelecus Cocco, Giorn. Sci. Lett. Sicil. xxvi, 1829, p. 46. Type species, *A. hemigymnus* Cocco (*fide* Jordan, Gen. Fish.).

ARGYROPELECUS INTERMEDIUS
Hatchet Fish

Argyropelecus intermedius Clarke, Trans. N.Z. Inst. x, May 1878, p. 244, pl. vi. Hokitika, N.Z.

Polyipnus kirkii Hector, Trans. N.Z. Inst. xxviii, June 1896, p. 743. *Nomen nudum*. N.Z. (Kirk). ("Challenger" specimens of *"Sternoptyx diaphana"* from near the Kermadecs are probably this species). *Polyipnus* probably also occurs in New Zealand.

Family IDIACANTHIDAE
Genus IDIACANTHUS

Idiacanthus Peters, Monatsb. Akad. Wiss. Berlin, Dec. 1876 (1877) p. 846. Haplotype, *I. fasciola* Peters, from northward of Australia and New Guinea ("Gazelle").

IDIACANTHUS NIGER
Starry Dragon

Idiacanthus niger Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 11, 1914, p. 14. N.Z. ("Terra Nova").

Idiacanthus aurora Waite, Sci. Rept. Austr. Antarct. Exped. iii, 1, Fishes, June 30, 1916, p. 53, pl. v, fig. 1 and text-fig. 11. Off Macquarie Island; 1450-636 fathoms. (Figured with further notes; Regan and Trewavas, Dana Rept. vi, 1930, p. 128, fig. 124).

Family STOMIATIDAE
Genus STOMIAS

Stomias Rafinesque, Analyse, 1815, p. 89. *Nomen nudum*.

Stomias Schinz, Das Thierreich (Cuvier) ii, 1822, p. 310. Haplotype, *Esox boa* Risso.

STOMIAS GRACILIS
Boa Fish

Stomias gracilis Garman, Mem. Mus. Comp. Zool. Harvard xxiv, Dec. 1899, p. 274. South of Australia ("Challenger").

Family CHLOROPHTHALMIDAE
Genus CHLOROPHTHALMUS

Chlorophthalmus Bonaparte, Icon. Faun. Ital., fasc. xxviii, Pesci, 1840, unpaged. Orthotype, *C. agassizi* Bonaparte.

CHLOROPHTHALMUS NIGRIPINNIS
Cucumber Fish

Chlorophthalmus nigripinnis Gunther, Ann. Mag. Nat. Hist. (5) ii, Aug. 1, 1878, p. 182; Voy. Challenger Zool. xxii, 1887, p. 193, pl. li, fig. A. Off Twofold Bay, 120 faths.

Genus BATHYSAUROPSIS

Bathysauropsis Regan, Ann. Mag. Nat. Hist. (8) vii, 1911, p. 127. Haplotype, *Chlorophthalmus gracilis* Gunther.

BATHSAUROPSIS GRACILIS
Deepsea Lizard Fish

Chlorophthalmus gracilis Gunther, Ann. Mag. Nat. Hist. (5) ii, Aug. 1, 1878, p. 182; Voy. Challenger Zool., xxii, 1887, p. 194, pl. xlix, fig. A. Off New Zealand, etc.

Family HARPADONTIDAE
Genus BATHYSAURUS

Bathysaurus Gunther, Ann. Mag. Nat. Hist. (5) ii, Aug. 1, 1878, p. 181. Logotype, *B. ferox* Gunther.

BATHYSAURUS FEROX
Deepsea Bombay Duck

Bathysaurus ferox Gunther, Ann. Mag. Nat. Hist. (5) ii, 1878, p. 182; Rept. Voy. Chall. Zool., xxii, 1887, p. 181, pl. xlvi, fig. a. East coast of N.Z.; 1,100 faths. ("Challenger" Station 168.)

Family BATHYPTEROIDAE
Genus BATHYPTEROIS

Bathypterois Gunther, Ann. Mag. Nat. Hist. (5) ii, Aug. 1, 1878, p. 183. Logotype, *B. longifilis* Gunther.

BATHYPTEROIS LONGIFILIS
Feeler Fish

Bathypterois longifilis Gunther, Ann. Mag. Nat. Hist. (5) ii, Aug. 1, 1878, p. 183; Rept. Voy. Challenger Zool. xxii, 1887, p. 185, pl. xlvii, fig. b and pl. xlviii, fig. b. Near the Kermadec Islands; 520 and 630 faths. ("Challenger" Stations 170, 170a.)

Family MYCTOPHIDAE
Lantern Fishes
Genus PROTOMYCTOPHUM

Protomyctophum Fraser-Brunner, Proc. Zool. Soc. Lond. 118, Feb. 1949, p. 1045, as subgenus of *Electrona*. Orthotype, *Myctophum tenisoni* Norman.

PROTOMYCTOPHUM TENISONI

Myctophum tenisoni Norman, Discovery Report ii, 1930, pp. 319 & 321, fig. 27. Antarctic and Southern Atlantic.

PROTOMYCTOPHUM NORMANI

Myctophum normani Taning, Vidensk. Med. Dansk. nat. Foren. xciv, July 19, 1932, p. 127, fig. 2. East of N.Z. and Cape of Good Hope.

PROTOMYCTOPHUM ANDERSSONI

Myctophum anderssoni Lonnberg, Zool. Anzeiger xxviii, April 25, 1905, p. 763; Wiss. Ergeb. Schwed. Sudpolar Exped. v, 6, 1905, p. 61. Falkland Islands.

Genus HIEROPS

Hierops Fraser-Brunner, Proc. Zool. Soc. Lond. 118, Feb. 1949, p. 1046, as subgenus of *Electrona*. Orthotype, *Scopelus arcticus* Lutken.

HIEROPS SUBPARALLELUS

Myctophum arcticum subparallelum Taning, Vidensk. Med. Dansk. nat. Foren., xciv, July 19, 1932, p. 128. Cook Strait and South Island of N.Z.

HIEROPS PARALLELUS

Myctophum parallelum Lonnberg, Zool. Anz. xxviii, 23, 1905, p. 764. 350 miles north-west of South Georgia Island.

Protomyctophum (*Hierops*) *parallelum* Andriashev, Explor. Faun. Seas i (9), 1962, p. 237, fig. 16 (Eastern side of South Island of N.Z.)

Genus METELECTRONA

Metelectrona Wisner, Copeia 1963 (1), March 30, 1963, p. 24. Orthotype, *M. ahlstromi* Wisner.

METELECTRONA AHLSTROMI

Metelectrona ahlstromi Wisner, Copeia 1963 (1), March 30, 1963, p. 24, fig. 1. South-central Pacific Ocean, about 400 miles S.E. of N.Z.

Genus ELECTRONA

Electrona Goode & Bean, Spec. Bull. U.S. Nat. Mus. ii (Oceanic Ichth.), 1896, pp. 71 & 91. Orthotype, *Scopelus risso* Cocco.

ELECTRONA ANTARCTICA

Scopelus antarcticus Gunther, Ann. Mag. Nat. Hist. (5) ii, Aug. 1, 1878, p. 184; Rept. Voy. Challenger Zool., xxii, 1887, p. 196, pl. li, fig. D. Antarctic Ocean; 1,975 fathoms.

ELECTRONA CARLSBERGI

Myctophum carlsbergi Taning, Vidensk. Med. Dansk. nat. Foren. xciv, July 19, 1932, p. 126, fig. 1. East of N.Z.

ELECTRONA RISSO SALUBRIS

Scopelus risso Cocco, Giorn. Sci. Lett. Sicilia xxvi, 1829, p. 144, *fide* Sherborn, Index Anim. Messina.

Electrona risso salubris Whitley, Rec. Austr. Mus. xix, 1933, p. 62. Between Cape Everard and Gabo Island, Victoria. *Id.* Moreland, Rec. Domin. Mus. iii, 1956, p. 10, fig. 2.

Genus ELAMPADENA

Elampadena Whitley, Rec. Austr. Mus. xxiii, Oct. 21, 1953, p. 135. Orthotype, *Scopelus subasper* Gunther.

ELAMPADENA SUBASPERA

Scopelus subasper Gunther, Cat. Fish. Brit. Mus. v, 1864, p. 411. Pacific Ocean at 43°40'S. Lat. x 123°E. Long. [Indian Ocean, well to southward of Western Australia.]

Note: Recorded from Macquarie Island as *Myctophum antarcticum.*

Genus HYGOPHUM

Hygophum Taning, Vidensk. Med. Dansk. nat. Foren. xciv, July 19, 1932, p. 133. Logotype, *Scopelus hygomi* Lutken, selected by Bolin, Stanford Ichth. Bull. i, (4) 1939, p. 113.

HYGOPHUM HANSENI

Myctophum (*Hygophum*) *hanseni* Taning, Vidensk. Med. Dansk. nat. Foren. xciv, July 19, 1932, p. 132, fig. 4. East of N.Z. and Cape of Good Hope.

HYGOPHUM HYGOMI

Scopelus hygomi Lutken, K. Dansk. Vidensk. Selsk. Skr. (6) vii, 1892, p. 256, fig. 15. Type-loc. selected by Bolin, Rept. M. Sars Exp. iv, 2, 1959, p. 7, as 38°N. Lat. x 22°20'W. Long., North Atlantic Ocean.

Genus BENTHOSEMA

Benthosema Goode & Bean, Spec. Bull. U.S. Nat. Mus. ii (Oceanic Ichth.), 1896, pp. 71 and 75. Orthotype, *Salmo mulleri* Gmelin.

BENTHOSEMA SIMILIS

Myctophum simile Taning, Vidensk. Medd. Dansk. nat. Foren lxxxvi, 1928, p. 56. North Atlantic. See Rass, Trudy Inst. Okeanol. Akad. Nauk SSR., xli, 1960, p. 149.

Genus LAMPADENA

Lampadena Gill, Mem. Nat. Acad. Sci. Washington vi, 1893, pp. 113 & 123, *ex* Goode & Bean, MS. Haplotype, *Scopelus parvimanus* Gunther. Not *Lampadena* as published by Goode & Bean in 1896.

LAMPADENA PARVIMANUS

Scopelus parvimanus Gunther, Cat. Fish. Brit. Mus. v, 1864, p. 406. South Pacific. Type redescribed and figured by Norman, Ann. Mag. Nat. Hist. (10) iv, 1929, p. 514, fig. 3.

LAMPADENA NOTIALIS

Lampadena notialis Nafpaktitis & Paxton, Los Angeles County Mus. Contrib. Sci. cxxxviii, pp. 4 & 13, figs. 5, 8, & 10. [Tasman Sea, between Australia and N.Z. =] 42°S. x 160°11'E. Long. to 42°08'S. Lat. x 160°05'E. Long. Published 1968.

LAMPADENA SPECULIGERA

Lampadena speculigera Goode & Bean, Spec. Bull. U.S. Nat. Mus. ii (Oceanic Ichth.), 1896, p. 85, pl. xxvi, fig. 99. [N.E. United States of America =] 39°48'N. Lat. x 70°36'W. Long.; 551 fathoms.

Genus MYCTOPHUM

Myctophum Rafinesque, Ind. Ittiol. Sicil., May 1810, pp. 35 and 56, pl. ii, fig. 5. Haplotype, *M. punctatum* Rafinesque.

Scopelus Cuvier, Regne Anim. ed. 1, ii, "1817" = Dec. 1816, p. 169. Logotype, *Serpe humboldti* Risso = *Myctophum punctatum* Raf.

MYCTOPHUM NOVAESEELANDIAE

Scopelus (*Myctophum*) *novaeseelandiae* Steindachner, Anzeiger Akad. Wiss. Wien. 37th year, no. xvi, 1900, p. 177; Denkschr. Akad. Wiss. Wien lxx, 1900 (1901), p. 513. N.Z. Type lost (Wahlert, Veroff. Ubersee Mus. Bremen A, ii, 5, 1955, p. 323).

MYCTOPHUM HOOKERI

Scopelus hookeri Whitley, Rec. Austr. Mus. xxiii, 3, Oct. 21, 1953, p. 134. Lord Howe Island.

MYCTOPHUM PHENGODES

Scopelus phengodes Lutken, Vidensk. Medd. Copenhagen (6) vii, 1892, p. 253, fig. 11. Atlantic Ocean.

Note: One specimen (Australian Museum regd. no. IB.3994), 4¼ inches long, was washed on the deck of a ship between Sydney and Auckland.

Genus SYMBOLOPHORUS

Symbolophorus Bolin & Wisner, Rept. M. Sars Exped. iv, 2, 1959, p. 11. Orthotype, *Myctophum californiense* Eigenmann & Eigenmann.

SYMBOLOPHORUS BARNARDI

Myctophum humboldti barnardi Taning, Vidensk. Medd .Dansk. naturh. Foren xciv, 1932, p. 128. Cape, Southern Atlantic and Tasman Sea.

Genus GONICHTHYS

Gonichthys Gistel, Isis (Munich) v. 1850, p. 71. Haplotype, *G. loricatus* Lowe.

GONICHTHYS BARNESI

Gonichthys barnesi Whitley, Austr. Zool. x, 2, April 30, 1943, p. 174, fig. 6. Lord Howe Island.

Genus DIAPHUS

Diaphus Eigenmann & Eigenmann, Proc. Calif. Acad. Sci. (2) iii, Sept. 1, 1891, p. 3. Orthotype, *D. theta* Eig. & Eig.

Lamprossa Jordan & Hubbs, Mem. Carneg. Mus. x, 2, June 27, 1925, p. 156. Orthotype, *Diaphus anteorbitalis* Gilbert.

DIAPHUS (LAMPROSSA) OSTENFELDI

Diaphus ostenfeldi Taning, Vidensk. Med. Dansk. nat. Foren. xciv, July 19, 1932, p. 142, fig. 15. West of N.Z.

Genus COLLETTIA

Collettia Goode & Bean, Spec. Bull. U.S. Nat. Mus. ii (Oceanic Ichth.), 1896, pp. 71 & 88. Orthotype, *Nyctophus rafinesquii* Cocco.

COLLETTIA PERSPICILLATA

Aethoprora perspicillata Ogilby, Proc. Linn. Soc. N.S.Wales xxiii, June 23, 1898, p. 36. Lord Howe Island.

Diaphus danae Taning, Vidensk. Med. Dansk. nat. Foren. xciv, July 19, 1932, p. 140, fig. 13. North of N.Z.

Genus LAMPANYCTODES

Lampanyctodes Fraser-Brunner, Proc. Zool. Soc. Lond. 118, Feb. 1949, p. 1080. Orthotype, *Scopelus hectoris* Gunther.

LAMPANYCTODES HECTORIS

Scopelus hectoris Gunther, Ann. Mag. Nat. Hist. (4) xvii, May 1, 1876, p. 399; Trans. N.Z. Inst. ix, 1877, p. 471. Southern side of Cook Strait.

Genus SERPA

Serpa Cloquet, Dict. Sci. Nat. xlviii, 1827, p. 190. Logotype, *S. crocodilus* Cloquet, selected by Whitley, Rec. Austr. Mus. xix, 1933, p. 64.

SERPA PECCATUS

Serpa peccatus Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, 1939, p. 228. N.Z.

SERPA AUSTRALIS

Lampanyctus alatus australis Taning, Vidensk. Med. Dansk. nat. Foren. xciv, July 19, 1932, p. 145. Off N.Z., Australia and Cape of Good Hope.

SERPA CONSPICUA

Serpa conspicua Whitley, Austr. Zool. xiii, 3, 1936, p. 160, 2 figs. Kaikoura.

SERPA PUSILLA

Scopelus pusillus Johnson, Proc. Zool. Soc. Lond. lviii, 1890, pp. 457-458. Madeira.

Genus DIOGENICHTHYS

Diogenichthys Bolin, Stanf. Ichth. Bull. i (4), 1939, p. 119. Orthotype, *Myctophum laternatum* Garman.

DIOGENICHTHYS ATLANTICUS

Myctophum laternatum atlanticum Taning, Vidensk. Medd. Dansk. nat. Foren., lxxxvi, 1928, p. 56. North Atlantic, Strait of Gibraltar.

Genus CERATOSCOPELUS

Ceratoscopelus Gunther, Cat. Fish. Brit. Mus. v, 1864, pp. 405 & 412, as subgenus of *Scopelus*. Haplotype, *Scopelus maderensis* Lowe.

CERATOSCOPELUS TOWNSENDI

Myctophum townsendi Eigenmann & Eigenmann, West American Scientist 1889, p. 125 (*fide* McCulloch, Rec. Austr. Mus. xiv, 1923, p. 115, pl. xiv, fig. 2). Cortez Banks, California.

Lampanyctus guntheri Waite, Trans. N.Z. Inst. xlii, 1909 (1910), p. 372, Kermadecs. Not *L. guntheri* Goode & Bean, Spec. Bull. U.S. Nat. Mus. ii (Oceanic Ichth.), 1896, p. 79, fig. 90, from Newfoundland.

Genus GYMNOSCOPELUS

Gymnoscopelus Gunther, Journ. Mus. Godeffroy i, 4, 1873, p. 91. Haplotype, *G. aphya* Gunther.

GYMNOSCOPELUS PIABILIS

Lampanyctus piabilis Whitley, Rec. Austr. Mus. xviii, March 25, 1931, p. 103, fig. 1. Macquarie Island.

Genus NOTOSCOPELUS

Notoscopelus Gunther, Cat. Fish. Brit. Mus. v, 1864, pp. 405 & 415, as subgenus of *Scopelus*. Logotype, *Lampanyctus resplendens* Richardson, selected by Goode & Bean, Spec. Bull. U.S. Nat. Mus. ii (Oceanic Ichth.), 1896, p. 82.

NOTOSCOPELUS ELONGATUS EJECTUS

Scopelus elongatus Costa, Fauna Regno Napoli, Pesci i, June 1844, *Scopelus* 2 (*fide* Sherborn, Index Anim.). Naples.

Notoscopelus ejectus Waite, Rec. Austr. Mus. v, 3, March 11, 1904, p. 150, pl. xviii, fig. 2. Lord Howe Island.

NOTOSCOPELUS LONGIPINNIS

Lampanyctus longipinnis Regan, Terra Nova Zool. i, 4, March 25, 1916, p. 140, pl. vi, fig. 9. Off Three Kings Islands.

Genus SCOPELOPSIS

Scopelopsis Brauer, Wiss. Ergebn. Deutsch. Tiefsee Exped. Valdivia xv, 1906, p. 146. Haplotype, *S. multipunctatus* Brauer.

SCOPELOPSIS MULTIPUNCTATUS

Scopelopsis multipunctatus Brauer, Wiss. Ergeb. Deutch. Tiefsee-Exped. Valdivia xv, 1906, p. 146. Off South Africa.

Scopelopsis caudalis Whitley, Rec. Austr. Mus. xviii, April 20, 1932, p. 333. Lord Howe Island.

Note: Rass (Akad. Nauk. CCCP Trudy Inst. Okeanol., xli, 1960, pp. 146-152. figs. 1-2) in a paper in Russian and with a Russian title, maps the occurrences of Myctophidae in New Zealand and to the northward. On page 149, *Lampanyctus hectoris* and other well-recognized species, but, as far as I can make out, the following are listed, their names being different from those in my foregoing list: (p. 148, fig. 2) *Myctophum humboldti, M. asperum, Lampanyctus alatus, Hygophum reinhardti, Diogenichthys atlanticus, Centrobranchus nigroocellatus* and *Gonichthys cocco.*

See also Rass, Acad. Sci. USSR, Biol. Pacif. Ocean iii, 1967, p. 162, etc.

Bussing (Biol. Antarctic Seas II, 1965, pp. 200, 202, 203 & 207) also mentions as from around New Zealand: *Electrona subaspera* (Gunther), *Lampanyctus pusillus* (Johnson) and other Myctophidae.

Family NOTOSUDIDAE

Genus NOTOSUDIS

Notosudis Waite, Sci. Rept. Austral. Antarct. Exped. (C) iii, 1, June 30, 1916, p. 56. Orthotype, *N. hamiltoni* Waite.

NOTOSUDIS HAMILTONI

Southern Lizard Fish

Notosudis hamiltoni Waite, Sci. Rept. Austral. Antarct. Exped. (C) iii, 1, June 30, 1916, p. 57, pl. v, fig. 2 and text-fig. 12. Macquarie Island.

Family PARALEPIDIDAE

Genus PARALEPIS

Paralepis Bosc, Nouv. Dict. Hist. Nat. ed. 2, xxiv, Sept. 1818, p. 520. Tautotype, *P. coregonoides* Risso (see Whitley, Rec. Austr. Mus. xx, 1937, p. 11).

PARALEPIS PRIONOSA

Barracudina

Paralepis atlantica prionosa Rofen, Aquatica ii, 1963, p. 1. Antarctic and western South Pacific.

PARALEPIS RISSOI

Paralepis rissoi Bonaparte, Icon. faun. ital., 1841, unpaged. Italy.

Genus LESTIDIUM

Lestidium Gilbert, Bull. U.S. Fish. Comm. xxiii, 2, 1903 (Aug. 5, 1905) p. 607. Orthotype, *L. nudum* Gilbert.

LESTIDIUM NUDUM

Lestidium nudum Gilbert, Bull. U.S. Fish. Comm. xxiii, 2, 1903 (Aug. 5, 1905), p. 607, fig. 236. Hawaiian Islands, 283-284 faths.

Note: Recorded from the Kermadecs by Waite.

LESTIDIUM GRACILE

Lestidium gracile Ege, Dana Rept. 40, 1953, pp. 4 *et seq.*, figs. 20 & 23. East of N.Z. ("Dana" Station 3,642).

LESTIDIUM PSEUDOSPHYRAENOIDES PROGRESSUM

Paralepis pseudosphyraenoides Ege, Kjobenh. Nath. Medd. lxix, 1918, p. 243. N.E. Atlantic and Mediterranean.

Lestidium pseudosphyraenoides progressum Ege, Dana Rept. 40, 1953, pp. 3 *et seq.*, figs. 17, 21 & 22. North of N.Z. ("Dana" Station 3,630).

Note: *L.p. danae* (Ege), tabulated as coming from N.Z. by Ege, *loc. cit.* 1953, p. 86, actually occurred well outside N.Z. waters.

Genus PRYMNOTHONOIDES

Prymnothonoides Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, Sept. 1939, p. 228. Orthotype, *P. regani* Whitley & Phillipps.

PRYMNOTHONOIDES REGANI

Veiled Barracudina

Prymnothonoides regani Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, Sept. 1939, p. 228, based on *"Prymnothonus"* Regan, Terra Nova Zool. i, 4, March 25, 1916, p. 138, pl. vii, fig. 3. Off Cape Maria van Diemen; 2 metres.

Genus MACROPARALEPIS

Macroparalepis Ege, Vidd. Medd. nat. Foren. Kjob. xciv, 1933, p. 229. Logotype, *M. affinis* Ege, *vide* Harry, Pacific Science vii, 1953, p. 231.

MACROPARALEPIS MOLESTUS

Macroparalepis molestus Marshall, Discov. Rept. xxvii, 1955, p. 315, fig. 5. Near Campbell Island, south of N.Z.

Genus BATHYMICROPS

Bathymicrops Murray & Hjort, Depths of the Ocean, 1912, p. 416. Orthotype, *B. regis* Murray & Hjort. Genus and species generally, but wrongly, attributed to Koefoed, Rept. Sci. Res. Michael Sars Exped. iv, 1, 1927, p. 64.

BATHYMICROPS BREVIANALIS

Blind Cucumber Fish

Bathymicrops sp. Bruun, Galatheas Jordomsejling, 1953, p. 174, fig. North-east of N.Z., etc.

Bathymicrops brevianalis Nielsen, Galathea Rept. viii, 1966, pp. 49, 62 & 65, fig. 10. Kermadec Trench; 5,850-5,900 metres (holotype) and Madagascar-Monbassa.

Family ALEPISAURIDAE
Genus ALEPISAURUS

Alepisaurus Lowe, Proc. Zool. Soc. (Lond.), Oct. 1833, p. 104. Haplotype, *A. ferox* Lowe.

ALEPISAURUS RICHARDSONII
Lancet Fish, Wolf Fish

Alepisaurus richardsonii Bleeker, Verh. K. Akad. Wetensch. Amsterdam ii, 1855, pp. 2 & 10. Van Diemen's Land. Based on *Alepisaurus* sp. Richardson, Voy. Erebus & Terror, Fish., 1845, p. 34, pl. xxii, figs. 1-4. Tasmania.

Family ANGUILLIDAE
Genus ANGUILLA

Anguilla Shaw, Gen. Zool. (Pisces) iv, 1, 1803, p. 15. Tautotype, *Muraena anguilla* Linne. The Prussian *Nomencl. Anim.* quotes Schrank, Fauna Boica, i, 2, 1798, pp. 304, and 307 (not seen).

ANGUILLA DIEFFENBACHII
Long-finned Eel, Tuna; Orea; Reherehe; Kuwharuwharu

Anguilla dieffenbachii Gray, Zool. Miscell., June 1842, p. 73. River Thames, N.Z.
Anguilla aucklandii Richardson, Zool. Voy. Erebus and Terror, Fish 1848, p. 113, pl. xlv, figs. 7-13. Auckland Islands [? = Auckland].
Anguilla waitei Phillipps, N.Z. J. Sci. Tech. viii, 1, Sept. 1925, p. 28, fig. 1. Wellington, Karori, and near Kaikehe, North Island.

ANGUILLA AUSTRALIS SCHMIDTII
Short-finned Eel; Tuna heke, Matamoe, Papakura, Hao, Tahu

Anguilla australis Richardson, Proc. Zool. Soc. Lond. ix, 98, Oct. 1841, p. 22. Port Arthur, Tasmania.
Anguilla schmidtii Phillipps, N.Z. J. Sci. Tech. viii, 1, Sept. 1925, p. 30, fig. 4. Foxton, Wellington.
Anguilla australis orientalis Schmidt, Trans. N.Z. Inst. lviii, March 19, 1928, p. 388. N.Z., Chatham Islands, etc.

Family SIMENCHELYIDAE
Genus SIMENCHELYS

Simenchelys Goode & Bean, Bull. Essex Inst. xi, 1879, p. 27, *ex* Gill, MS. Orthotype, *Simenchelys parasiticus* Goode & Bean.

SIMENCHELYS PARASITICUS
Parasitic Eel

Simenchelys parasiticus Goode & Bean, Bull. Essex Inst. xi, 1879, p. 27. Offshore from Newfoundland; burrowing in halibut at 200-300 faths. *Id.* Gosline, Journ. Wash. Acad. Sci. xlii, 4, 1952, p. 130, fig. 1.

Family SYNAPHOBRANCHIDAE
Genus SYNAPHOBRANCHUS

Synaphobranchus Johnson, Proc. Zool. Soc., London, 1862, p. 169. Orthotype, *S. kaupi* Johnson.

SYNAPHOBRANCHUS AFFINIS

Synaphobranchus affinis Gunther, Ann. Mag. Nat. Hist. (4) xx, Nov. 1, 1877, p. 445. Off Inosima, Japan.

Genus DIASTOBRANCHUS

Diastobranchus Barnard, Ann. S. Afr. Mus. xiii, 1923, p. 441. Haplotype, *D. capensis* Barnard.

DIASTOBRANCHUS CAPENSIS DANAE
Basketwork Eel

Diastobranchus capensis Barnard, Ann. S. Afr. Mus. xiii, 1923, p. 441. Cape Point, South Africa.

Synaphobranchus danae Bruun, Dana Rept. ix, Jan. 12, 1927, p. 13, pl. i, figs. 1 and 3. East of New Zealand.

Genus HISTIOBRANCHUS

Histiobranchus Gill, Proc. U.S. Nat. Mus. vi, 1883, p. 255. Orthotype, *H. infernalis* Gill.

HISTIOBRANCHUS BRUUNI
Bruun's Eel

Histiobranchus bruuni Castle, Galathea Rept. vii, 1964, pp. 29 & 34, figs. 1 A-C & F. Tasman Sea: 45°51'S. Lat. x 164°32'E. Long., westward of South Island of New Zealand.

HISTIOBRANCHUS BATHYBIUS

Synaphobranchus bathybius Gunther, Ann. Mag. Nat. Hist. (4) xx, Nov. 1, 1877, p. 445. Middle of North Pacific and midway between Cape of Good Hope and Kerguelen's Land.

Note: Recorded from the Kermadec Trench by Castle, Galathea Rept. vii, 1964.

Family MURAENESOCIDAE
Genus PSEUDOXENOMYSTAX

Pseudoxenomystax Breder, Bull. Bingham Oceanogr. Coll. i, 1927, p. 6. Orthotype, *P. dubius* Breder.

Note: Golvan (Ann. Parasito. Hum. et Comp. xxxvii, 6 bis, 1962, fasc. suppl., p. 68) places this genus in Muraenesocidae, but it seems nearer Leptocephalidae, with *Bassanago* at least of subgeneric ranking.

PSEUDOXENOMYSTAX HIRSUTUS
Hairy Eel

Pseudoxenomystax hirsutus Castle, Trans. Roy. Soc. N.Z. lxxxviii, Nov. 1960, p. 463, fig. 1. Oaro, Kaikoura; 430 faths.

Genus BASSANAGO

Bassanago Whitley, Rec. Austr. Mus. xxii, June 30, 1948, p. 71. Orthotype, *B. bulbiceps* Whitley.

BASSANAGO BULBICEPS
Swollen-headed Conger

Bassanago bulbiceps Whitley, Rec. Austr. Mus. xxii, June 30, 1948, p. 71, fig. 2. Bass Strait, Victoria; 200 faths.

Family NETTASTOMIDAE
Genus NETTASTOMA

Nettastoma Rafinesque, Caratt. gen. spec. Sicil., April 1, 1810, p. 66. Haplotype, *N. melanura* Rafinesque.

NETTASTOMA MELANURA
Duckbill Eel

Nettastoma melanura Rafinesque, Caratt gen. spec. Sicil., April 1, 1810, p. 66, pl. xvi, fig. 1. Sicily.

Note: Larva recorded from south-west of the Kermadec Islands by Castle, Trans. Roy. Soc. N.Z., Zool. v, 7, 1964, p. 80, figs. 1 f-g.

Family LEPTOCEPHALIDAE
Genus GNATHOPHIS

Gnathophis Kaup, Abh. Naturw. Verein Hamburg 1859 (1860) iv, 2, p. 7. Orthotype, *G. heterognathos* Kaup *fide* Jordan, Gen. Fish. iii, 1919, p. 297 = *Myrophis heterognathos* Bleeker, *fide* Castle, 1963.

Rhynchocymba Jordan & Hubbs, Mem. Carneg. Mus. x, 2, 1925, p. 195. Orthotype, *Leptocephalus nystromi* Jordan & Snyder.
Poutawa Griffin, Trans. Roy. Soc. N.Z. lxvi, Aug. 1936, p. 16. Haplotype, *Congrus habenatus* Richardson.

GNATHOPHIS HABENATUS
Little Conger, Silver Eel

Congrus habenatus Richardson, Zool. Voy. Erebus & Terror, Fish., 1848, p. 109, pl. i, figs. 1-5. Cook's Strait.

GNATHOPHIS INCOGNITUS

Gnathophis incognitus Castle, Zool. Publ. Vict. Univ. Wellington 34, July 12, 1963, p. 15, figs. 7-10. Kaikoura coast; 40-50 faths. Adults from New Zealand to Kermadecs and near New Caledonia; young from Australia.

Genus LEPTOCEPHALUS

Leptocephalus Scopoli, Intr. Hist. Nat. 1777, p. 453. Logotype, *L. morrisii* Gmelin = *L. taeniola* Meuschen, the larva of *Muraena* [now *Leptocephalus*] *conger* Linn.

LEPTOCEPHALUS VERREAUXI
Conger; Koiro

Conger verreauxi Kaup, Arch. Naturg. xxii, 1, 1856, p. 72. Australia (Verreaux).

LEPTOCEPHALUS WILSONI

Gymnothorax wilsoni Bloch & Schneider, Syst. Ichth., 1801, p. 529. New Holland.
?*Conger labiata* Castelnau, Proc. Linn. Soc. N.S.Wales iii, May 1879, pp. 355 & 396. Port Jackson, New South Wales.
Leptocephalus mongianus Phillipps, N.Z. J. Sci. Tech. xiii, 4, Feb. 1932, p. 230. Monganui, Doubtless Bay.

LEPTOCEPHALUS ATTENUATUS

Leptocephalus attenuatus Castle, Trans. Roy. Soc. N.Z., Zool. v, 7, 1964, p. 79, fig. 1, h-i. Between New Zealand and Kermadec Islands.

LEPTOCEPHALUS STENORHYNCHUS

Leptocephalus stenorhynchus Castle, Zool. Publ. Vict. Univ. N.Z., xxxvii, 1964, p. 31 and Trans. Roy. Soc. N.Z., Zool. v, 7, 1964, p. 81 (S.W. of Kermadec Islands).

LEPTOCEPHALUS GIGANTEUS
Giant Larval Eel

Leptocephalus giganteus Castle, Trans. Roy. Soc. N. Zeal. lxxxvii, July 1959, p. 179, figs. 1-2. Shallow water, South Westland. Type in Dominion Museum. Larva about 3 feet long.

LEPTOCEPHALUS larvae
Larval eels of more than one genus

"*Leptocephalus longirostris* Kaup", Haast, Trans. N.Z. Inst. vii, July 1875, p. 238. Ninety Mile Beach.
"*Leptocephalus altus* Richardson", Hutton, Trans. N.Z. Inst. viii, May 1876, p. 215. Dunedin.
Congrellus sp. Waite, Trans. N.Z. Inst. xlii, 1910, p. 374. Kermadec Islands.
Leptocephalus spp. of Castle's papers.

Genus FORSKALICHTHYS

Forskalichthys Whitley, Rec. Austr. Mus. xviii, 1935, p. 219. Orthotype, *Conger cinereus* Ruppell.

FORSKALICHTHYS CINEREUS

Conger cinerus Ruppell, Atlas zu Rupp., Reise (Senckenb. Nat. Ges.), Fische, 1830-31, p. 115, pl. 115, pl. xxix, fig. 1. Red Sea.
Note: Found S.W. of Kermadecs (Castle, Trans. Roy. Soc. N.Z., Zool., v, 7, 1964, p. 81).

Family ECHELIDAE
Genus SCOLECENCHELYS

Scolecenchelys Ogilby, Proc. Linn. Soc. N.S.Wales xxii, 2, Oct. 25, 1897, p. 246. Orthotype, *Muraenichthys australis* Macleay.

SCOLECENCHELYS AUSTRALIS
Worm Eel

Muraenichthys australis Macleay, Proc. Linn. Soc. N.S.Wales vi, Sept. 12, 1881, p. 272. Lane Cove, near Sydney, New South Wales.

Genus MURAENICHTHYS

Muraenichthys Bleeker, Nat. Tijdschr. Dierk. ii, 1864, p. 117. Orthotype, *M. gymnopterus* Bleeker.

Aotea Phillipps, Trans. N.Z. Inst. lvi, April 26, p. 533. Haplotype, *A. acus* Phillipps.

MURAENICHTHYS OLIVERI

Muraenichthys oliveri Waite, Trans. N.Z. Inst. xlii, 1910, p. 374, pl. xxv, fig. 2. Kermadec Islands.

MURAENICHTHYS BREVICEPS ACUS, comb. nov.
Needle Eel

Muraenichthys breviceps Griffin, Trans. N.Z. Inst. liii, Aug. 31, 1921, p. 351, pl. liv, fig. 1. Tasman Bay, Nelson, etc. Not *M. breviceps* Gunther, Ann. Mag. Nat. Hist. (4) xvii, May 1, 1876, p. 401. Tasmania.

Aotea acus Phillipps, Trans. N.Z. Inst. lvi, April 26, 1926, p. 534, pl. xc. Cook Strait, N.Z.—from stomach of Snapper.

Muraenichthys breviceps halituna Whitley, Austr. Zool. xii, 2, July 18, 1955, p. 110. Tasman Bay.

Family OPHICHTHYIDAE
Genus LEPTOGNATHUS

Leptognathus Swainson, Nat. Hist. Classif. Fish. Amphib. Rept. i, Oct. 1838, p. 221; *ibid.* ii, July 1839, pp. 196 & 334. Haplotype, *L. oxyrhynchus* Swainson.

LEPTOGNATHUS NOVAEZELANDIAE
Snake Eel

Ophisurus novaezelandiae Hector, Trans. N.Z. Inst. ii, April 1870, p. 34, pl. iii. Near Makaraka, Poverty Bay, N.Z.

Family NEMICHTHYIDAE
Genus BORODINULA

Borodinula Whitley, Austr. Zool. vi, 1931, p. 334. Orthotype, *Nemichthys infans* Gunther.

BORODINULA GILLI
Avocet Eel

Labichthys gilli Bean, Proc. U.S. Nat. Mus. xiii, July 1, 1890, p. 45. Alaska.

Avocettina sp. Richardson, Wellington Post, April 23, 1957, with fig. and Cox, People, Feb. 5, 1958, pp. 28 & 29. Cook Strait.

BORODINULA INFANS

Nemichthys infans Gunther, Ann. Mag. Nat. Hist. (5) ii, Sept. 1, 1878, p. 251. Mid-Atlantic; 2,500 faths.

Genus NEMICHTHYS

Nemichthys Richardson, Zool. Voy. Samarang, Fish., 1848, p. 25. Haplotype, *N. scolopacea* Richardson.

NEMICHTHYS SCOLOPACEUS
Snipe Eel

Nemichthys scolopacea Richardson, Zool. Voy. Samarang, Fish., 1848, p. 25, pl. x, figs. 1-3. Southern Atlantic.

Family CYEMIDAE
Genus CYEMA

Cyema Gunther, Ann. Mag. Nat. Hist. (5) ii, 1878, p. 251. Haplotype, *C. atrum* Gunther.

CYEMA ATRUM
Arrow Eel

Cyema atrum Gunther, Ann. Mag. Nat. Hist. (5) ii, 1878, p. 251. Pacific and Antarctic; 1,500 and 1,800 fathoms.

Family SERRIVOMERIDAE
Genus SERRIVOMER

?Oxystomus Rafinesque, Ind. ittiol. Sicil., May 1810, pp. 49 & 62. Haplotype, *O. hyalinus* Rafinesque. Generic name preoccupied.

Serrivomer Gill & Ryder, Proc. U.S. Nat. Mus. vi, Nov. 27, 1883, p. 260. Orthotype, *S. beanii* Gill & Ryder.

?Bertinulus Whitley, Rec. Austr. Mus. xxii, 1948, p. 73. Orthotype, *O. hyalinus* Rafinesque.

SERRIVOMER BERTINI

Serrivomer bertini Bauchot, Dana Rept. 48, June 20, 1959, p. 132. N.S.Wales, New Zealand, Pacific and Indian Oceans ("Dana" Expedition).

SERRIVOMER SAMOENSIS

Serrivomer samoensis Bauchot, Dana Rept. 48, June 20, 1959, p. 134. South Pacific Ocean, 11°S. lat. x 172°37'W. long., over 4,780 metres ("Dana" Station 3587).

Family MURAENIDAE
Genus VERDITHORAX

Verdithorax Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 311. Orthotype, *Muraena prasina* Richardson.

VERDITHORAX PRASINUS
Green Eel

Muraena prasina Richardson, Zool. Voy. Erebus & Terror, Fish. 1848, p. 93. "Bondy Bay, near Sidney", New South Wales.

Muraena krullii Hector, Trans. N.Z. Inst. iv, 1877, p. 468, pl. viii, fig. 107a. Bay of Islands.

Genus SERRANGUILLA

Serranguilla Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, Sept. 1939, p. 228. Orthotype, *Gymnothorax prionodon* Ogilby.

SERRANGUILLA PRIONODON
Sawtooth Eel

Gymnothorax prionodon Ogilby, Proc. Linn. Soc. N.S.Wales (2) ix, 4, March 28, 1895, p. 720. Port Jackson, N.S.Wales. Type in Australian Museum.

Genus LYCODONTIS

Lycodontis McLelland, Calcutta J. Nat. Hist. v, 18, July 1844, pp. 158 & 173; altered to *Strophidon* on p. 202. Logotype, *L. literata* McLelland.

LYCODONTIS THYRSOIDEA
Moray, Reef Eel

Muraena thyrsoidea Richardson, Zool. Sulphur 1845, p. 111, pl. xlix, fig. 1. Canton, China.

Note: Recorded from the Kermadec Is. by Waite.

LYCODONTIS EUPTERA

Muraena euptera Gunther, Cat. Fish. Brit. Mus. viii, 1870, p. 122. Raoul Island, Kermadecs (MacGillivray).

LYCODONTIS GRIFFINI

Gymnothorax griffini Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, Sept. 1939, p. 229. New name for *G. meleagris* Griffin, Trans. N.Z. Inst. lviii, Sept. 1927, p. 138, pl. x, fig. 2. White Id., Bay of Plenty. Not *G. meleagris* Shaw & Nodder, Nat. Miscell. vii, Sept. 1, 1795, pl. 220 from "the southern ocean."

LYCODONTIS NUBILA

Muraena nubila Richardson, Zool. Voy. Erebus & Terror, Fish., 1848, p. 81, pl. xlvi, figs. 6-10. Norfolk Island.

LYCODONTIS RAMOSA

Gymnothorax ramosus Griffin, Trans. N.Z. Inst. lvi, April 26, 1926, p. 539, pl. xciv. Whangaroa and near Bay of Islands and North Auckland.

Genus UROPTERYGIUS

Uropterygius Ruppell, Neue Wirbelth. Abyssin. Fische, 1838, p. 83. Haplotype, *U. concolor* Ruppell.

UROPTERYGIUS OBESUS

Uropterygius obesus Whitley, Rec. Austr. Mus. xviii, 6, April 20, 1932, p. 329, pl. xxix, fig. 1. Montague Id., N.S.Wales; 70 faths.

Muraena tuhua Griffin, Trans. N.Z. Inst. lxiii, Feb. 28, 1933, p. 171, pl. xxiv, fig. 2. Tuhua = Mayor Id., Bay of Plenty.

UROPTERYGIUS SHIRLEYI

Muraena shirleyi Griffin, Trans. N.Z. Inst. lxiii, Feb. 28, 1933, p. 172, pl. xxiv, fig. 1. Off Mokohinau Is., Auckland.

Family NOTOCANTHIDAE

Genus NOTOCANTHUS

Notocanthus Bloch, Abhandl. Bohm. Gesells. i, 1788, p. 278. Haplotype, *N. chemnitzi* Bloch.

NOTOCANTHUS SEXSPINIS

Spineback

Notocanthus sexspinis Richardson, Zool. Voy. Erebus and Terror, Fish., 1846, p. 54, pl. xxxii, figs. 4-11. King George's Sound, Western Australia.

Family MACRORAMPHOSIDAE

Genus MACRORAMPHOSUS

Macroramphosus Lacepede, Hist. Nat. Poiss. v, 1803, p. 136. Haplotype, *Silurus cornutus* Gmelin, 1789.

MACRORAMPHOSUS ELEVATUS

Snipe Fish

Macrorhamphosus scolopax var. *elevatus* Waite, Austr. Mus. Mem. iv, Dec. 23, 1899, p. 59, pl. vii, fig. 1. Port Hacking to Broughton Island, N.S.Wales.

Genus CENTRISCOPS

Centriscops Gill, Proc. Acad. Nat. Sci. Philad. v, 1862, p. 234, footnote. Haplotype, *Centriscus humerosus* Richardson.

CENTRISCOPS HUMEROSUS

Bellows Fish

Centriscus humerosus Richardson, Zool. Voy. Erebus and Terror, Fish, 1846, p. 56, pl. xxxiv, figs. 5-6. South Australia.

Centriscops humerosus var. *obliquus* Waite, Rec. Canterb. Mus. i, 3, June 24, 1911, p. 170, pl. xxvi. N.Z.

CENTRISCOPS SINUOSUS

Centriscops sinuosus Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 1, 1914, p. 21. N.Z. (Hutton).

Genus NOTOPOGON

Notopogon Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 1, 1914, pp. 14, 18 & 20. Logotype, *N. lilliei* Regan, selected by Whitley, Fish. N.S.W. (McCulloch) ed. 3, 1934, the selection of *schoteli* by earlier authors was invalid because that species was not mentioned by Regan, p. 14.

NOTOPOGON XENOSOMA

Notopogon xenosoma Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 1, 1914, p. 14. Cape North, N.Z. ("Terra Nova").

Centriscops cristatus McCulloch, Biol. Res. Endeavour ii, July 3, 1914, p. 93. N.Z.

NOTOPOGON LILLIEI

Notopogon lilliei Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 1, 1914, p. 14. N.Z. ("Terra Nova").

Centriscops cristatus McCulloch, Biol. Res. Endeavour ii, July 3, 1914, p. 93. N.Z.

Family SYNGNATHIDAE

Genus NOVACAMPUS

Novacampus Whitley, Austr. Zool. xii, 2, July 18, 1955, p. 110. Orthotype, *Syngnathus norae* Waite.

NOVACAMPUS NORAE

Pipefish

Syngnathus pelagicus Hector, Proc. Wellington Philos. Soc. 1898-99 (before June 1899), pp. 5 and 14. Queen Charlotte Sound. Record only. Not *S. pelagicus* Linne, Syst. Nat. ed. 10, 1758, p. 337.

Syngnathus norae Waite, Proc. N.Z. Inst. 1910, i, Sept. 10, 1910, p. 25 and Rec. Canterb. Mus. i, 3, 1911, p. 173, pl. xxvii, fig. 1. Stewart Island to Pegasus Bay, S. Island of N.Z.

Genus LEPTONOTUS

Leptonotus Kaup, Archiv. Naturg. xix, 1, 1853, p. 232. Virtual haplotype, *L. blainvillei* Kaup.

LEPTONOTUS BLAINVILLEANUS

Short-snouted Pipefish

Syngnathus blainvilleanus Eydoux and Gervais, Magasin de Zool. vii, 1837, p. 3; Voy. Favorite, Poiss. 1839, p. 79, pl. xxxii. "Habitat mare Indicum".

Leptonotus blainvillei Kaup, Arch. Naturg. xix, 1, 1853, p. 232. New name for *Syngnathus blainvillianus* Eydoux and Gervais.

LEPTONOTUS ELEVATUS

Doryichthys elevatus Hutton, Fish. N.Z., Feb. 1872, p. 68. Wellington Harbour.

Genus CAMPICHTHYS

Campichthys Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 313. Orthotype, *Ichthyocampus tryoni* Ogilby.

CAMPICHTHYS FILUM

Ichthyocampus filum Gunther, Cat. Fish. Brit. Mus. viii, 1870, p. 178. Type-locality, Bay of Islands, selected by Whitley, Austr. Zool. vi, 1931, p. 313.

Genus STIGMATOPORA

Stigmatopora Kaup, Arch. Naturg. xix, 1, 1853, p. 233. Logotype, *Syngnathus argus* Richardson.

STIGMATOPORA LONGIROSTRIS

Stigmatophora longirostris Hutton, Fish N.Z., Feb. 1872, p. 69. Wellington Harbour.

Genus SOLEGNATHUS

Solegnathus Swainson, Nat. Hist. Classif. Fish. Amphib. Rept. ii, July 1839 pp. 195 and 333. Haplotype, *Syngnathus hardwickii* Gray.

SOLEGNATHUS ROBUSTUS NASO

Solegnathus robustus McCulloch, Zool. Res. Endeav. i, 1911, p. 28, pl. ix, fig. 2. Off Flinders Island, South Australia.

Solegnathus robustus naso Whitley, Austr. Zool. x, 1, Dec. 19, 1941, p. 17. Fish market, Auckland.

SOLEGNATHUS SPINOSISSIMUS

Spiny Sea Horse

Solenognathus spinosissimus Gunther, Cat. Fish. Brit. Mus. viii, 1870, p. 195. Tasmania.

Genus MACLEAYINA

Macleayina Fowler, Proc. Acad. Nat. Sci. Philad. lix, 3, 1907 (1908), p. 426. Orthotype, *H. bleekeri* Fowler.

MACLEAYINA ABDOMINALIS

Seahorse; Kiore

Hippocampus abdominalis Lesson, Bull. Sci. (Ferussac) xi, 1827, p. 127, *fide* Sherborn, Index Anim. N.Z. *Id.* Lesson, Mem. Soc. Hist. Nat. (Paris) iv, Sept. 1828, p. 411 and Voy. Coquille Zool. 1829, pp. 73 and 125. "Baie des Iles ou Marien".

Family FISTULARIIDAE

Genus FISTULARIA

Fistularia Linne, Syst. Nat. ed. 10, 1758, p. 312. Haplotype, *F. tabacaria* Linne.

FISTULARIA PETIMBA

Flutemouth

Fistularia petimba Lacepede, Hist. Nat. Poiss. v, 1803, p. 349. New Britain and Reunion (Commerson) and other locs. from literature.

FAMILY SCOMBERESOCIDAE

Genus SCOMBERESOX

Scomberesox Lacepede, Hist. Nat. Poiss. v, 1803, pp. 344. Haplotype, *S. camperii* Lacepede.

Sayris Rafinesque, Caratt. Alc. N. Gen. Spec. Sicil., Apr. 1, 1810, p. 60. Type, *Sayris recurvirostra* Rafinesque.

SCOMBERESOX FORSTERI

Skipper; Skipjack

Esox saurus Bloch and Schneider, Syst. Ichth. 1801, p. 394 (ref. to Forster only). N.Z. *Id.* Forster, Desc. Anim. 1844, p. 143. Not *Salmo saurus* Linne, Syst. Nat. ed. 10, 1758, p. 310. Washed up on N.Z. beaches after storms.

Sairis scombroides Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 221; Rept. 12th meet B.A.A.S. 1842 (late 1843) p. 26, *ex Esox scombroides* Solander, MS. and *Esox saurus* Forster, MS., *all nomina nuda.* Dusky Bay and sea between N.Z. and N. Holland.

Esox scombroides Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 221, *ex* Solander MS. Dusky Bay and Sea between N.Z. and N. Holland.

Scombresox forsteri Cuv. & Val., Hist. Nat. Poiss. xviii, 1846, p. 481; ed. 2, p. 357. N.Z. (Forster).

Family HEMIRAMPHIDAE
Genus REPORHAMPHUS

Repohamphus Whitley, Austr. Zool. vi, 4, Feb. 13, 1931, p. 314. Orthotype, *Hemirhamphus australis* Steindachner.

REPORHAMPHUS IHI
Garfish; Piper; Takeke; Ihi

Hyporhamphus ihi Phillipps, N.Z. J. Sci. Tech. xiii, 4, Feb. 1932, p. 230. Wellington.

Genus EULEPTORHAMPHUS

Euleptorhamphus Gill, Proc. Acad. Nat. Sci. Philad. 1859 (1860), p. 156. Haplotype *E. brevoortii* Gill.

EULEPTORHAMPHUS LONGIROSTRIS
Long-billed Piper

Hemiramphus longirostris Cuvier, Regne Anim. ed. 2. ii, April 1829, p. 286, footnote: "Indes". Based on "Kuddera C." Russell, Fish. Vizag., pl. 178 from Pondicherry.

Notes: Kermadecs—Waite (*Arrhamphus sclerolepis* Gunther (Cat. Fish. Brit. Mus. vi, 1866, p. 277) was described from "New Zealand?" but is really Australian).

FAMILY OXYPHORHAMPHIDAE
Genus OXYPORHAMPHUS

Oxyporhamphus Gill, Proc. Acad. Nat. Sci. Philad. 1863 (1864), p. 273. Orthotype, *Hemirhamphus cuspidatus* Cuv. & Val.

Evolantia Heller and Snodgrass, Proc. Wash, Acad. Sci. vi, Sept. 12, 1903, p. 189. Haplotype *Exocoetus micropterus* Cuv. & Val.

OXYPORHAMPHUS MICROPTERUS
Small-winged Flying Fish; Maroro

Exocoetus micropterus Cuv. & Val., Hist. Nat. Poiss. xiv, "1846" = May 1847, p. 127; ed. 2, p. 92, pl. 529. King George's Sound, W. Australia; Carteret Harbour, New Ireland; near Bourou, East Indies and Malabar, India.

Family EXOCOETIDAE
Genus CYPSILURUS

Cypsilurus Swainson, Nat. Hist. Class. Fish., Amphib. Rept. i, Oct. 1838, p. 299; *ibid.* ii, July 1839, pp. 187 and 296. Haplotype, *C. appendiculatus* Sw. = *Exocetus appendiculatus* Wood.

CYPSILURUS SPILONOTOPTERUS
Flying Fish

Exocoetus spilonotopterus Bleeker, Nederl. Tijdschr. Dierkunde iii, 1866, p. 113. Sumatra, East Indies.

CYPSILURUS SUBPELLUCENS

Exocoetus subpellucens Richardson, Trav. N.Z. (Dieffenbach), ii, Jan. 1843, p. 221. *Nom. nud.* N.Z.

Esox subpellucens Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843. p. 221. *Nom. nud., ex* Solander MS. N.Z.
(A "bearded" post-larval form of some flying-fish).

CYPSILURUS MELANOCERCUS

Exocoetus melanocercus Ogilby, Proc. Linn. Soc. N.S.Wales, x, June 4, 1885, p. 123. Port Jackson, N.S.Wales.

Genus DANICHTHYS

Danichthys Bruun, J. Linn. Soc. Lond. xxix, Zool., 1934, p. 135. Orthotype, *Exocoetus rondeletii* Cuv. & Val.

DANICHTHYS CRIBROSUS

[*Exocoetus*] *cribrosa* Kner, Reise Novara, Fische, iii, 1867, p. 325. Sydney.

DANICHTHYS ILMA

Exocoetus ilma Clarke, Trans. N.Z. Inst. xxi, June 1899, pp.92 & 94, pl. vi. 80 to 100 miles due west of N.Z.; Westland, Hokitika and Taranaki.

Genus HIRUNDICHTHYS

Hirundichthys Breder, Bull. Bingham Oceangr. Coll. (2) ii, 1928, pp. 14 & 20. Orthotype, *Exocoetus rubescens* Rafinesque.

HIRUNDICHTHYS SPECULIGER

Exocoetus speculiger Cuvier & Valenciennes, Hist. Nat. Poiss. xix, "1846" = May, 1847, p. 94; ed. 2, p 69. "Mers des Indes".

FAMILY CORYPHAENOIDIDAE

Genus CETONURUS

Cetonurus Gunther, Rept. Voy. Challenger, Zool., xxii, pref. Aug. 1, 1887 pp. 125 and 143. Haplotype, *Coryphaenoides crassiceps* Gunther.

CETONURUS CRASSICEPS

Thickhead

Coryphaenoides crassiceps Gunther, Ann. Mag. Nat. Hist. (5) ii, July 1, 1878, p. 25. North of Kermadec Island, 520-650 faths.

Macrurus crassiceps Gunther, Rept. Voy. Challenger, Zool. xxii, 1887, p. 143, pl. xxxvii.

Macrurus globiceps Filhol, La Nature, 1884, p. 185, fig. 2, and Nature xxix, March 20, 1884, p. 485, fig. 1, *ex* Vaillant, MS.—*fide* Zool. Rec. 1884, p. 29. "All our oceans"; 1500-3000 metres ("Talisman").

Genus PARAMACRURUS

Paramacrurus Bleeker, Versl. Akad. Amsterdam (2) viii, 1874, p. 370. Orthotype, *Lepidoleprus australis* Richardson.

PARAMACRURUS AUSTRALIS

Whiptail, Javelin Fish, Grenadier, Rat-tail

Lepidoleprus australis Richardson, Proc. Zool. Soc. Lond. vii, Nov. 1839, p. 100. Port Arthur, Tasmania.

Genus OXYGADUS

Oxygadus Gilbert & Hubbs, Bull. U.S. Nat. Mus. 100, i, 7, 1920, pp. 370 & 515. Orthotype, *Coelorhynchus parallelus* Gunther.

Oxygadus Jordan, Gen. Fish. iv, Aug. 15, 1920, p. 570, *ex* Gilbert & Hubbs, MS. Orthotype, *Macrurus parallelus* Gunther.

OXYGADUS KERMADECUS

Coelorhynchus kermadecus Jordan & Starks, Bull. U.S. Fish. Comm. xxii, Aug. 13, 1904, pp. 618 and 619. New name for *Macrurus parallelus* Gunther, Rept. Voy. Challenger, Zool. xxii, 1887, p. 125, pl. xxix, fig. A., only. Kermadec Islands. Not typical *M. parallelus* Gunther, Ann. Mag. Nat. Hist. (4) xx, Nov. 1, 1877, p. 439 from Inoshima, Japan. (Gilbert & Hubbs said "The specimens from New Zealand perhaps represent a third species".)

Genus CORYPHAENOIDES

Coryphaenoides Gunner, Trondhiemska Selsk. Skrift. iii, 1765, pp. 50 & 58. Haplotype, *Coryphaenoides rupestris* Gunner.—*fide* Sherborn.

CORYPHAENOIDES RUDIS

Coryphaenoides rudis Gunther, Ann. Mag. Nat. Hist. (5) ii, July 1878, p. 24. Pacific, north of Kermadec Island, 500-650 fathoms.

Macrurus rudis Gunther, Rept. Voy. Challenger, Zool. xxii, 1887, p. 131, pl. xxvii. North of the Kermadec Islands. Largest figured specimen designated as type by Gilbert and Hubbs, Proc. U.S. Nat. Mus. li, 1916, p. 144.

CORYPHAENOIDES SERRULATUS

Coryphaenoides serrulatus Gunther, Ann. Mag. Nat. Hist. (5) ii, July 1, 1878, p. 26. North-east of N.Z., 700 faths. ("Challenger" Stn. 169). Figured as *Macrurus serrulatus* Gunther, Rept. Voy. Challenger, Zool. xxii, 1886, p. 133, pl. xxx, fig. a.

Genus COELORINCHUS

Coelorinchus Giorna, Mem. Acad. Sci. Turin, 1805-8 (1809), p. 179. Type, *C. laville* Giorna.

COELORINCHUS OLIVERIANUS

Javelin Fish

Coelorhynchus oliverianus Phillipps, Trans. N.Z. Inst. lviii, Aug. 15, 1927, p. 125, pl. iii, fig. 1. Island Bay.

COELORINCHUS ASPERCEPHALUS

Coelorhynchus aspercephalus Waite, Rec. Canterb. Mus. i, 3, June 24, 1911, p. 178, pl. xxix, fig. 2. N.Z. Govt. Trawling Stations.

Genus GARICHTHYS

Garichthys Whitley, Fish. N.S.W. (A. R. McCulloch) ed. 3, 1934. Orthotype, *Coelorhynchus* (*Paramacrurus*) *mirus* McCulloch.

GARICHTHYS FASCIATUS

Macrurus fasciatus Gunther, Ann. Mag. Nat. Hist. (5) ii, July 1, 1878, p. 24. Western Coast of southernmost South America, 120-245 faths.
Note: Chatham Is. (Moreland, 1957).

GARICHTHYS MIRUS

Coelorhynchus (*Paramacrurus*) *mirus* McCulloch, Biol. Res. Endeavour, v, 4, June 8, 1926, p. 178, pl. xlvi. East of Sydney, N.S.W., 150 faths.
Note: Chatham Islands (Moreland, 1957).

Genus NEZUMIA

Nezumia Jordan & Starks, Bull. U.S. Fish. Comm. xxii, 1902 (1904) p. 620. Orthotype, *N. condylura* Jordan & Gilbert.

NEZUMIA NIGROMACULATA

Macrourus nigromaculatus McCulloch, Rec. Austr. Mus. vi, 5, July, 18, 1907, p. 346, pl. lxiii, figs. 1-1a. 35 miles east of Sydney, New South Wales; 800 faths.
Note: Chatham Is. (Moreland, 1957).

Genus FUYANGIA

Chalinura Goode & Bean, Bull. Mus. Comp. Zool. x, 1883, p. 198. Haplotype, *C. simula* Goode and Bean.
Preoccupied by *Chalinora* Dalman in Arachnida.

Fuyangia Whitley, Austr. Zool. vi, 4, Feb. 13, 1931, p. 334. New name for *Chalinura* Goode and Bean, preoccupied. Orthotype, *C. simula* Goode and Bean.

FUYANGIA MURRAYI

Coryphaenoides murrayi Gunther, Ann. Mag. Nat. Hist. (5) ii, July 1, 1878, p. 26. East of N.Z.; 1,100 fathoms.

Macrurus murrayi Gunther, Rept. Voy. Challenger, Zool. xxii, 1887, p. 146, pl. xxxiv, fig. A.

Genus TRACHYRINCUS

Trachyrincus Giorna, Mem. Acad. Sci. Turin 1805-8 (1809), p. 179. Tautotype, *Lepidoleprus trachyrincus* Risso.

TRACHYRINCUS LONGIROSTRIS

Macrurus longirostris Gunther, Ann. Mag. Nat. Hist. (5) ii, July 1, 1878, p. 23. North-east of N.Z.; 700 fathoms.

Trachyrhynchus longirostris Gunther, Rept. Voy. Challenger, Zool. xxii, 1887, p. 153, pl. xli, fig. B.

Genus LEPIDORHYNCHUS

Lepidorhynchus Richardson, Zool. Voy. Erebus and Terror, Fish. 1846, p. 53. Haplotype, *Macrourus denticulatus* Richardson.

LEPIDORHYNCHUS DENTICULATUS
Deepsea Whiptail

Macrourus denticulatus Richardson, Zool. Voy. Erebus and Terror, Fish. 1846, p. 53, pl. xxxii, figs. 1-3. South Australia.

Genus NEMATONURUS

Nematonurus Gunther, Rept. Voy. Challenger Zool., xxii, 1887, pp. 124 & 150. Logotype, *Macrurus armatus* Hector.

NEMATONURUS ARMATUS
Threadtail

Macrurus armatus Hector, Ann. Mag. Nat. Hist. (4) xv, 1875, p. 81 and Trans. N.Z. Inst. vii, June 1875, p. 249, pl. xi, fig. 78a. Off Cape Farewell; 400 faths. ("Challenger" Exped.)

Coryphaenoides variabilis Gunther, Ann. Mag. Nat. Hist. (5) ii, July 1, 1878, p. 27. Between Cape of Good Hope & Kerguelen Land; south of Australia; mid-Pacific, and Juan Fernandez.

Coryphaenoides gigas Vaillant, Exp. Sci. Travaill. Talism., Poiss., 1888, p. 232, pl. xx, fig. 2. North Atlantic; 4,165 and 4,255 metres.

Genus BATHYGADUS

Bathygadus Gunther, Ann. Mag. Nat. Hist. (5) ii, July 1, 1878, p. 23. Haplotype, *B. cottoides* Gunther.

BATHYGADUS COTTOIDES

Bathygadus cottoides Gunther, Ann. Mag. Nat. Hist. (5) ii, July 1, 1878, p. 23; Rept. Voy. Challenger, Zool., xxii, 1887, p. 154, pl. xlii, fig. A. Deep sea between N.Z. and Kermadec Is.. 520 to 700 faths.

Note: Mr. Charles McCann has a number of new records of species of this family to be published. Rass (Acad. Sci. USSR, Biol. Pacif. Ocean iii, 1967, pp. 200 et seq.) discusses New Zealand and Pacific Coryphaenoididae.

Family MERLANGIIDAE
Genus MACRURONUS

Macruronus Gunther, Zoological Record viii, pref. May, 1873, p. 103. Orthotype, *Coryphaenoides novaezelandiae* Hector.

MACRURONUS NOVAEZELANDIAE
Hoki

Coryphaenoides novaezelandiae Hector, Trans. N.Z. Inst. iii, May 1871, p. 136, pl. xviii, fig. 1. Off Ward Id., Port Nicholson. [Barbel omitted from figure and a dangling branchiostegal ray figured instead *teste* J. Moreland.]

Genus MERLANGIUS

Merlangius Geoffroy, Descr. 719 Plantes & 134 Animaux, 1767, p. 401, pl. dclxi. Logotype, *Gadus merlangus* Linne, designated by Whitley, Rec. Austr. Mus. xxii, 1948, p. 83.

?Merlus Guichenot in Gay, Chili (Peces), 1849, p. 329, *ex* Cuvier, vernac. Haplotype, *M. gayi* Guichenot. Preocc. by *Merlus* Freshaye, Mag. Zool. ii, 1838, pl. iv, a genus of birds.

?Epicopus Gunther, Cat. Fish. Brit. Mus. ii, 1860, pp. 232 & 248. Haplotype, *Merlus gayi* Guichenot.

Huttonichthys Whitley, Mem. Qld. Mus. xi, 1937, p. 122. Orthotype, *Gadus australis* Hutton.

MERLANGIUS (HUTTONICHTHYS) AUSTRALIS
Whiting, Haddock

Gadus australis Hutton, Cat. Fish. N.Z., Feb. 1872, pp. 45 & 115, pl. vii, fig. 72. Cook Straits.

Family GADIDAE

Genus HALARGYREUS

Halargyreus Gunther, Cat. Fish. Brit. Mus. iv, 1862, p. 342. Haplotype, *H. johnsonii* Gunther.

HALARGYREUS JOHNSONII

Cod

Halargyreus johnsonii Gunther, Cat. Fish. Brit. Mus. iv, 1862, p. 342. Madeira.

Note: A dry specimen from N.Z. was regarded as this species by Gunther (Rept. Voy. Challenger, xxvi). See Templeman, 1968.

Genus PHYSICULUS

Physiculus Kaup, Arch. Naturges. (Wiegmann) xxiv, 1, 1858, p. 88. Orthotype, *P. dalwigkii* Kaup.

Pseudophycis Gunther, Cat. Fish. Brit. Mus. iv, 1862, p. 350. Haplotype, *Lota breviuscula* Richardson.

PHYSICULUS (PSEUDOPHYCIS) BACHUS

Red Cod; Hoka

Enchelyopus bachus Bloch and Schneider, Syst. Ichth. 1801, p. 53. N.Z. = South Island.

G[adus] b[achus] Bloch and Schneider, Syst. Ichth. 1801, p. 53, *ex* Forster, MS. N.Z. [= South Island].

Lota baccha Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 221. Murderer's Bay, Queen Charlotte Sound.

Gadus rubiginosus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 221, *ex* Solander MS. Murderer's Bay, Queen Charlotte Sound.

Blennius venustus Richardson, Trav. N.Z. (Dieffenbach), ii, Jan. 1843, p. 222; Rept. 12th meet. Brit. Assn. Adv. Sci. 1842 (late 1843) p. 27, *ex* Parkinson, MS. Ship Cove.

Brosmius venustus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 222; Rept. 12th meet. B.A.A.S. 1842 (1843) p. 27, *ex Blennius venustus* Parkinson, MS. Ship Cove.

Blennius rubiginosus Richardson, Rept. 12th meet. Brit. Assn. Adv. Sci. 1842, (late 1843), p. 27. *Nomen nudum, ex* Solander, MS. Tolaga Bay.

Gadus bacchus Forster, Descr. Anim. (ed. Lichtenstein) 1844, p. 120. South Island.

PHYSICULUS (PSEUDOPHYCIS) BREVIUSCULUS

Bastard Red Cod

Lota breviuscula Richardson, Voy. Erebus & Terror, Fish., 1846, p. 61, pl. xxxviii, figs. 1-2. Bay of Islands.

Phycis richardsoni Kaup, Arch. Naturg. 24(1), 1858, p. 89. New Zealand.

Genus LOTELLA

Lotella Kaup, Archiv. Naturges. (Wiegmann) xxiv, 1, 1858, p. 88. Haplotype, *L. schlegeli* Kaup.

LOTELLA RHACINA

Rock Cod, Southern Hake

Gadum rhacinum Bloch & Schneider, Syst. Ichth. 1801, p. 56. Name, in accusative case, *ex* Forster, MS., as a variety of *Phycis tinca* Bloch & Schneider, N.Z. [type-loc. Queen Charlotte Sound.]

Lota rhacina Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 222 Queen Charlotte Sound.

Gadus rhacinus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 222, *ex* Forster, MS. Queen Charlotte Sound.

Genus MORA

Mora Risso, Hist. Nat. Europe Merid. iii, 1826, p. 224. Haplotype, *Mora mediterranea* Risso.

MORA PACIFICA
Googley-eyed Cod; Ribaldo

Mora pacifica Waite, Trans. N.Z. Inst. xlvi, June 15, 1914, p. 128, pl. v. Kaikoura, S.I. of N.Z.; 200 fathoms.

Genus LEPIDION

Lepidion Swainson, Nat. Hist. Classif. Fish. Amphib. Rept. i, October 1838, p. 318. Tautotype, *Gadus lepidion* Risso, equals *L. rissoii* Swainson.

LEPIDION MICROCEPHALUS

Lepidion microcephalus Cowper, Pacific Science x, 1956, p. 407, figs. 1-2. East of Tasmania. 400-420 fathoms.

Lepidion sp. Anon., Dominion (Wellington newspaper), Sept. 3, 1957, p. —, fig. Palliser Bay.

Family GAIDROPSARIDAE
Genus GAIDROPSARAS

Gaidropsaras Rafinesque, Ind. Ittiol. Sicil., 1810, p. 51. Haplotype, *G. mustellaris* Rafinesque = *Gadus mustela* Linne.

GAIDROPSARAS NOVAEZELANDIAE
Rock Ling

Motella pacificus Hector, 9th. Ann. Rept. Colon. Mus., 1874, p. 8. N.Z. Not of Temminck & Schlegel, 1846, from Japan.

Motella novaezelandiae Hector, Trans. N.Z. Inst. vi, June 1874, p. 107, pl. xviii, fig. 76b. Cape Campbell.

Onos novaezelandiae Hutton, Index Faun. N.Z., 1904, p. 48.

Family BREGMACEROTIDAE
Genus AUCHENOCEROS

Calloptilum Hutton, Trans. N.Z. Inst. v, May 1873, p. 266, *ex* Richardson. Haplotype, *C. punctatum* Hutton. Not *Calloptilum* Richardson, *sensu stricto.*

Auchenoceros Gunther, Rept. Voy. Challenger, Zool. xxxi, 1889, Pelag. Fish., p. 24. New name for *Calloptilum* Hutton *non* Richardson. Haplotype, *C. punctatum* Hutton.

AUCHENOCEROS PUNCTATUS
Ahuru; Ahuruhuru

Calloptilum punctatum Hutton, Trans. N.Z. Inst. v, May 1873, pp. 241 & 267, pl. xi. Mouth of Thames River and Cape Campbell.

Family MELAMPHAIDAE
Genus SIO

Sio Moss, Dana Report 56, March 30, 1962, p. 3. Orthotype, *Melamphaes nordenskjoldii* Lonnberg.

SIO NORDENSKJOLDII

Melamphaes nordenskjoldii Lonnberg, Wiss. Ergebn. schwed. Sudpolarexped. v(6), 1905, p. 58. [Well to the south-east of South America=] 49°56'S. by 49°56'W.; 2,700 metres.

Genus SCOPELOGADUS

Scopelogadus Vaillant, Exped. Travailleur & Talisman, Poissons, 1888, p. 141. Haplotype, *S. coeles* Vaillant = *mizolepis* (Gunther, 1878) from off Aru Islands, Irian.

SCOPELOGADUS BEANII

Melamphaes beanii Gunther, Rept. Voy. Challenger xxii, 1887, p. 29. New name for *Plectromus crassiceps* Bean, 1885, anticipated by *Scopelus crassiceps* Gunther, 1878, from western North Atlantic—see Ebeling & Weed, 1963, Dana Rept. 60, p. 24, fig. 12.

Genus MELAMPHAES

Melamphaes Gunther, Cat. Fish. Brit. Mus. v, Dec. 10, 1864, p. 433. New name for *Metopias* Lowe, 1843, preocc. Haplotype *Metopias typhlops* Lowe.

MELAMPHAES MICROPS

Crusthead or Midnight Fish

Scopelus microps Gunther, Ann. Mag. Nat. Hist. (5)2, 1878, p. 186. Between Cape of Good Hope and Kerguelen Island; 1375 fathoms.

Melamphaes microps Ebeling, Dana Rept. 58, 1962, p. 32, fig. 17 [far eastward of New Zealand].

MELAMPHAES SIMUS

Melamphaes simus Ebeling, Dana Rept. 58, Nov. 30, 1962, p. 94, figs. 34 & 61. South of Canary Islands (type), northward of New Zealand, etc.

MELAMPHAES SUBORBITALIS

Plectromus suborbitalis Gill, Proc. U.S. Nat. Mus. 6(17), Nov. 27, 1883, p. 258. Western North Atlantic; less than 1735 fathoms.

Melamphaes suborbitalis Ebeling, Dana Rept. 58, 1962, p. 56, fig. 23 (range includes a record about halfway between Tasmania and New Zealand).

MELAMPHAES sp.

Bone Helmet Fish

Melamphaes sp. Castle, Evening Post (newspaper, Wellington), Sept. 2, 1957, with fig. Cook Strait; 500 faths.

Family CETOMIMIDAE

Genus GYRINOMIMUS

Gyrinomimus Parr, Bull. Bingham Oceanogr. Coll. iv, 6, 1934, pp. 21 & 29. Orthotype, *G. myersi* Parr.

GYRINOMINUS GRAHAMI

Black Whale Fish

Gyrinomimus simplex Anon., Evening Post (newspaper, Wellington), April 9, 1956, with fig. and of New Zealand authors. Not *G. simplex* of Parr, Copeia 1946 (3), 1946, p. 116, pl. i, figs. A-C. Gulf of Mexico. *Id.* Harry, Zoologica xxxvii, 1952, p. 55, figs. 1 et seq.

Gyrinomimus grahami L. R. Richardson & Garrick, Copeia 1964 (3), 1964, p. 523, fig. 1. Cook Strait. 1,300 faths.

Family MONOCENTRIDAE

Genus CLEIDOPUS

Cleidopus De Vis, Pro. Linn. Soc. N.S.Wales vii, 3, Oct. 28, 1882, p. 367. Haplotype, *C. gloria-maris* De Vis.

CLEIDOPUS NEOZELANICUS

Pineapple Fish

Cleidopus neozelanicus Powell, Rec. Auckl. Inst. Mus. ii, 3, Nov. 17, 1938, p. 151, pl. xxxvi. Opoutama Beach, 40 miles south of Gisborne.

Family BERYCIDAE

Genus BERYX

Beryx Cuvier & Valenciennes, Hist. Nat. Poiss. iii, April, 1829, p. 221. Logotype, *B. decadactylus* Cuv. & Val.

BERYX SPLENDENS

Alfonsino

Beryx splendens Lowe, Proc. Zool. Soc. Lond. 1833, i, (April 16, 1834), p. 142. Madeira. *Id.* Moreland, Rec. Domin. Mus. iii, 1956, p. 9, fig. 1.

Genus CENTROBERYX

Centroberyx Gill, Proc. Acad. Nat. Sci. Philad., xiv, 1862, p. 238. Logotype, *Beryx lineatus* Cuv. & Val., *fide* Jordan, Gen. Fish.

Austroberyx McCulloch, Zool. Res. Endeav. i, Dec. 22, 1911, p. 39. Orthotype, *Beryx affinis* Gunther.

CENTROBERYX AFFINIS
Golden Snapper, Nannygai, Koarea

Beryx affinis Gunther, Cat. Fish. Brit. Mus. i, 1859, p. 13. Australia.

Genus HOPLOSTETHUS

Hoplostethus Cuvier and Valenciennes, Hist. Nat. Poiss. iv, 1829, p. 469. Haplotype, *H. mediterraneus* Cuv. & Val.

HOPLOSTETHUS ELONGATUS
Long Roughy

Trachichthys elongatus Gunther, Cat. Fish. Brit. Mus. i, 1859, p. 10. Great Barrier Island (Sowerby).

HOPLOSTETHUS INTERMEDIUS

Trachichthys intermedius Hector, Ann. Mag. Nat. Hist. (4) xv, Jan. 1, 1875, p. 78 and Trans. N.Z. Inst. vii, June 1875, p. 245, pl. xi, fig. 18a. Off Cape Farewell, 400 fathoms. ("Challenger" Exped.)

Genus PARATRACHICHTHYS

Paratrachichthys Waite, Austr. Mus. Mem. iv, Dec. 23, 1899, p. 64. Orthotype, *Trachichthys trailli* Hutton.

PARATRACHICHTHYS TRAILLI
Roughy

Trachichthys trailli Hutton, Ann. Mag. Nat. Hist. (4) xvi, Nov. 1875, p. 315 and Trans. N.Z. Inst. viii, May 1876, p. 212. Stewart Island.

Family ZEIDAE
Genus ZEUS

Zeus Linne, Syst. Nat. ed. 10, Jan. 1, 1758, p. 266. Logotype, *Z. faber* Linne.

ZEUS AUSTRALIS
John Dory; Kuparu

Zeus australis Richardson, Voy. Erebus and Terror, Fish. 1845, p. 36, pl. xxv, fig. 1. Port Jackson, New South Wales (additional notes on a W. Austr. specimen are given on p. 138, publ. 1848).

Genus ZENOPSIS

Zenopsis Gill, Proc. Acad. Nat. Sci. Philad. 1862 (1863), p. 126. Haplotype, *Zeus nebulosus* Temminck and Schlegel from Japan.

ZENOPSIS NEBULOSUS
Mirror Dory

Zeus nebulosus Temminck and Schlegel, Fauna Japonica (Pisc., 1845), p. 123 pl. lxvi, from Japan.

[*Zenopsis nebulosa* Griffin, Trans. N.Z. Inst. liv, Dec. 14, 1923, p. 256, pl. xxvi, from Bay of Plenty to Kauraki Gulf. May be slightly distinct.]

Genus OREOSOMA

Oreosoma Cuvier, Regne Anim. ed. 2, ii, April, 1829, p. 171; Cuv. & Val., Hist. Nat. Poiss. iv, Nov. 1829, p. 515. Haplotype, *O. atlanticum* Cuv. & Val.

OREOSOMA WAITEI
Mountainsides

Oreosoma waitei Whitley, Rec. Austr. Mus. xvii, June 27, 1929, p. 109. Lyall Bay, Wellington. Type figured by Waite, Trans. Proc. N.Z. Inst. xliv, June 10, 1912, p. 197, pl. xi, as *O. atlanticum*.

Genus CYTTUS

Cyttus Gunther, Cat. Fish. Brit. Mus. iii, 1861, p. 396. Logotype, *Capros australis* Richardson.

CYTTUS AUSTRALIS

Boarfish

Capros australis Richardson, Trans. Zool. Soc. Lond. iii, June 11, 1842, p. 73; Ann. Mag. Nat. Hist. xi, March 1843, p. 170; Zool Voy. Erebus and Terror, 1845, p. 137, pl. lix, figs. 1-5. Port Arthur, Tasmania.

CYTTUS NOVAEZEALANDIAE

Silver Dory

Zeus novaezealandiae Arthur, Trans. N.Z. Inst. xvii, May 1885, p. 163, pl. xiv, fig. 3. Off Otago Heads; 25 faths.

Genus RHOMBOCYTTUS

Rhombocyttus Gill, Mem. Nat. Acad. Sci. Wash. vi, 1893, pp. 115 and 123. Haplotype, *Cyttus traversi* Hutton.

RHOMBOCYTTUS TRAVERSI

Horsehead

Cyttus traversi Hutton, Cat. N.Z. Fish., Feb. 1872, p. 19, Saltwater Creek, Canterbury.

Genus NEOCYTTUS

Neocyttus Gilchrist, Mar. Invest. S. Afr. iv, 1906, p. 153. Genotype, *N. rhomboidalis* Gilchrist. (*Fide* Zoological Records).

NEOCYTTUS GIBBOSUS

Spiky Dory

Neocyttus rhomboidalis var. *gibbosus* McCulloch, Biol. Res. Endeav. ii, 3, July 3, 1914, p. 120, text-fig. 8. Great Australian Bight. 350-450 fathoms.

Genus CAPROMIMUS

Capromimus Gill, Mem. Nat. Acad. Sci. Wash. vi, 1893, pp. 115 & 123. Haplotype, *Platystethus abbreviatus* Hector.

CAPROMIMUS ABBREVIATUS

Rough Dory

Platystethus abbreviatus Hector, Ann. Mag. Nat. Hist. (4) xv, Jan. 1875, p. 79 and Trans. N.Z. Inst. vii, June 1875, p. 247, pl. xi, fig. 31c. Off Cape Farewell, 400 faths. ("Challenger" Exped.)

Antigonia mulleri Klunzinger, Sitzb. Akad. Wiss. Wien lxxx, 1, 1879, p. 380, pl. v, fig. 3. N.Z.

Family DIRETMIDAE

Genus DIRETMUS

Diretmus Johnson, Proc. Zool. Soc. Lond. 1863 (April 20, 1864), p. 403. Haplotype, *D. argenteus* Johnson.

Discus Campbell, Trans. N.Z. Inst. xi, May 1879, p. 298. Haplotype, *D. aureus* Campbell. Preoccupied by *Discus* Fitzinger, 1833, a genus of mollusca.

Campbellina Fowler, Notulae Naturae 310, Aug. 22, 1958, p. 15. Orthotype, *Discus aureus* Campbell. Substitute for *Discus,* preocc.

DIRETMUS AUREUS

Disc Fish

Discus aureus Campbell, Trans. N.Z. Inst. xi, May 1879, p. 297 and fig. Hokitika beach, N.Z.

Discus auratus Hector, 14th Ann. Rept. Colon. Mus. 1879, p. 12. *Errore* Hokitika.

Family LOPHOTIDAE

Genus REGILOPHOTES

Regilophotes Whitley, Rec. Austr. Mus. xix, Aug. 2, 1933, p. 72. Orthotype, *Lophotes guntheri* Johnston.

REGILOPHOTES GUNTHERI
Crested Bandfish; Unicorn Fish

Lophotes guntheri Johnston, Proc. Roy. Soc. Tas. 1882 (1883), pp. 142 and 177. Emu Bay district, Tasmania.

Family REGALECIDAE
Genus REGALECUS

Regalecus Ascanius, Icones rerum nat. ii, 1772, p. 5. Haplotype, *R. glesne* Ascanius (*fide* Sherborn, Index Animalium).

REGALECUS PACIFICUS
Oarfish

Regulus pacificus Haast, Trans. N.Z. Inst. ix, May 1877, p. 646. *Nomen nudum.*

Regalecus pacificus Haast, Trans. N.Z. Inst. x, May 1878, p. 246, pl. vii. New Brighton, N.Z.

Regalecus argenteus Parker, N.Z. J. Sci. i, 1883, p. 520; Trans. N.Z. Inst. xvi, May 1884, p. 284, pl. xxiii, Moeraki, Otago, N.Z.

Family AGROSTICHTHYIDAE
Genus AGROSTICHTHYS

Agrostichthys Phillipps, Proc. Zool. Soc. Lond. 1924, ii, p. 232. Orthotype, *Regalecus parkeri* Benham.

AGROSTICHTHYS PARKERI
Streamer Fish; Parker's Ribbon Fish

Regalecus parkeri Benham, Trans. N.Z. Inst. xxvi, Aug. 1904, p. 198, pl. ix. Deborah Bay, near Port Chalmers, S. Island, N.Z.

Family TRACHIPTERIDAE
Genus DESMODEMA

Desmodema Walters & Fitch, Calif. Fish & Game xlvi, 4, Oct. 1960, p. 446. Orthotype, *Trachipterus jacksonensis* var. *polystictus* Ogilby.

DESMODEMA ARAWATAE
(Figure 1)
Southern Ribbonfish or Dealfish

Trachypterus arawatae Clarke, Trans. N.Z. Inst. xiii, April 1881, p. 197 & fig. Arawata, N.Z.

Note: An unsual ribbonfish was figured, amongst others, as *Trachipterus jacksonensis* Ramsay, by Hamilton, Trans. N.Z. Inst. xlviii, 1916, pp. 371 & 374, fig. 2, of which Hamilton wrote, "Caught at Nelson in November, 1908. Only a drawing preserved." After it had been missing for over half a century, I found what is evidently this specimen in the Canterbury Museum, Christchurch, and made a fresh sketch of it, which is here reproduced alongside a copy of Hamilton's figure. The specimen had more dorsal rays than were shown in Hamilton's figure and it was 17 inches in *total* length. Labels in its bottle read: "*Regalecus* juv. (*pacificus*). Loc. Nelson. 1908. Specimen drawn H.S.B." Canterbury Museum registered no. P.442.2. Old Collection; old catalogue no. 718. The lateral line, descending to the ventral surface indicates it is a Trachipterid rather than a *Regalecus*. Fin-rays could not be counted accurately, but the fish had the following characters.

Br. 6. D.vi + more than 125. A.O. P.6. V. 5? C.12? or 13. Head (2 inches) equals depth (2), 6.1 in standard length (12.3). Snout to vent 4.5 inches. Facies as figured. Strong granulations on supraorbital, preorbital, maxilla and opercles. Skin of body with minute pimples. Ventral surface of body thrown into three V-shaped folds before anus. Lateral line with small tubes and descending to ventral surface an eye-diameter behind vent, after which there is a series of about 37 ventro-lateral spines to before the tail; some of these spines are further apart than others and there are some

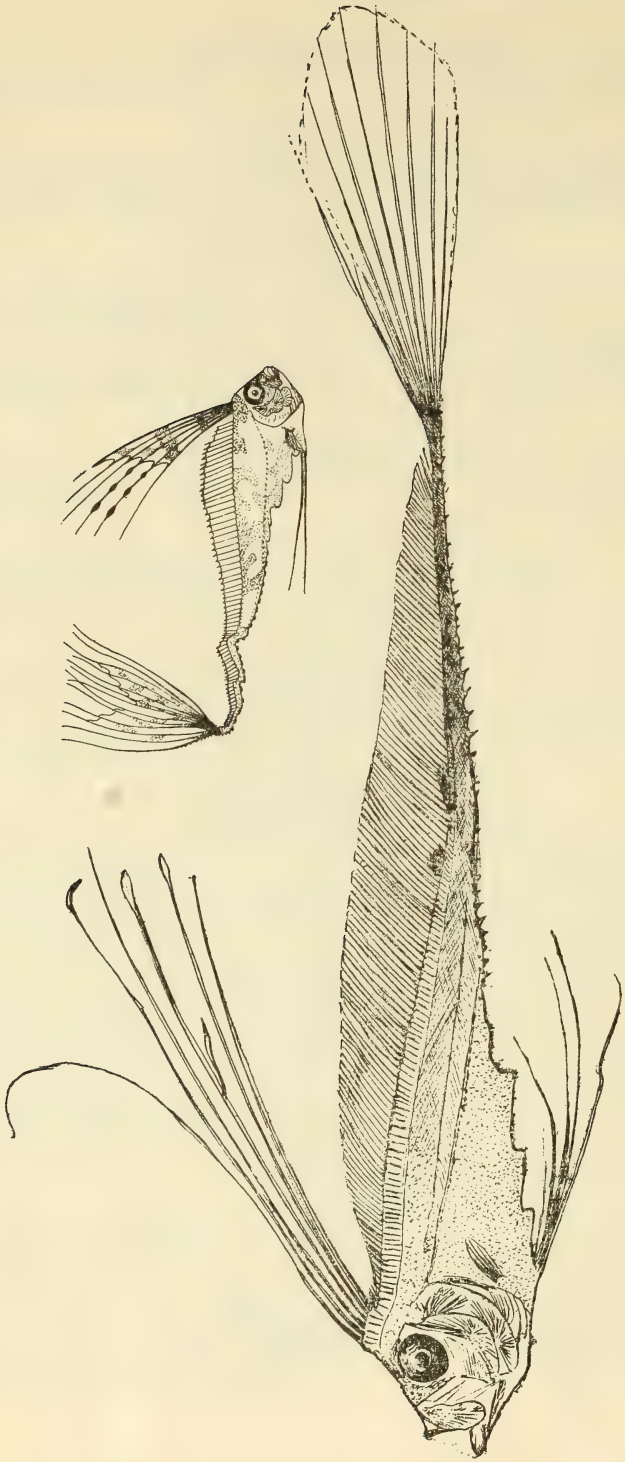

Figure 1.—*Desmodema arawatae*. Sketch of a specimen presumably male and doubtless the long-missing original of the illustration (inset) published in 1916 by Hamilton.

spines above this lower series. A crest-like first dorsal fin of six very long spines, at least one of which has a tag or leaf-shaped tip. Two very short rays occur before the second dorsal fin ascends to its longest median rays and descends to before the tail. Caudal fin with about a dozen rays, some now broken. Colour after long preservation, dark brown. Traces of dark blotches along dorsal fin near bases of some rays.

Resembles slightly Phillipps' figure of a young *"Trachipterus"* from French Pass, N.Z.* and Pietschmann's figures of *T. repandus*. Probably the opposite sex of the more usually figured specimens of young trachiperids, this curious specimen deserves more detailed study.

Family CEPOLIDAE

Genus CEPOLA

Cepola Linne, Mus. Adolph. Frid. ii, 1764, p. 63; Syst. Nat., ed. 12, 1766, p. 445. Logotype, *C. taenia* Linne.

CEPOLA AOTEA

Bandfish

Cepola aotea Waite, Proc. N.Z. Inst. 1910, part i, Sept. 10, 1910, p. 26. Rec. Canterb. Mus. i, 3, 1911, p. 217, pl. xliv. Bay of Plenty, N.Z.

Family BOTHIDAE

Genus AZYGOPUS

Azygopus Norman, Biol. Res. Endeavour v, 5, June 15, 1926, p. 261. Haplotype, *A. pinnifasciatus* Norman.

AZYGOPUS PINNIFASCIATUS FLEMINGI

Stripe-finned Flounder

Azygopus pinnifasciatus Norman, Biol. Res. Endeavour v, 5, June 15, 1926, p. 262, fig. 10. Great Australian Bight.

Azygopus pinnifasciatus flemingi Nielsen Galathea Rept. iv, June 15, 1961, p. 223, fig. 3. Off Greymouth; 610 metres ("Galathea" Stn. 626). Types in Zoological Museum, Copenhagen; a paratype in Australian Museum, Sydney.

Genus LOPHONECTES

Lophonectes Gunther, Rept. Voy. Challenger, Zool., i, 6, 1880, p. 28. Haplotype, *L. gallus* Gunther.

LOPHONECTES MONGONUIENSIS

Crested Flounder

Arnoglossus mongonuiensis Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 1, 1914, p. 16; Voy. Terra Nova, Zool. i, 1, 1914, p. 21, pl. xi, fig. 2. Cape North; 70 fathoms.

Genus CAULOPSETTA

Caulopsetta Gill, Mem. Nat. Acad. Sci. Wash. vi, 1893, pp. 101, 121 & 124. Orthotype, *Pseudorhombus scaphus* Hutton = *Pleuronectes scapha* Bloch & Schneider.

CAULOPSETTA SCAPHUS

Megrim

Pleuronectes scapha Bloch & Schneider, Syst. Ichth., 1801, p. 163, *ex* Forster, MS. [South Island of] N.Z.

CAULOPSETTA BOOPS

Pseudorhombus boops Hector, Ann. Mag. Nat. Hist. (4) xv, Jan. 1875, p. 81 and Trans. N.Z. Inst. vii, 1875, p. 249, pl. xi, fig. 82b. 200 miles off Cape Farewell, N.Z..; 400 faths. "Challenger" Exped. Type figured by Gunther, Rept. Voy. Chall., Zool. xxii, 1887, p. 163, fig. 5.

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* Compare McCann, Rec. Domin. Mus. II, 1953, p. 5, especially figs. 5 and 6, according to whom it would be an adult male.

CAULOPSETTA HECTORIS

Pseudorhombus hectoris Gunther, Rept. Voy. Challenger, Zool. xxii, 1887, p. 163, fig. 4. Off the coast of N.Z., Station 167; 150 fathoms.

[Family BRACHYPLEURIDAE
Genus BRACHYPLEURA

Brachypleura Gunther, Cat. Fish. Brit. Mus. iv, 1862, p. 419. Haplotype, *B. novaezeelandiae* Gunther.

BRACHYPLEURA NOVAEZEELANDIAE

Brachypleura novaezeelandiae Gunther, Cat. Fish. Brit. Mus. iv, 1862, p. 419. N.Z. (Sir John Richardson, Haslar Collection).
Chabanaud (Bull. Inst. franc. Afr. Noire xvi, 1954, p. 1294) states that the type-locality was erroneous, the species inhabiting tropical seas from the Maldives to the Arafura Sea.]

Family RHOMBOSOLEIDAE
Genus COLISTIUM

Colistium Norman, Biol. Res. Endeavour v, 5, June 15, 1926, pp. 261 and 272. Logotype, *Ammotretis nudipinnis* Waite, selected by Burton, Zool. Record lxiii, 1926 (1927), Pisces, p. 44.

COLISTIUM NUDIPINNIS
Turbot

Ammotretis nudipinnis Waite, Proc. N.Z. Inst. 1910, ii, Jan. 18, 1911, p. 50 (N.Z.) and Rec. Cant. Mus. i, 1911, p. 209, pl. xxxix. Porangahau Bay; 16-17 fathoms., sand.

COLISTIUM GUNTHERI
Brill

Ammotretis guntheri Hutton, Trans. N.Z. Inst. v, May 1873, p. 267, pl. xi, fig. 82a. Wellington Harbour.

Genus RHOMBOSOLEA

Rhombosolea Gunther, Cat. Fish. Brit. Mus. iv, 1862, p. 458. Logotype, *R. monopus* Gunther.
Bowenia Haast, Trans. N.Z. Inst. v, May 1873, p. 276. Haplotype, *B. novaezealandiae* Haast.
Apsetta Kyle, Proc. Zool. Soc. Lond. 1900 (Apr. 1, 1904) p. 986. Haplotype, *A. thompsoni* Kyle.

Subgenus RHOMBOSOLEA
RHOMBOSOLEA PLEBEIA
Sand Flounder; Patiki

Rhombus plebeius Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 222, *ex* Solander MS. Tolaga Bay.
Pleuronectes plebeius Richardson, Trav. N.Z. (Dieffenbach) ii, 1843, p. 222, *ex* Solander MS. Tolaga Bay.
Rhombosolea monopus Gunther, Cat. Fish. Brit. Mus. iv, 1862, p. 459. Bay of Islands (A. Smith), N.Z. (Owen), and Australia.
Bowenia novaezealandiae Haast, Trans. N.Z. Inst. v, 1873, p. 277, pl. xvi. Lake Ellesmere.
Apsetta thompsoni Kyle, Proc. Zool. Soc. Lond. 1900 (April 1, 1901), p. 986, figs. 1-3. N.Z.
Rhombus solea Prince, Trans. Amer. Fish. Soc. xlv, June 1916, p. 125. Error for *Rhombosolea* [*plebeia*]. N.Z.

RHOMBOSOLEA MILLARI
Yellow Flounder, Yellow Belly, Patikitotara

Rhombosolea millari Waite, Rec. Canterb. Mus. i, 3, June 24, 1911, p. 207, pl. xxxvii. Hawke Bay.

RHOMBOSOLEA TAPIRINA
Green-back Flounder

Rhombosolea tapirina Gunther, Cat. Fish. Brit. Mus. iv, 1862, p. 459. Australia and Auckland Islands.

Rhombosolea flesoides Gunther, Ann. Mag. Nat. Hist. (3) xi, Feb. 1, 1863, p. 117. Victoria.

Subgenus ADAMASOMA

Adamasoma Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, Sept. 1939, p. 231. Orthotype, *Rhombosolea retiaria* Hutton.

RHOMBOSOLEA (ADAMASOMA) RETIARIA
River or Black Flounder; Patikimohoao, Patiki

Rhombosolea retiaria Hutton, Trans. N.Z. Inst. vi, 1874, p. 107. New name for *R. tapirina* Hutton, Trans. N.Z. Inst. v, May 1873, p. 268, pl. xii, fig. 83b, *non* Gunther. Wellington Harbour.

RHOMBOSOLEA (ADAMASOMA) RETIARIA ADAMAS
Diamond Plaice

Rhombosolea (*Adamasoma*) *retiaria adamas* Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, Sept. 1939, p. 232. Hokitika, Christchurch. Based on Phillipps, N.Z. J. Sci. Tech. vii, 6, 1925, p. 368, fig.

Genus PELTORHAMPHUS

Peltorhamphus Gunther, Cat. Fish. Brit. Mus. iv, 1862, p. 460. Haplotype, *P. novaezeelandiae* Gunther.

PELTORHAMPHUS NOVAEZEELANDIAE
Sole; Patikirori

Peltorhamphus novaezeelandiae Gunther, Cat. Fish. Brit. Mus. iv, 1862, p. 461. N.Z. (type) and "Norfolk Island" [latter probably an error].

Genus PELOTRETIS

Pelotretis Waite, Proc. N.Z. Inst. 1910, ii, Jan. 18, 1911, p. 50. Haplotype, *P. flavilatus* Waite.

PELOTRETIS FLAVILATUS
Lemon Sole

Pelotretis flavilatus Waite, Proc. N.Z. Inst. 1910, ii, Jan. 18, 1911, p. 50. N.Z.

Family ATHERINIDAE
Genus PRANESUS

Pranesus Whitley, Mem. Qld. Mus. x, Aug. 28, 1930, p. 9. Orthotype, *P. ogilbyi* Whitley.

PRANESUS OGILBYI
Hardyhead

Atherina pinguis Kirk, Trans. N.Z. Inst. xii, May 1880. p. 309 and fig. Not *Atherina pinguis* Lacepede, Hist. Nat. Poiss. v, 1803, p. 373, pl. xi.

Pranesus ogilbyi Whitley, Mem. Qld. Mus. x, Aug. 28, 1930, p. 9. Moreton Bay, Qld.

Family MUGILIDAE
Genus MUGIL

Mugil Linne, Syst. Nat. ed. 10, Jan. 1, 1758, pp. 243 and 316. Haplotype, *M. cephalus* Linne, from European Seas.

MUGIL BROUSSONNETII
Yellow-eyed Mullet, Grey Mullet; Kanae

Mugil broussonnetii Cuvier and Valenciennes, Hist. Nat. Poiss. xi, July, 1836, p. 117. Southern Seas (Cook) [? = N.Z.].

Mugil communis Cuv. & Val., Hist. Nat. Poiss. xi, July 1836, p. 118, *ex* Solander, MS. No locality.

Mugil lavaretoides Cuv. & Val., Hist. Nat. Poiss. xi, July 1836, p. 118, *ex* Solander, MS. No locality = Tolaga Bay—*teste* Richardson, Trav. N.Z. (Dieff.) ii, Jan. 1843, p. 218.

?Mugil strigatus Cuv. & Val., Hist. Nat. Poiss. xi, July 1836, p. 119, *ex* Solander, MS. No locality.

Leuciscus (*Ptycholepis*) *salmoneus* Richardson, Trav. N.Z. (Dieff) ii, Jan. 1843, p. 218. Tolaga Bay, N.Z.

Mugil salmoneus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 218, *ex* Forster MS. Tolaga Bay, N.Z. [Authors have wrongly regarded this species as a synonym of *Chanos* from the New Hebrides (Not N.Z.) or even of *Gonorynchus*.]

Genus ALDRICHETTA

Aldrichetta Whitley, Austr. Zool. xi, 1945, p. 19. Orthotype, *Mugil forsteri* Cuv. & Val.

ALDRICHETTA FORSTERI

Yellow-eyed Mullet, Picton Herring, Awa

Mugil forsteri Cuvier & Valenciennes, Hist. Nat. Poiss. xi, July 1836, p. 141. Rivers of N.Z. (Forster).

Mugil albula Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 211, *ex* Forster, MS. South Island of N.Z. Vernacular, as "Albulae" in Bloch & Schneider, Syst. Ichth. 1801, p. 120. Not *Mugil albula* Linne, 1766.

Family SPHYRAENIDAE

Genus SPHYRAENA

Sphyraena Bloch & Schneider, Syst. Ichth., 1801, p. 109. Tautotype, *Esox sphyraena* Linne.

SPHYRAENA GRANDISQUAMIS

Pike

Sphyraena grandisquamis Steindachner, Sitzb. Akad. Wiss. Wien, liii, 1866, p. 446. Port Jackson, N.S.W.

Genus AUSTRALUZZA

Australuzza Whitley, Austr. Zool. xi, June 20, 1947, p. 136. Orthotype, *Sphyraena novaehollandiae* Gunther.

AUSTRALUZZA NOVAEHOLLANDIAE

Snook

Sphyraena novaehollandiae Gunther, Cat. Fish. Brit. Mus. ii, 1860, p. 335. Hobson's Bay, Victoria.

Family STROMATEIDAE

Genus CUBICEPS

Cubiceps Lowe, Proc. Zool. Soc. Lond., Dec. 1843, p. 82. Haplotype, *Seriola gracilis* Lowe.

CUBICEPS BAXTERI

Cubehead

Cubiceps baxteri McCulloch, Rec. Austr. Mus. xiv, 1, Feb. 28, 1923, p. 15, pl. i, fig. 4. Lord Howe Island. *Id.* Moreland, Rec. Domin. Mus. iii, 1956, p. 10.

CUBICEPS CAERULEUS

Cubiceps caeruleus Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 1, 1914, p. 15 and Voy. Terra Nova i, 1, 1914, p. 19. Three Kings Iss. (Compare *Cubiceps caeruleus* McCulloch, Rec. Austr. Mus. xiv, 1, Feb. 28, 1923, p. 15, pl. i, fig. 3. Lord Howe Island). [Possibly Hutton's record of *Cubiceps gracilis* may refer to *caeruleus* Regan: *Cubiceps gracilis* Hutton, Trans. N.Z. Inst. xxviii, 1896, p. 315. Christchurch Market. Not *Seriola gracilis* Lowe, Proc. Zool. Soc. Lond. 1843, p. 82, described from Madeira as having, amongst other characters, "secundae analisque . . . radiis posterioribus sub-productis, in pinnulas subsecedentibus."]

Genus HYPEROGLYPHE

Hyperoglyphe Gunther, Cat. Fish. Brit. Mus. 1, 1859, p. 337. Haplotype, *Diagramma porosa* Richardson.

HYPEROGLYPHE ANTARCTICA

Barrel Fish, Bream

Perca antarctica Carmichael, Trans. Linn. Soc. (Lond.), xii, 1819, p. 501. Tristan da Cunha.

Diagramma porosa Richardson, Zool. Voy. Erebus & Terror, Fish., 1845, p. 26, pl. xvi, figs. 5-6. "Coasts of Australia [= New South Wales].

Eurumetopos johnstonii Morton, Pap. Proc. Roy. Soc. Tas. 1887 (1888), pp. xlvii & 77, with plate. Near Bridgwater, Tasmania.

Seriolella amplus Griffin, Trans. N.Z. Inst. lix, Aug. 30, 1928, p. 376, pl. lviii, fig. 3. Near Mayor Island, Bay of Plenty. A synonym according to Haedrich, 1967.

Family CENTROLOPHIDAE

Genus SERIOLELLA

Seriolella Gay, Hist. Chile ii, 1849, p. 238, *ex* Guichenot, MS. Orthotype, *S. porosa* Gay (*fide* Sherborn, Index Anim. and Jordan, Gen. Fish.).

Neptomenus Gunther, Cat. Fish. Brit. Mus. ii, 1860, p. 389. Haplotype, *N. brama* Gunther.

Neptonemus Hutton and of authors.

SERIOLELLA MACULATA

Silver Fish

Stromateus maculatus Forster, Die Neuesten Reisen i, Tagebuch White, 1794, p. 131, no. 7. Based on "A Fish of New South Wales" Phillip, 1790. [Botany Bay,] N.S.Wales.

Scomber punctatus Bloch & Schneider, Syst. Ichth. 1801, p. 37, *ex* Forster MS. N.Z.

Gasterosteus punctatus Bloch & Schneider, Syst. Ichth. 1801, p. 37, *ex* Forster, MS. N.Z.

Neptonemus bilineatus Hutton, Trans. N.Z. Inst. v, May 1873, p. 261, pl. viii, fig. 31a, Wellington, N.Z.

SERIOLELLA BRAMA

Warehou

Neptomenus brama Gunther, Cat. Fish. Brit. Mus. ii, 1860, p. 390. N.Z. (purch. J. Gould).

SERIOLELLA POROSA

Silver Warehou

Seriolella porosa Guichenot, Hist. Chile (Gay) ii, 1849, p. 239, pl. vii, fig. 2. S. America—*fide* Norman, Discov. Rept. xvi, 1937, p. 115, fig. 62.

Genus CENTROLOPHUS

Centrolophus Lacepede, Hist. Nat. Poiss. iv, 1802, p. 441. Haplotype, *C. niger* Lacepede.

CENTROLOPHUS MAORICUS

Rudderfish

Centrolophus maoricus Ogilby, Rec. Austr. Mus. ii, 5, Sept. 1893, p. 64. N.Z., pelagic.

CENTROLOPHUS HUTTONI

Centrolophus huttoni Waite, Proc. N.Z. Inst. iv, May 11, 1910, p. 109 and Trans. N.Z. Inst. xlii, June 1, 1910, p. 387. Kaikoura, South Island of N.Z.—accompanying Sunfish (*Mola*). Holotype redescribed and figured by Smith, Ann. Mag. Nat. Hist. (13) ix, 1966, p. 2, pl. IB.

The following genus and species has not yet been defined:

Cristaculeus dyscritus Thomson, Ann. Rept. Mar. Dept. N.Z. 1926, p. 19, *ex* Young, MS. *Nomen nudum.*

Family SCHEDOPHILIDAE
Genus HOPLOCORYPHIS

Hoplocoryphis Gill, Proc. Acad. Nat. Sci. Philad. 1862, p. 127. Orthotype, *Schedophilus maculatus* Gunther.

HOPLOCORYPHIS PHYSALIARUM
Raft Fish

Hoplocoryphis physaliarum Whitley, Rec. Austr. Mus. xix, 1, Aug. 2, 1933, p. 68. Manly, N.S.W.

Note: Kermadec Is.—Waite as *Schedophilus maculatus*. Canterbury Museum has a specimen.

Family ICICHTHYIDAE
Genus ICICHTHYS

Icichthys Jordan & Gilbert, Proc. U.S. Nat. Mus. iii, 1880, p. 305. Orthotype, *I. lockingtoni* Jordan & Gilbert.

ICICHTHYS sp.
Limp Ragfish

Icichthys sp. nov. (unnamed) Haedrich, Bull. Mus. Comp. Zool. Harvard 135 (2), 1967, p. 68. N.Z.

Family TETRAGONURIDAE
Genus TETRAGONURUS

Tetragonurus Risso, Ichth. Nice, 1810, p. 347. Haplotype, *T. cuvieri* Risso.
Ctenodax Macleay, Proc. Linn. Soc. N.S.Wales x, 4, April 3, 1886, p. 718. Haplotype, *C. wilkinsoni* Macleay.

TETRAGONURUS WILKINSONI
Squaretail

Ctenodax wilkinsoni Macleay, Proc. Linn. Soc. N.S.Wales x, 4, April 3, 1886, p. 719, pl. xlvii. Lord Howe Island.
Tetragonurus cuvieri (New Zealand form) Grey, Dana Rept. xli, 1955, pp. 24 etc., fig. 8a.

Family ACANTHOCLINIDAE
Genus ACANTHOCLINUS

Acanthoclinus Jenyns, Zool. Voy. Beagle, Fish. 1841, p. 91. Orthotype, *A. fuscus* Jenyns.

ACANTHOCLINUS QUADRIDACTYLUS
Rockfish, Taumaka

Blennius quadridactylus Bloch & Schneider, Syst. Ichth. 1801, p. 177. [South Island of] N.Z.
Blennius littoreus Bloch & Schneider, Syst. Ichth. 1801, p. 177, *ex* Forster, MS. [South Island of] N.Z.
Clinus littoreus Cuv. & Val., Hist. Nat. Poiss. xi, July 1836, p. 389, *ex Blennius littoreus* Forster, MS. N.Z.
?Acanthoclinus fuscus Jenyns, Zool. Voy. Beagle, Fish. 1841, p. 92, pl. xviii, fig. 2. Bay of Islands, N.Z.
Acanthoclinus taumaka Clarke, Trans. N.Z. Inst. xi, May 1879, p. 293, pl. xv. Jackson's Bay.

Genus TAUMAKOIDES

Taumakoides Whitley, Austr. Zool. xii, 2, July 18, 1955, p. 111. Orthotype, *Acanthoclinus trilineatus* Griffin.

TAUMAKOIDES TRILINEATUS

Acanthoclinus trilineatus Griffin, Trans. N.Z. Inst. lxiii, June 1933, p. 330, pl. xxxiv & text-fig. 2. Bay of Islands and Great Barrier Is., N.Z. Types in Auckland Museum.

Family ANTHIIDAE

Genus ELLERKELDIA

Gilbertia Jordan & Eigenmann, Bull. U.S. Fish. Comm. viii, 1888, March 25, 1891, p. 346, *ex* Jordan, MS. Orthotype, *Plectropoma semicinctum* Cuv. & Val. Preoccupied by *Gilbertia* Cossmann, Ann. Soc. Roy. Malac. Belg. xxiv, 1889 (publ. before April, 1890), p. 347, a molluscan genus.

Ellerkeldia Whitley, Rec. Austr. Mus. xv, 5, April 6, 1927, p. 298. Orthotype, *E. annulata* (Gunther) = *Plectropoma annulata* Gunther.

ELLERKELDIA HUNTII

Half-banded Sea Perch

?Plectropoma semicinctum Cuv. & Val., Hist. Nat. Poiss. ix, March 1833, p. 442. Juan Fernandez.

Plectropoma huntii Hector, 9th Ann. Rept. Colon. Mus. 1874, p. 10. *Nomen nudum. Id.* Hector, Trans. N.Z. Inst. vii, June 1875, p. 240, pl. x, fig. 1. Chatham Is.

Genus CAESIOPERCA

Caesioperca Castelnau, Proc. Zool. Acclim. Soc. Vict. i, July 15, 1872, p. 49. Haplotype, *Serranus rasor* Richardson.

Lacepedia Castelnau, Proc. Zool. Acclim. Soc. Vict. ii, May 10, 1873, p. 42. Haplotype, *L. cataphracta* Castelnau.

CAESIOPERCA LEPIDOPTERA

Red Perch; Oia

Epinephelus lepidopterus Bloch & Schneider, Syst. Ichth. 1801, p. 302. N.Z. = South Island.

Perca lepidoptera Bloch & Schneider, Syst. Ichth. 1801, p. 302, *ex* Forster, MS. N.Z. = South Island.

Scorpis hectori Hutton, Cat. Fish. N.Z., Feb. 1872, pp. 4 & 106, pl. i, fig. 4. Milford Sound.

Genus CALLANTHIAS

Callanthias Lowe, Proc. Zool. Soc. Lond. vii, Oct. 1839, p. 76. Haplotype, *C. paradisaeus* Lowe.

CALLANTHIAS ALLPORTI

Allport's Perch

Callanthias allporti Gunther, Ann. Mag. Nat. Hist. (4) xvii, May 1, 1876, p. 390. Tasmania.

CALLANTHIAS SPLENDENS

Callanthias splendens Griffin, Trans. N.Z. Inst. liii, Aug. 31, 1921, p. 352, pl. lv, fig. 1 & text-fig. Hauraki Gulf.

Genus CAPRODON

Caprodon Temminck and Schlegel, Faun. Japon. (Poiss., 1843), p. 64. *Genus caelebs.* Haplotype *C. sp.* = *Anthias schlegelii* Gunther.

CAPRODON LONGIMANUS

Longfin; Mata

Anthias longimanus Gunther, Cat. Fish. Brit. Mus. i, 1859, p. 94. Indian or Australian seas.

Scorpis fairchildi Hector, Trans. N.Z. Inst. vii, June 1874, p. 241. New name for *Scorpis hectori* Hutton, Trans. N.Z. Inst. v, 1873, p. 259, pl. vii, *non s. str.* Bay of Plenty.

Genus PLAGIOGENEION

Plagiogeneion Forbes, Trans. N.Z. Inst. xxii, May 1890, p. 273. Haplotype, *Therapon rubiginosus* Hutton.

PLAGIOGENEION RUBIGINOSUS
Ruby Fish

Therapon rubiginosus Hutton, Hutton & Ulrich, Rept. Geol. & Goldfields Otago, pref. June 1875, p. 132, *nomen nudum*. Hutton, Ann. Mag. Nat. Hist. (4) xvi, Nov. 1875, p. 314; Trans. N.Z. Inst. viii, May 1876, p. 209. Otago.

Genus SERRANOPS

Serranops Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan 1 1914, p. 15. Haplotype, *S. maculicauda* Regan.

SERRANOPS MACULICAUDA

Serranops maculicauda Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 1 1914, p. 15 and Voy. Terra Nova Zool. i, 1, 1914, p. 16, pl. xi, fig. 3. Cape North. 70 fathoms.

Genus LEPIDOPERCA

Lepidoperca Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 1 1914, p. 15. Logotype, *L. inornata* Regan, *fide* Jordan, Gen. Fish.

LEPIDOPERCA INORNATA

Lepidoperca inornata Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 1 1914, p. 15 and Voy. Terra. Nova Zool. i, 1, 1914, p. 17, pl. xi, fig. 4. Cape North; 70 fathoms.

Genus ANTHIAS

Anthias Bloch, Nat. ausl. Fische vi, 1792, p. 97. Tautotype, *Labrus anthias* Linnaeus.

ANTHIAS PULCHELLUS

Anthias pulchellus Waite, Mem. Austr. Mus. iv, 1, Dec. 23, 1899, p. 77, pl. xii, New South Wales coastline: Bungaree Norah to Wollongong; 32-78 fathoms.
Note: A specimen from Moeraki in Otago Museum, Dunedin and others in Dominion Museum, Wellington (J. Moreland, MSS.).

Family MALACANTHIDAE
Genus MALACANTHUS

Malacanthus Cuvier, Regne Anim. ed. 2, ii, April 1829, p. 264. Haplotype, *Coryphaena plumieri* Bloch.

MALACANTHUS HOEDTI
Blanquillo

Malacanthus hoedti Bleeker, Act. Soc. Sci. Indo-Neerl. vi, 1859, p. 18. New Guinea. *Id.* F. H. Berry, Copeia 1958, 2, p. 117, fig. 7 (range includes New Zealand).

Family EPINEPHELIDAE
Genus AULACOCEPHALUS

Aulacocephalus Temminck & Schlegel, Faun. Japon. (Poiss., 1842), p. 15. *Genus caelebs*. Haplotype, *A.* sp. = *A. temminckii* Bleeker.

AULACOCEPHALUS TEMMINCKII

Aulacocephalus temminckii Bleeker, Verh. Bat. Gen. xxv, 1853, p. 10. New name for *A.* sp. Temminck & Schlegel, Faun. Japon. (Poiss., 1842), p. 15, pl. v, fig. 2, from Japan.
Aulacocephalus schlegelii Gunther, Cat. Fish. Brit. Mus. i, 1859, p. 173. New name for *A.* sp. Temminck & Schlegel, *loc. cit.,* 1842. Japan.
"Strange catch" Doak & Tarlton, N.Z. Weekly News, July 1, 1968, p. 7, fig. Poor Knights Islands; 120 feet.
Note: Kermadec Islands (Waite).

Genus TRACHYPOMA

Trachypoma Gunther, Cat. Fish. Brit. Mus. i, 1859, p. 167. Haplotype, *T. macracanthus* Gunther.

TRACHYPOMA MACRACANTHUS
Pacific Perch

Trachypoma macracanthus Gunther, Cat. Fish. Brit. Mus. i, 1859, p. 167. Norfolk Island. *Type* figured by Boulenger, Cat. Perc. Fish. Brit. Mus. 1895, p. 146, pl. ii.

Note: Kermadec Is.—Waite.

Genus EPINEPHELUS

Epinephelus Bloch, Nat. ausl. Fische vii, 1793, p. 11. Logotype, *E. marginalis* Bloch.

EPINEPHELUS DAMELII
Black Rock Cod

Serranus damelii Gunther, Ann. Mag. Nat.. Hist. (4) xvii, May 1, 1876, p. 391. Sydney, N.S.W.

EPINEPHELUS OCTOFASCIATUS

Epinephelus octofasciatus Griffin, Trans. N.Z. Inst. lvi, Apr. 26, 1926, p. 540, pl. xcv. Arid Island, N.E. of Great Barrier Island, Auckland district, N.Z.

Genus ACANTHISTIUS

Acanthistius Gill, Proc. Acad. Nat. Sci. Philad. 1862 (1863), p. 236, footnote. Haplotype, *Plectropoma serratum* Cuv. & Val.

ACANTHISTIUS CINCTUS
Wirrah

Plectropoma cinctum Gunther, Cat. Fish. Brit. Mus. i, 1859, p. 162. Norfolk Id. *Type* figured by Boulenger, Cat. Perc. Fish. Brit. Mus. 1895, p. 142, pl. i.

Note: Recorded from the Kermadec Is. by Waite.

Genus POLYPRIONUM

Polyprionum Bosc, Nouv. Dict. Hist. Nat., ed. 2, xxvii, 1818, p. 514, *ex* Cuvier, vernac. Logotype, *Amphiprion americanus* Bloch & Schneider, Syst. Ichth. 1801, p. 205, by present designation.

Hectoria Castelnau, Intercol. Exhib. Essays no. 5., before May, 1873, p. 8 and Proc. Zool. Acclim. Soc. Vict. ii, May 10, 1873, p. 150. Haplotype, *Oligorus gigas* Gunther = *Polyprionum oxygeneios* (Bl. Schn.).

POLYPRIONUM MOEONE
Bass; Moeone

Polyprion moeone Phillipps, Trans. N.Z. Inst. lviii, Aug. 15, 1927, p. 126. New Zealand (Waite, *op. cit.* xlv, 1913, p. 215, pl. v, as *P. americanus*).

POLYPRIONUM OXYGENEIOS
Groper: Hapuku

Epinephelus oxygeneios Bloch & Schneider, Syst. Ichth. 1801, p. 301. Queen Charlotte Is., N.Z.

Perca prognatha Bloch & Schneider, Syst. Ichth. 1801, p. 301, *ex* Forster, MS. (Queen Charlotte Sound.)

Polyprion cernuum Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 206, N.Z. Not *Polyprion cernium* Valenciennes, Mem. Mus. D'Hist. Nat. (Paris) xi (4), Jan. 1825, p. 265, pl. xvii, (Marseilles (type) &c.).

Sciaena gadoides Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 206, *ex* Solander, MS. N.Z. [= Motuaro].

Centropristis gigas Owen, Desc. Cat. Osteol. Ser. Mus. Roy Coll. Surg. i, 1853. p. 51. Off N.Z. (Home).

Oligorus gigas Gunther, Cat. Fish. Brit. Mus. i, 1859, p. 251, *ex* Owen. N.Z.

Oligorus gadoides Hutton, Trans. N.Z. Inst. v, 1872 (May 1873), p. 259, *ex Sciaena gadoides* Solander, MS. [Motuaro.]

?Polyprion kneri Steindachner, Sitzb. Akad. Wiss. Wien, lxxi, 1, 1875, p. 443. Juan Fernandez.

Family POMATOMIDAE
Genus ROSENBLATTIA

Rosenblattia Mead & Falla, Bull. Mus. Comp. Zool.. Harvard, cxxxiv, 7, 1965, p. 261. Orthotype, *R. robusta* Mead & Falla.

ROSENBLATTIA ROBUSTA
Deepsea Soldier Fish

Acropoma? Whitley *in* Graham, Treasury N.Z. Fishes, ed. 2, Sept. 1956, p. 406 [Cook Strait], N.Z. (Moreland MS., 1954.) Not *Acropoma* Temminck & Schlegel, Faun. Japon. (Poiss.), 1843, p. 31, from Japan.

Rosenblattia robusta Mead & Falla, Bull. Mus. Comp. Zool. Harvard, cxxxiv, 7, 1965, p. 261, figs. 1 & 3. Type-locality: between 46°53'S. lat. x 179°48'W. long. and 46°42'S. x 179°32'W., south-western Pacific, from less than 1878 metres. Found in subantarctic Pacific and Indian Oceans.

Family APOGONIDAE
Genus SCEPTERIAS

Scepterias Jordan & Jordan, Mem. Carneg. Mus. x, 1, Dec. 1922, p. 44. Orthotype, *S. fragilis* Jordan & Jordan.

SCEPTERIAS LENIMEN
Big-eyed Cardinal Fish

Scepterias lenimen Whitley, Rec. Austr. Mus. xix, 4, Sept. 19, 1935, p. 230. Great Australian Bight (type) and south of Gabo Island, Victoria.

"Apogonid" Moreland, N.Z. Dept. Sci. Industr. Res. Bull. cxxii, 1957, appendix 6, p. [34]. Chatham Islands.

"Big-eyed Cardinal Fish" Moreland, Evening Post (newspaper, Wellington), May 9, 1961, with figs. Off Cape Palliser; 300 fathoms.

Note: The New Zealand fish is much bigger (2 ft. 4 in. long) than the Australian.

Family CORYPHAENIDAE
Genus CORYPHAENA

Coryphaena Linne, Syst. Nat., ed. 10, Jan. 1, 1758, p. 261. Logotype, *C. hippurus* Linne.

CORYPHAENA HIPPURUS
Dolphin

Coryphaena hippurus Linne, Syst. Nat., ed. 10, 1758, p. 261. Open Seas.

Coryphaena hippurus dampieri Whitley, Rec. Austr. Mus. xx, 1939, p. 271. Lord Howe Id.

Family CARANGIDAE
Genus USACARANX

Usacaranx Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 316. Orthotype, *Caranx nobilis* Macleay.

USACARANX LUTESCENS
Trevally; Araara

Scomber hippos Cuvier & Valenciennes, Hist. Nat. Poiss. ix, March 1833, p. 108, *ex* Forster, MS. N.Z. Not *Scomber hippos* Linne, Syst. Nat. ed. 12, 1766, p. 494.

Scomber lutescens Richardson, Ann. Mag. Nat. Hist. xi, Jan. 1 1843, p. 26 Descr. *ex* Solander MS. N.Z., March 30, 1770 = Queen Charlotte Sound.

Scomber micans Richardson, Ann. Mag. Nat. Hist. xi, Jan. 1 1843, p. 27; Rept. 12th meet. B.A.A.S. 1842 (1843), p. 21, *ex* Solander, MS. Motuaro, Queen Charlotte Sound, N.Z. "This species was first discovered at Opooagi" (Richardson, Zool. Voy. Erebus and Terror, Fish. 1848, p. 135).

Scomber platinoides Richardson, Ann. Mag. Nat. Hist. xi, Jan. 1. 1843, p. 28. Descr. *ex* Solander, MS. Tolaga Bay.

USACARANX ARCHEYI
Archey's Trevally

Usacaranx archeyi Griffin, Rec. Auckland Mus. i, Sept. 23, 1932, p. 130, pl. xxii. Hauraki Gulf, N.Z. Types in Auckland Museum.

Genus DECAPTERUS

Decapterus Bleeker, Nat. Tijdschr. Ned. Ind. i, 1851, p. 342. Logotype, *Caranx kurra* Cuv. & Val.

DECAPTERUS KOHERU
Scad: Koheru

Caranx koheru Hector, Trans. N.Z. Inst. vii, June 1875, p. 247, pl. xi, fig. 24a. Tutukaka Harbour, near Ngunguru.

Genus TRACHURUS

Trachurus Rafinesque, Caratt. n. gen. Sicil., Apr. 1, 1810, p. 41. Logotype, *T. saurus* Rafinesque.

TRACHURUS DECLIVIS
Herring Scad

Caranx declivis Jenyns, Zool. Voy. Beagle, Fish. 1841, p. 68, pl. xiv. King George's Sound, Western Australia.

TRACHURUS CLUPEOIDES, comb. nov.
Horse-Mackerel; Hature

Scomber trachurus Forster, Voy. World Resolution, i, 1777, p. 181. Dusky Bay, N.Z. Not *Scomber trachurus* Linne, 1758.

Scomber clupeoides Richardson, Ann. Mag. Nat. Hist. xi, Jan. 1, 1843, p. 26; Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 210, *ex* Solander, MS. Dusky Bay.

Scomber dimidiatus Richardson, Ann. Mag. Nat. Hist. xi, Jan. 1, 1843, p. 27, *ex* Broussonet, MS. N.Z.

Trachurus novaezelandiae Richardson, Trav. N.Z. (Dieff.) ii, Jan. 1843, p. 210; Rept. 12th meet. B.A.A.S. 1842 (1843), p. 21. N.Z. (type) and Shark Bay. Based on Cuv. & Val., Hist. Nat. Poiss. ix, March 1833, p. 26, vernac.

Caranx sinus-obscuri Richardson, Trav. N.Z. (Dieff.) ii, Jan. 1843, p. 210. Dusky Bay, N.Z.

Genus NAUCRATOPSIS

Naucratopsis Gill, Proc. Acad. Nat. Sci. Philad. xiv, 1862 (1863), p. 441, footnote. Orthotype, *Seriola gigas* Gunther.

NAUCRATOPSIS HIPPOS
Samson Fish

Seriola hippos Gunther, Ann. Mag. Nat. Hist. (4) xvii, 1876, p. 392. Sydney, N.S.Wales.

Genus REGIFICOLA

Regificola Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 316. Orthotype, *Seriola grandis* Castelnau.

REGIFICOLA GRANDIS
Kingfish; Yellowtail; Haku

Seriola grandis Castelnau, Proc. Zool. Acclim. Soc. Vict. i, July 15, 1872, p. 115. Melbourne Market.

Seriola cultrata Hutton, Cat. Fish. N.Z., Feb. 1872, p. 17. Museum name. Not *Platystethus cultratum* Gunther. N.Z.

Genus NAUCRATES

Naucrates Rafinesque, Caratt. n. gen. Sicil., 1810, p. 44. Haplotype, *N. fanfarus* Rafinesque.

NAUCRATES ANGELI
Pilot Fish

Naucrates angeli Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 316. Maroubra, N.S.W.

Family ARRIPIDIDAE
Genus ARRIPIS

Arripis Jenyns, Zool. Voy. Beagle, Fish, 1840, p. 13. Orthotype, *Centropristes georgianus* Cuv. & Val. For variant spellings see Agassiz, Scudder, Sherborn.

Mulloides Richardson, Rept. 12th meet. B.A.A.S. 1842 (1843), p. 16, *ex* Solander, MS. Haplotype, *Mulloides sapidissimus* (Sol.) Rich. = *Arripis trutta.*

Homodon Brisout de Barneville, Echo Monde Savant xiii, June 4, 1846, p. 1045 (*fide* Sherborn). Logotype, *Centropristes georgianus* Cuv. & Val.

Lepidomegas Thominot, Bull. Soc. Philom. (7) iv, 1880, p. 173. Haplotype, *L. mulleri* Thominot.

ARRIPIS TRUTTA
Kahawai

Sciaena trutta Bloch & Schneider, Syst. Ichth. 1801, p. 542, *ex* Forster, MS. Queen Charlotte Sound, N.Z.

Perca trutta Cuvier & Valenciennes, Hist. Nat. Poiss. ii, Oct. 1828, p. 54. Cook Strait.

Sciaena mulloides sapidissimus and *Mulloides sapidissimus* Richardson, Trans. Zool. Soc. Lond. iii, June 16, 1842, p. 79. Based on a drawing by Parkinson. Name *ex* Solander, MS. N.Z. = Opooragee and Queen Charlotte Sound.

Chorinemus forsteri Richardson, Ann. Mag. Nat. Hist. xi, Jan. 1 1843, p. 24; Trav. N.Z. (Dieff.) ii, Jan. 1843, p. 210. N.Z. and Port Essington. But the true *Scomber forsteri* (syn. *maculatus*) came from Tahiti, not N.Z.

Scomber maculatus Richardson, Ann. Mag. Nat. Hist. xi, Jan. 1 1843, p. 24; Trav. N.Z. (Dieff.) ii, Jan. 1843, p. 210, *ex* Forster, MS. N.Z. [Tahiti.]

Centropristes tasmanicus Hombron and Jacquinot, Voy. Pole Sud, Zool. iii, 1853, p. 40, pl. iv, fig. 1. "Tasmanie ou Nouvelle-Zelande."

Lepidomegas mulleri Thominot, Bull. Soc. Philom. (7) iv, 1880, p. 173. Melbourne (type in Paris Museum seen) and N.Z.

Family EMMELICHTHYIDAE
Genus EMMELICHTHYS

Emmelichthys Richardson, Zool. Voy. Erebus and Terror, Fish., March 1, 1845, p. 47. Haplotype, *E. nitidus* Richardson.

EMMELICHTHYS NITIDUS
Red Baitfish

Emmelichthys nitidus Richardson, Zool. Voy. Erebus and Terror, Fish., March, 1, 1845, p. 47, pl. xxix, figs. 7-8. Western Australia.

Family LEPIDOTIDAE
Genus LEPIDOTUS

Lepidotus Asso, An. Cienc. Nat. (Madrid) iv, 1801, p. 38. Haplotype, *L. catalonicus* Asso.

LEPIDOTUS SQUAMOSUS
Ray's Bream

Toxotes squamosus Hutton, Ann. Mag. Nat. Hist. (4) xvi, Nov. 1875, p. 313. Trans. N.Z. Inst. viii, May 1876, p. 210. Cook Strait.

Family PTERACLIDAE
Genus PTERACLIS

Pteraclis Gronow, Actae Helveticae vii, 1772, p. 43, pl. xi, fig. 1. Orthotype, *P. pinnata* Gronow = *Coryphaena velifera* Pallas (*fide* Jordan, Gen. Fish).

PTERACLIS VELIFER
Wingfish; Batfish

Coryphaena velifera Pallas, Spic. Zool. viii, 1779, p. 19, pl. iii, fig. 1. Moluccas.

Pteraclis (*Bentenia*) *sp.* Whitley, Rec. Austr. Mus. xviii, June 29, 1931, p. 146. N.Z.

Pteraclis velifer australiae Whitley, Rec. Austr. Mus. xix, Sept. 19, 1935, p. 238. Balmoral, N.S.W. Type figured in Austr. Mus. Mag. vi, 2, May 1936, p. 47, fig.

Family MULLIDAE
Genus BARBUPENEUS

Barbupeneus Whitley, Austr. Zool. vi, 1931, p. 317. Orthotype, *Upeneus signatus* Gunther.

BARBUPENEUS SIGNATUS
Goatfish

Upeneus signatus Gunther, Ann. Mag. Nat. Hist. (3) xx, 1867, p. 59. Port Jackson, N.S.W.

Note: Kermadecs—Waite.

Genus UPENEICHTHYS

Upeneichthys Bleeker, Verh. Akad. Amsterd. ii, 1855, pp. 2 and 7. Haplotype, *Upeneus porosus* Cuv. & Val.

Hypeneichthys Ogilby, N.S.Wales (Griffin), 1888, p. 273. Emendation.

Atahua Phillipps, Proc. Roy. Soc. N.Z. lxxi, Dec. 1941, p. 243. Haplotype, *A. clarki* Phillipps.

UPENEICHTHYS POROSUS
Red Mullet; Goatfish; Ahuruhuru

Upeneus porosus Cuv. & Val., Hist. Nat. Poiss. iii, April, 1829, p. 455. New Zealand (Lesson and Garnot) was selected as type-locality by Whitley, Rec. Austr. Mus. xvii, 1929, p. 124. The exact place is given by Lesson (Voy. Coquille Zool. ii, 1829, p. 217) as the River Kiddi Kiddi which flows into the Bay of Islands.

?[*Mugil*] *strigatus* Cuv. & Val., Hist. Nat. Poiss. xi, July 1836, p. 119, *ex* Solander, MS. No loc. [? N.Z.]

Labrus calophthalmus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 207; Rept. 12th meet. B.A.A.S. 1842 (1843) p. 17, *ex* Solander, MS. Queen Charlotte Sound. Preocc. by *Labrus caliophthalmus* Rafinesque, Caratt. n. gen., 1810, p. 37.

Atahua clarki Phillipps, Proc. Roy. Soc. N.Z. lxxi, Dec. 1941, p. 243, pl. xli, fig. 5. Hawke Bay.

Family SPARIDAE
Genus CHRYSOPHRYS

Chrysophrys Quoy and Gaimard, Voy. Uranie et Physicienne, Zool. 1824, p. 229, *ex* Cuvier, MS. Haplotype, *C. unicolor* Quoy and Gaimard.

Pagrosomus Gill, Mem. Acad. Nat. Sci. Washington vi, 1893, p. 97. Haplotype, *Labrus auratus* Bloch and Schneider.

Sparosomus Gill, Mem. Acad. Nat. Sci. Washington vi, 1893, pp. 116 and 123. Haplotype, *Labrus auratus* Bloch and Schneider.

CHRYSOPHRYS AURATUS
Snapper; Tamure

Sparus pagrus Forster, Voy. World Resolution ii, 1777, p. 450. Queen Charlotte Sound. Not *Sparus pagrus* Linne, Syst. Nat., ed. 10, 1758, p. 279, from southern Europe.

Labrus auratus Bloch and Schneider, Syst. Ichth. 1801, p. 266. N.Z. = Queen Charlotte Sound.

Sciaena aurata Bloch and Schneider, Syst. Ichth. 1801, p. 266, *ex* Forster, MS. N.Z.

Pagrus guttulatus Cuvier and Valenciennes, Hist. Nat. Poiss. vi, Sept. 1830, p. 160, part. Jervis Bay, N.S.Wales (type), N.Z., and W. Australia.

Pagrus micropterus Cuv. & Val., Hist. Nat. Poiss. vi, Sept. 1830, p. 163. Mouth of the Thames River.

Pagrus latus Richardson, Ann. Mag. Nat. Hist. ix, July 1842, p. 392. Between Opooragi and Owhooragi.

Sciaena lata Richardson, Ann. Mag. Nat. Hist. ix, July 1842, p. 392, *ex* Solander, MS. Between Opooragi and Owhooragi.

Sciaena aurata Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 209; Rept. 12th meet. B.A.A.S. 1842 (1843), p. 20. Descr. Anim. (ed. Lichtenstein) 1844, p. 307. Between Owhooragi and Opooragi also Queen Charlotte Sound.

Family KYPHOSIDAE

Genus SEGUTILUM

Segutilum Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 319. Orthotype, *Pimelepterus sydneyanus* Gunther.

SEGUTILUM SYDNEYANUM

Drummer

Pimelepterus sydneyanus Gunther, Ann. Mag. Nat. Hist. (5) xviii, Nov. 1, 1886, p. 368. Port Jackson, N.S.W.

Pachymetopon drewii Hector, 21st Ann. Rept. Col. Mus. 1886, p. 21. *Nomen nudum.* Wanganui.

Pimelepterus drewii Hector, Trans. N.Z. Inst. xix, 1887, p. 590. *Nomen nudum.* Off Kapiti Is., N.Z. Chirotype in Domin. Mus., Wellington. Copy of Clarke's drawing of same in Australian Museum.

Family GIRELLIDAE

Genus GIRELLA

Girella Gray, Illustr. Ind. Zool. ii, Feb. 1835, pl. xcviii, fig. 3, *teste* Nomencl. Anim. Haplotype, *G. punctata* Gray.

GIRELLA TRICUSPIDATA

Blackfish; Parore

Boops tricuspidatus Quoy & Gaimard; Voy. Uranie Physic., Zool. 1824, p. 296. "Shark Bay", W. Australia.

Ctenolabrus ? knoxi Hutton, Trans. N.Z. Inst. v, May 1873, p. 265, pl. x. Whangarei Harbour, Cook Strait, N.Z.

Girella percoides Hector, Trans. N.Z. Inst. vii, July 1875, p. 243, pl. x, fig. 6D. Nelson, N.Z.

Girella multilineata Clarke, Trans. N.Z. Inst. xxxi, June, 1899, p. 98, pl. vii. Moturoa Is., N.Z.

Sparus hamiltoni Phillipps, Trans. N.Z. Inst. lviii, Aug. 15, 1927, p. 130, pl. v. fig. 4. Hauraki Gulf and Poor Knights Islands.

Genus IREDALELLA

Iredalella Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 320. Orthotype, *Girella cyanea* Macleay.

IREDALELLA CYANEA

Bluefish; Korokoropounamu

Girella cyanea Macleay, Proc. Linn. Soc. N.S.Wales v, 3, Feb. 1881, p. 409. No locality [probably Sydney district, N.S.Wales].

Family SCORPIDAE

Genus SCORPIS

Scorpis Cuvier & Valenciennes, Hist. Nat. Poiss. viii, "1831" = Jan. 1832, p. 503. Haplotype, *S. georgianus* Cuv. & Val., *ibid.* p. 503, pl. 245 from King George's Sound, Western Australia.

Neptotichthys Hutton, Trans. N.Z. Inst. xxii, May 1890, p. 278. Haplotype, *Ditrema violacea* Hutton.

SCORPIS VIOLACEUS
Hardbelly; Maomao

Ditrema violacea Hutton, Trans. N.Z. Inst. v, May 1873, p. 261, p. viii, fig. 31b. Wellington, N.Z.

SCORPIS AEQUIPINNIS
Sweep; Hui

Scorpis aequipinnis Richardson, Zool. Voy. Erebus and Terror, Fish. 1848, p. 121. King George's Sound, Western Australia.

Genus ATYPICHTHYS

Atypichthys Gunther, Cat. Fish. Brit. Mus. iv, 1862, p. 510. New name for *Atypus* Gunther, 1860, preocc. Haplotype, *Atypus strigatus* Gunther.

ATYPICHTHYS STRIGATUS
Stripey

Atypus strigatus Gunther, Cat. Fish. Brit. Mus. ii, 1860, pp. 64 and 518. Raoul Island, Kermadec Group; type-locality designated by Whitley, Austr. Zool. vi, 1931, p. 319.

Family CHAETODONTIDAE
Genus CHELMONOPS

Chelmonops Bleeker, Arch. Neerl. Sci. Nat xi, 1876, p. 304. Orthotype, *Chaetodon truncatus* Kner.

CHELMONOPS TRUNCATUS
Coral Fish

Chaetodon truncatus Kner, Sitzb. Akad. Wiss. Wien. xxxiv, 1859, p. 442, pl. ii. Sydney.

CHELMONOPS HOWENSIS
Coral Fish

Chaetodon howensis Waite, Rec. Austr. Mus. v, April 1903, p. 33, fig. 2. Lord Howe Island.

Family PEMPHERIDAE
Genus PEMPHERIS

Pempheris Cuvier, Regne Anim., ed. 2, ii, April, 1829, p. 195. Logotype, *P. touea* Cuvier = *P. compressa* (White).

PEMPHERIS ADSPERSA

Pempheris adspersus Griffin, Trans. N.Z. Inst. lviii, Aug. 15, 1927, p. 139, pl. xi, fig. 3. Bay of Islands.

PEMPHERIS COMPRESSA
Bullseye

Sparus ? compressus White, J. Voy. N.S.Wales 1790, p. 267, pl., fig. 2. [Botany Bay], N.S.Wales.

PEMPHERIS ANALIS

Pemperis analis Waite, Trans. N.Z. Inst. xlii, 1910, p. 375, pl. xxxvi. Denham Bay, Kermadecs.

Family HISTIOPTERIDAE
Genus ZANCLISTIUS

Zanclistius Jordan, Proc. U.S. Nat. Mus. xxxii, 1907, p. 236. Orthotype, *Z. elevatus* (Ramsay and Ogilby).

ZANCLISTIUS ELEVATUS
Short Boarfish

Histiopterus elevatus Ramsay and Ogilby, Proc. Linn. Soc. N.S.Wales (2) iii, 1888, p. 1311. Off Port Jackson, N.S.Wales; 70 faths.

Genus PARISTIOPTERUS

Richardsonia Castelnau, Proc. Zool. Acclim. Soc. Vict. i, July 15, 1872, p. 112. Haplotype, *R. insignis* Castelnau. Name preoccupied by *Richardsonia* Kner, 1864, and Steindachner, 1866, another genus of fishes (= *Retropinna*).

Paristiopterus Bleeker, Arch. Neerl. Sci. Nat. xi, i, 1876, p. 268. Orthotype, *Richardsonia insignis* Castelnau.

Macullochia Waite, Proc. N.Z. Inst. 1910, i, Sept. 10, 1910, p. 25. Haplotype, *Histiopterus labiosus* Gunther. New name for *Richardsonia* Castelnau, 1872, preoccupied.

PARISTIOPTERUS LABIOSUS

Giant Boarfish

Histiopterus labiosus Gunther, Proc. Zool. Soc. Lond. 1871, p. 658, pl. lix. South Australia.

Richardsonia insignis Castelnau, Proc. Zool. Acclim. Soc. Vict. i, July 15, 1872, p. 112. Westernport and Queenscliff, Victoria.

Histiopterus farnelli Waite, Prelim. Rept. Thetis Exped., June 1898, p. 33, pl. iv; Austr. Mus. Mem. iv, 1899, p. 116, pl. xxvii, Shoalhaven Bight, N.S.Wales.

Genus GRIFFINETTA

Griffinetta Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, Sept. 1939, p. 233. Haplotype, *G. nelsonensis* Whitley & Phillipps.

GRIFFINETTA NELSONENSIS

Griffinetta nelsonensis Whitley and Phillipps, Trans. Roy. Soc. N.Z. lxix, Sept. 1939, p. 233. New name for *Pseudopentaceros richardsoni* McCulloch and Phillipps, Rec. Austr. Mus. xiv, 1, Feb. 28, 1923, p. 18, pl. iv, fig. 1. Nelson, N.Z. ?Not *Pentaceros richardsoni* Smith, Ill. Zool. S. Afr. (Pisc.) 1844, pl. xxi, from South Africa.

Family APLODACTYLIDAE

Genus DACTYLOSARGUS

Meandrites Richardson, Rept. 12th meet. B.A.A.S. 1842 (1843), p. 16. Tautotype, [*Aplodactylus*] *maeandratus* Richardson. Name preoccupied by *Meandrites* Cuvier, Tab. Elem. (1798), p. 677 and *Meandrites* Bruguiere, Encycl. Meth. (Vers) (1), 1789, p. xvii, a genus of Corals in which there is a species *maendra*.

Dactylosargus Gill, Proc. Acad. Nat. Sci. Philad. xiv, May 1862, pp. 110 and 112. Virtual haplotype, *Aplodactylus arctidens* Richardson.

DACTYLOSARGUS ARCTIDENS

Marblefish; Keke; Granite Trout

Aplodactylus arctidens Richardson, Proc. Zool. Soc. Lond. vii, Nov. 1839, p. 96. Tasmania.

Sciaena maeandratus Richardson, Trans. Zool. Soc. Lond. iii, June 16, 1842, p. 83, *ex* Solander, MS. Cape Kidnappers.

Sciaena maeandrites Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 207, *ex* Solander, MS. Off Cape Kidnappers.

Haplodactylus donaldii Haast, Trans. N.Z. Inst. v, May 1873, p. 272, pl. xvi, uppermost figure. Lyttelton.

Haplodactylus schauinslandii Steindachner, Anzeiger Akad. Wiss. Wien. 37th year, no. xvi, 1900, p. 174; Denkschr. Akad. Wiss. Wien lxx, 1901, p. 487, pl. i, fig. 1. N.Z.

Family CHEILODACTYLIDAE

Genus NEMADACTYLUS

Nemadactylus Richardson, Proc. Zool. Soc. Lond. vii, Nov. 1839, p. 97. Orthotype, *N. concinnus* Richardson. Emended to *Nematodactylus* by Gill, Proc. Acad. Nat. Sci. Philad. 1862, pp. 114 & 121.

Sciaenoides Richardson, Rept. 12th. meet. B.A.A.S. 1842 (1843), p. 18. Logotype, *S. abdominalis* Richardson, selected by Whitley, Rec. Austr. Mus. xix, 1935, p. 235.

Dactylopagrus Gill, Proc. Acad. Nat. Sci. Philad. xiv, May 1862, p. 114. Orthotype, *Cheilodactylus carponemus* Cuv. & Val.

Dactylosparus Gill, Proc. Acad. Nat. Sci. Philad. xiv, May 1862, p. 117. Orthotype, *D. carponemus.*

NEMADACTYLUS MACROPTERUS
Tarakihi

Cichla macroptera Bloch and Schneider, Syst. Ichth. 1801, p. 342. N.Z. [= South Island.]

Sciaena macroptera Bloch and Schneider, Syst. Ichth. 1801, p. 342, *ex* Forster, MS. [South Id.] N.Z.

Cheilodactylus carponemus Cuvier, Regne Anim. ed. 2, ii, 1829, p. 117. New name for *Cichla macroptera* Bloch and Schneider. *Id.* Cuvier and Valenciennes, Hist. Nat. Poiss. v, July 1830, p. 362 (N.Z. records, not Australian ones, not plate).

Sparus carponemus Cuvier and Valenciennes, Hist. Nat. Poiss. v, July 1830, p. 363, *ex* Parkinson, MS. Queen Charlotte Sound, N.Z.

Nemadactylus concinnus Richardson, Proc. Zool. Soc. Lond. vii, Nov. 1839, p. 97; Trans. Zool. Soc. Lond. iii, June 16, 1842, p. 116, pl. iv, fig. 2. Port Arthur, Tasmania.

Sciaenoides abdominalis Richardson, Trans. Zool. Soc. Lond. iii, June 16, 1842, p. 101; Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 208; Rept. 12th meet. B.A.A.S. 1842 (1843) pp. 18-19, *ex* Solander, MS. Cape Kidnappers, Matamihow and Dusky Bay.

NEMADACTYLUS DOUGLASII
Porae

Chilodactylus douglasii Hector, Trans. N.Z. Inst. vii, July 1875, p. 244, pl. x, fig. 11b. Ngunguru Bay and Bay of Islands.

Chilodactylus morwong Ramsay & Ogilby, Proc. Linn. Soc. N.S.Wales (2) i, 1886, p. 879, Botany Bay, New South Wales.

Genus CHEILODACTYLUS

Cheilodactylus Lacepede, Hist. Nat. Poiss. v, 1803, p. 5, pl. i, fig. 1. Haplotype, *C. fasciatus* Lacepede.

CHEILODACTYLUS SPECTABILIS
Red Moki; Nanua

Chilodactylus spectabilis Hutton, Cat. Fish. N.Z., Feb. 1872, p. 8. Cook Straits.

Genus GONIISTIUS

Goniistius Gill, Proc. Acad. Nat. Sci. Philad. xiv, May 1862, pp. 114 & 120. Orthotype, *Cheilodactylus zonatus* Cuv. & Val.

GONIISTIUS VIZONARIUS
Magpie Morwong

Chilodactylus vizonarius Saville-Kent, Proc. Roy. Soc. Tas. 1887, pp. xxx, xxxi & 48; and as *bizonarius* in 1897. Tasmania.

Cheilodactylus bizonarius Waite, N.Z. J. Sci. Tech. i, Jan. 1918, p. 6, fig. 2. Kapiti Is. Emended name. [This may be the species recorded from the Kermadecs by Waite, 1910 as *Goniistius gibbosus* Rich.]

Family CHIRONEMIDAE
Genus CHIRONEMUS

Chironemus Cuvier & Valenciennes, Hist. Nat. Poiss. iii, April 1829, p. 78. Haplotype, *C. georgianus* Cuv. & Val.

CHIRONEMUS FERGUSSONI
Fergusson's Kelpfish; Hiwihiwi

Haplodactylus fergussoni Hector, Trans. N.Z. Inst. vii, 1875, p. 243. Kawakawa Bay, East Cape.

Family LATRIDAE
Genus MENDOSOMA

Mendosoma Gay, Hist. Fisic. polit. Chile ii, 1848, p. 212, *ex* Guichenot, MS. Logotype, *M. lineatum* Gay (*fide* Jordan, Gen. Fish.). However, Sherborn quotes Guichenot in Gay, Chili (Peces), 1849, p. 213 and adds, "*vernac.* 1847".

MENDOSOMA LINEATUM
Trumpeter

Mendosoma lineatum Guichenot in Gay, Chili (Peces) 1849, p. 213, *fide* Sherborn, Index Anim. Chile.

Genus LATRIDOPSIS

Latridopsis Gill, Proc. Acad. Nat. Sci. Philad. xiv, May 1862, pp. 114 & 115. Orthotype, *Latris ciliaris* Richardson, i.e. *Anthias ciliaris* Bloch & Schneider.

Evistius Gill, Mem. Nat. Acad. Sci. Wash. vi, 1893, pp. 114 & 123. Haplotype, *Platystethus huttonii* Gunther.

LATRIDOPSIS CILIARIS
Moki

Anthias ciliaris Bloch & Schneider, Syst. Ichth., 1801, p. 310. N.Z. [= South Island.]

Sciaena ciliaris Bloch & Schneider, Syst. Ichth., 1801, p. 311, *ex* Forster, MS. N.Z. [= Dusky Bay and Queen Charlotte Sound, South Island.]

LATRIDOPSIS FORSTERI
Bastard Trumpeter

Latris forsteri Castelnau, Proc. Zool. Acclim. Soc. Vict. i, July 15, 1872, p. 77. Gippsland Coast, Victoria. Type in Paris Museum.

Platystethus huttoni Gunther, Ann. Mag. Nat. Hist. (4) xvii, May 1, 1876, p. 395, Rept. Voy. Challenger, Zool. xxxi, 1889, Pelagic Fish. p. 13, pl. ii, figs. H (type) and I; Trans. N.Z. Inst. ix, May, 1877, p. 470. Dunedin.

LATRIDOPSIS AEROSA

Latris aerosa Hutton, Trans. N.Z. Inst. ix, 1877, p. 353. Otago Heads.

Genus LATRIS

Latris Richardson, Proc. Zool. Soc. Lond. vii, 1839, p. 98. Haplotype, *Latris hecateia* Richardson.

LATRIS LINEATA
Trumpeter; Kohikohi

Cichla lineata Bloch and Schneider, Syst. Ichth. 1801, p. 342. N.Z. = South Island (Dusky Sound).

Sciaena lineata Bloch and Schneider, Syst. Ichth. 1801, p. 342, *ex* Forster, MS. N.Z. [= South Island.]

Sciaena salmonea Richardson, Trans. Zool. Soc. (Lond.) iii, June 16, 1842, p. 114, *ex* Parkinson, MS. Totaeranui, Queen Charlotte Sound.

Family POMACENTRIDAE
Genus PARMA

Parma Gunther, Cat. Fish. Brit. Mus. iv, 1862, p. 57. Logotype, *P. microlepis* Gunther, designated by Jordan, Gen. Fish. iii, 1919, p. 318.

PARMA MICROLEPIS

Parma microlepis Gunther, Cat. Fish. Brit. Mus. iv, 1862, p. 57. Port Jackson, New South Wales.

Parma sp. (J. Moreland, in lit.—new record for N.Z.).

Genus CHROMIS

Chromis Cuvier, Bull. Soc. Sci. Philom. Paris, Oct. 1814, p. 88. Tautotype, *Sparus chromis* Linne.

CHROMIS DISPILUS
Puller

Chromis dispilus Griffin, Trans. N.Z. Inst. liv, Dec. 14, 1923, p. 254, pl. xxv. Off Reef Point, near Ahipara Bay, North Auckland district; trawler.

Family ODACIIDAE
Genus COREGONOIDES

Coregonoides Richardson, Ann. Mag. Nat. Hist. xi, June 1, 1843, p. 426. Haplotype, *Odax vittatus* Richardson.

COREGONOIDES VITTATUS
Kelp Fish; Tarao

Odax vittatus Richardson, Ann. Mag. Nat. Hist. xi, June 1, 1843, p. 426, *ex* Solander, MS. Mattaruhow.

Coregonoides vittatus Richardson, Ann. Mag. Nat. Hist. xi, 1843, p. 426, *ex* Solander, MS. Mattaruhow.

Coregonus vittatus Richardson, Ann. Mag. Nat. Hist. xi, June 1, 1843, p. 426, *ex* Solander, MS. Mattaruhow.

Callyodon coregonoides Richardson, Ann. Mag. Nat. Hist. xi, 1843, p. 427, *ex* Parkinson, MS. Mattaruhow.

?Odax vittatus var. Arthur, Trans. N.Z. Inst. xvii, May 1885, p. 169, pl. xiv, fig. 7. Off Otago Heads, N.Z.

Genus CORIDODAX

Coridodax Gunther, Cat. Fish. Brit. Mus. iv, 1862, pp. 69 & 243. Haplotype, *C. pullus* (Forster).

CORIDODAX PULLUS
Greenbone, Butterfish, Southern Kelp Fish; Marari

Scarus pullus Bloch and Schneider, Syst. Ichth. 1801, p. 208. N.Z. [Queen Charlotte Sound.]

Sparus pullus Bloch and Schneider, Syst. Ichth. 1801, p. 288, *ex* Forster, MS. N.Z. [= Queen Charlotte Sound.]

Odax pullus Cuvier and Valenciennes, Hist. Nat. Poiss. xiv, "1839" = Jan. 1840, p. 304, pl. cccviii. N.Z. (Forster) and Westernport, Victoria.

Family LABRIDAE
Genus PSEUDOLABRUS

Labroides Richardson, Ann. Mag. Nat. Hist. xi, June 1, 1843, p. 426. Haplotype, *L. asellinus* Richardson, *ex* Solander MS. *Nomen nudum*. Not *Labroides* Bleeker, 1851, another genus of fishes.

Pseudolabrus Bleeker, Proc. Zool. Soc. Lond. 1861 (Apr. 7, 1862), p. 413. Orthotype, *Labrus rubiginosus* Temminck and Schlegel, 1845 = *Pseudolabrus japonicus* (Houttuyn 1782)—*fide* Jordan, Gen. Fish.

Lunolabrus Whitley, Rec. Austr. Mus. xix, Aug. 2, 1933, p. 86. Orthotype, *Labrus miles* Bloch and Schneider.

Subgenus LUNOLABRUS
PSEUDOLABRUS (LUNOLABRUS) MILES
Scarlet Parrotfish; Soldier; Puwai-whakarua; Pau

Labrus miles Bloch & Schneider, Syst. Ichth. 1801, p. 264. N.Z. (Cook) = South Island.

Labrus coccineus Bloch and Schneider, Syst. Ichth. 1801, p. 264, *ex* Forster, MS. N.Z. [= South Island.]

Julis rubiginosus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 218 and Ann. Mag. Nat. Hist. xi, June 1, 1843, p. 425. Mattaruhow and Cape Kidnappers, N.Z. Not *Labrus rubiginosus* Risso, 1826 or Temminck and Schlegel, 1845.

Sparus rubiginosus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 218, *ex* Solander, MS. Off Cape Kidnappers, N.Z.

Julis prasiophthalmus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 218. *Nomen nudum*. N.Z.

Sparus prasiophthalmus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 218. *Nomen nudum* ex Solander, MS. Queen Charlotte Sound.

Julis rubecula Richardson, Ann. Mag. Nat. Hist. xi, June 1, 1843, p. 423, *ex Sparus rubecula* Solander MS. Totaeranue = Ship Cove, Queen Charlotte Sound and Cape Kidnappers, N.Z. (type-loc. according to Solander's MS. in British Museum (Natural History).)

Sparus rubecula (and) var. *pallidior* Richardson, Ann. Mag. Nat. Hist. xi, June 1, 1843, p. 424, *ex* Solander, MS. Cape Kidnappers, N.Z.

Labrichthys roseipunctata Hutton, Trans. N.Z. Inst. xii, May 1880, p. 450. Dunedin.

Pseudolabrus cossyphoides Steindachner, Anzeiger Akad. Wiss. Wien. 37th year, no. xvi, 1900, p. 176; Denkschr. Akad. Wiss. Wien. lxx, 1901, p. 503, pl. ii, fig. 1. N.Z.

PSEUDOLABRUS (LUNOLABRUS) CELIDOTUS

Spotty; Paekirikiri

Labrus celidotus Bloch & Schneider, Syst. Ichth. 1801, p. 265, *ex* Forster, MS. N.Z. (Cook) = South Island.

Labrus poecilopleura Cuvier & Valenciennes, Hist. Nat. Poiss. xiii, "1839" = Dec. 1838, p. 95. N.Z. (Lesson and Garnot.)

Julis notatus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 218. *Nomen nudum*. [Tolaga Bay] N.Z.

Sparus notatus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 218; Zool. Voy. Erebus and Terror, Fish. 1846, p. 46, *ex* Solander, MS. [Tolaga Bay.] Not *Sparus notatus* Shaw, 1803.

Sparus stellatus Richardson, Ann. Mag. Nat. Hist. xi, June 1, 1843, p. 426. *Nomen nudum ex* Solander, MS. Toteeranue [= Ship] Cove [Queen Charlotte Sound] and Tolaga Bay, N.Z.

Labroides asellinus Richardson, Ann. Mag. Nat. Hist. xi, June 1, 1843, p. 426. *Nomen nudum* ex Solander, MS. Ship Cove and Tolaga Bay, N.Z. = Cape Kidnappers in Solander's original MS.

Labrus botryocosmus Richardson, Zool. Voy. Erebus and Terror, Fish. 1846, p. 53, pl. xxxi, figs. 6-10. Coasts of South Australia and Van Diemen's Land.

Labrichthys fucicolor Hutton, Trans. N.Z. Inst. xxii, May 1890, p. 281. Error for *Labrus fucicola* Richardson, Proc. Zool. Soc. Lond. viii, Aug. 1840, p. 26 (Port Arthur, Tasmania).

Subgenus PSEUDOLABRUS

PSEUDOLABRUS INSCRIPTUS

Wrasse

Labrus inscriptus Richardson, Zool. Voy. Erebus and Terror, Fish. 1848, p. 134, pl. lvi, figs. 1-2. Norfolk Island.

Note: Kermadec Is.—Waite.

PSEUDOLABRUS LUCULENTUS

Labrus luculentus Richardson, Zool. Voy. Erebus and Terror, Fish 1848, p. 130. Norfolk Island, Eastern and Western Australia.

Note: Kermadec Is.—Waite.

PSEUDOLABRUS CINCTUS

Labrichthys cincta Hutton, Trans. N.Z. Inst. ix, May 1877, p. 354. Coasts of Otago.

PSEUDOLABRUS PITTENSIS

Pseudolabrus pittensis Waite, Proc. N.Z. Inst. 1910, pt. i, Sept. 10, 1910, p. 26. Off Pitt Island, Chatham Group. Figured in Rec. Canterb. Mus. i, 3, June 24, 1911, p. 226, pl. xlviii.

Genus PICTILABRUS

Pictilabrus Gill, Proc. U.S. Nat. Mus. xiv, 1891 (1892), p. 403. Haplotype, *Labrichthys laticlavius* auctt. = *Labrus laticlavius* Richardson.

PICTILABRUS LATICLAVIUS

Senator

Labrus laticlavius Richardson, Proc. Zool. Soc. London, vii, Nov. 1839, p. 99; viii, Aug. 1840, p. 26. Port Arthur, Tasmania.

Genus TIRICORIS

Tiricoris Whitley, Austr. Zool. xii, 2, July 18, 1955, p. 111. Orthotype, *Cymolutes sandeyeri* Hector.

TIRICORIS SANDEYERI

King Wrasse

Cymolutes sandeyeri Hector, Trans. N.Z. Inst. xvi, May 1884, p. 323. Tiritiri Island, Auckland (S. "Sandeyer" [= Sandager]).

Cymolutes sandageri Sandager, Trans. N.Z. Inst. xx, May 1888, p. 130.

Coris sandageri Phillipps, N.Z. Mar. Dept. Fish. Bull. i, Aug.-Dec. 1927, p. 41. Emendation.

Genus VERREO

Verreo Jordan and Snyder, Proc. U.S. Nat. Mus. xxiv, May 2, 1902, p. 619. Orthotype, *Cossyphus oxycephalus* Bleeker, Versl. Akad. Amsterdam xiv, 1862, p. 128, from Japan.

VERREO UNIMACULATUS

Red Pigfish; Pakurakura

Cossyphus unimaculatus Gunther, Cat. Fish. Brit. Mus. iv, 1862, pp. 109 and 506. Australia.

VERREO BELLIS

Banded Pigfish; Kotakota

Cossyphus bellis Ramsay and Ogilby, Proc. Linn. Soc. N.S.Wales (2) ii, Nov. 30, 1887, p. 561. Shoalhaven district, New South Wales.

Genus DUYMAERIA

Duymaeria Bleeker, Acta Soc. Sci. Ind.-Ned. i, 1856, p. 52. Logotype, *Crenilabrus aurigaria* Richardson.

DUYMAERIA FLAGELLIFERA

Cockatoo

Ctenolabrus flagellifer Cuv. & Val., Hist. Nat. Poiss. xiii, 1839, p. 240. No locality.

Family LEPTOSCOPIDAE

Genus LEPTOSCOPUS

Leptoscopus Gill, Proc. Acad. Nat. Sci. Philad. 1859 (1860), p. 132. Haplotype, *Uranoscopus macropygus* Richardson.

LEPTOSCOPUS MACROPYGUS HUTTONII

Stargazer

Uranoscopus macropygus Richardson, Zool. Voy. Erebus and Terror, Fish. 1846, p. 55, pl. xxxiii, figs. 4-6. Port Jackson.

Leptoscopus huttonii Haast, Trans. N.Z. Inst. v, May 1873, p. 275, pl. xvi, fig. 3. Avon River.

Leptoscopus tricolor Haast, Trans. N.Z. Inst. v, May 1873, p. 276. Avon River.

Genus CRAPATALUS

Crapatalus Gunther, Ann. Mag. Nat. Hist. (3) vii, Feb. 1, 1861, p. 86. Haplotype, *C. novaezelandiae* Gunther. *Id.* Gill, Proc. Acad. Nat. Sci. Philad. xiii, 1861, p. 109.

CRAPATALUS NOVAEZELANDIAE
Sandfish

Crapatalus novaezelandiae Gunther, Ann. Mag. Nat. Hist. (3) vii, Feb. 1, 1861, p. 87, pl. x, fig. A. N.Z. (British Mus.)

Leptoscopus canis Arthur, Trans. N.Z. Inst. xvii, May 1885, p. 165, pl. xiv. Off Purakanui, South Island, N.Z.

Leptoscopus robsoni Hector, Trans. N.Z. Inst. vii, June 1875, p. 248. Cape Campbell (Not in Phillipps' Bibliography).

CRAPATALUS ANGUSTICEPS

Leptoscopus angusticeps Hutton, Trans. N.Z. Inst. vi, June 1874, p. 106, pl. xix, fig. 36c. Greymouth Harbour, N.Z.

Note: Mr. J. Moreland informs me that *Crapatalus angusticeps* is a species distinct from *C. novaezelandiae* and occupies a separate niche.

Family CHEIMARRICHTHYIDAE
Genus CHEIMARRICHTHYS

Cheimarrichthys Haast, Trans. N.Z. Inst. vi, June 1874, p. 103. Haplotype, *C. fosteri* Haast. Not *Cheimarrichthys* Sauvage, Rev. Mag. Zool. (3) ii, after June 1874, p. 332, a genus of Thibetan catfishes, now *Euchiloglanis.*

CHEIMARRICHTHYS FOSTERI
Torrent Fish; Papanoko, Papane

Cheimarrichthys fosteri Haast, Trans. N.Z. Inst. vi, 1874, p. 103, pl. xviii, fig. 38a. Otira Gorge.

Family PARAPERCICHTHYIDAE
Genus PARAPERCICHTHYS

Parapercichthys Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, 2, Sept. 1939, p. 235. Orthotype, *Enchelyopus colias* Bloch and Schneider.

PARAPERCICHTHYS COLIAS
Blue Cod; Rawaru

Enchelyopus colias Bloch and Schneider, Syst. Ichth. 1801, p. 54. N.Z. = South Id.*

G[*adus*] *c*[*olias*] Bloch and Schneider, Syst. Ichth. 1801, p. 54, *ex* Forster, MS. [South Island of] N.Z.

Percis nicthemera Cuv. & Val., Hist. Nat. Poiss. iii, 1829, p. 274. [Bay of Islands] N.Z. (Lesson & Garnot). Name variously spelt by later authors.

Labrus macrocephalus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 207; Rept. 12th meet. B.A.A.S. 1842 (1843), p. 16. *Nomen nudum ex* Solander MS. Queen Charlotte Sound. Preoccupied by *Labrus macrocephalus* Lacepede, Hist. Nat. Poiss. iii, 1802, p. 432.

Family PARAPERCIDAE
Genus NEOPERCIS

Neopercis Steindachner and Doderlein, Denkschr. Akad. Wiss. Wien xliv, 1885, p. 212. New name for *Parapercis* Steindachner, 1884, preoccupied. Type-species, therefore, *P. ramsayi,* Steindachner, although that species is not

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* Forster (Descr. Anim. 1844, p. 122) gives the localities for *Gadus colias* as "Habitat in mari alluente insulam australem Novae Zeelandiae, in fundi maris saxoso; in Portu obscuro multo maior; in Aestuario Reginae Charlottae minor constanter hamo captus hic Gadus . . . . . ."
I therefore select Dusky Sound as type-locality.

mentioned by Steindachner and Doderlein, who selected no type-species. Cantwell (Pacific Science xviii, July 1964, p. 242) correctly selected *ramsayi*.

NEOPERCIS GILLIESII
Grubfish

Percis gilliesii Hutton, Ann. Mag. Nat. Hist. (5) iii, Jan. 1, 1879, p. 53. Brighton, near Dunedin (R. Gillies).

Famliy URANOSCOPIDAE
Genus KATHETOSTOMA

Kathetostoma Gunther, Cat. Fish. Brit. Mus. ii, 1860, p. 231. Haplotype, *Uranoscopus laevis* Bloch & Schneider.

KATHETOSTOMA GIGANTEUM
Stargazer; Flathead

Kathetostoma giganteum Haast, Trans. N.Z. Inst. v. May 1873, p. 274, pl. xvi, fig. 2. Heathcote estuary, near Sumner.

KATHETOSTOMA FLUVIATILE

Kathetostoma fluviatilis Hutton, Cat. Fish. N.Z., Feb. 1872, p. 24. Manawatu River, N.Z.

Genus GENYAGNUS

Genyagnus Gill, Proc. Acad. Nat. Sci. Philad. 1861, pp. 111 and 115. Haplotype, *Uranoscopus monopterygius* Bloch and Schneider.

Synnema Haast, Trans. N.Z. Inst. v, May 1873, p. 274. Haplotype, *S. monopterygium* Bloch & Schneider.

GENYAGNUS MONOPTERYGIUS
Catfish

Uranoscopus monopterygius Bloch & Schneider, Syst. Ichth. 1801, p. 49. N.Z. (type) and Tahiti. Type-loc.: South Island.

Uranoscopus maculatus Bloch & Schneider, Syst. Ichth. 1801, p. 49, *ex* Forster, MS. N.Z. and Tahiti. Type-loc. South Island.

Uranoscopus cirrhosus Cuv. & Val., Hist. Nat. Poiss. iii, April, 1829, pp. 314 and 319. N.Z. (Lesson and Garnot.)

Uranoscopus forsteri Cuv. & Val., Hist. Nat. Poiss. iii, April, 1829, p. 318. N.Z. (Forster).

Uranoscopus kouripua Lesson, Voy. Coquille, Zool. ii, 1, 1829, p. 217, pl. xviii. Bay of Islands, N.Z.

Uranoscopus kouripoua Lesson, Dict. Class. d'Hist. Nat. xvi, October 1830, p. 469. Same as *U. cirrhosus* Cuv. & Val. N.Z.

Uranoscopus maculosus Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 207; Zool. Voy. Erebus and Terror, Fish. 1846, p. 54, *ex* Solander, MS. No locality [Doubtless South Island of N.Z.]. (Solander's description reproduced).

Genus GNATHAGNOIDES

Gnathagnoides Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, September 1939, p. 235. Orthotype, *Gnathagnus innotabilis* Waite.

GNATHAGNOIDES INNOTABILIS GRANDIOR

Gnathagnus innotabilis Waite, Rec. Austr. Mus. v, 4, June 16, 1904, p. 238, pl. xxvi, fig. 1. Off Narrabeen, N.S.Wales.

Gnathagnoides innotabilis grandior Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, Sept. 1939, p. 235. N.Z.

Family NOTOTHENIIDAE
Genus HARPAGIFER

Harpagifer Richardson, Zool. Voy. Erebus and Terror, Fish. 1844, p. 11. Haplotype, *Batrachus bispinis* Bloch and Schneider, 1801, from Tierra del Fuego and Cape Horn.

HARPAGIFER BISPINIS
Hornhead

Batrachus bispinis Bloch and Schneider, Syst. Ichth. 1801, p. 45. Tierra del Fuego.

Callionymus bispinis Bloch and Schneider, Syst. Ichth, 1801, p. 45, *ex* Forster, MS. Tierra del Fuego.

Harpagifer palliolatus Richardson, Zool. Voy. Erebus and Terror, Fish. 1845, p. 20, pl. xii, figs. 5-7. Falkland Islands.

Note: Recorded from Macquarie Island by Hamilton (Trans. N.Z. Inst. xxvii, May 1895, p. 577) and by Norman.

Genus NOTOTHENIA

Notothenia Richardson, Zool. Voy. Erebus and Terror, Fish. 1844, p. 5. Logotype, *N. coriiceps* Richardson, from Kerguelen Land, *fide* Jordan Gen. Fish.

NOTOTHENIA PURPURICEPS
Purple Head

Notothenia purpuriceps Richardson, Zool. Voy. Erebus & Terror, Fish. 1844, p. 7, pl. ii, figs. 3-4. Otago Heads and Kerguelen Island.

NOTOTHENIA CORNUCOLA

Notothenia cornucola Richardson, Zool. Voy. Erebus & Terror, Fish. 1844, p. 8, pl. viii, figs. 4 & 5. Cape Horn, South America.

Notothenia marginata Richardson, Zool. Voy. Erebus & Terror, Fish. 1844, p. 18, pl. xii, figs. 1 & 2 (not 3 & 4 as stated in text). Falkland Iss.

NOTOTHENIA MAORIENSIS
Maori Chief

?Notothenia macrocephalus Gunther, Cat. Fish. Brit. Mus. ii, 1860, p. 263, Falkland Islands. D.5/30-31; A.21. Lateral line interrupted below 3rd dorsal ray before last.

Notothenia maoriensis Haast, Trans. N.Z. Inst. v, 1873, p. 276, pl. xvi and fig. Lyttelton Harbour. D.3/29; A.23. Lateral line extending to below last dorsal ray.

Notothenia angustata Hutton, Ann. Mag. Nat. Hist. (4) xvi, Nov. 1875, p. 315. *Id.* Hutton & Ulrich, Rept. Geol. Goldfields Otago, 1875 (pref. June), p. 133; Trans. N.Z. Inst. viii, May 1876, p. 213. Dunedin & Bluff Harbours.

Notothenia arguta Hutton, Trans. N.Z. Inst. xi, May 1879, p. 339. Campbell Id.

NOTOTHENIA MICROLEPIDOTA
Black Cod

Notothenia microlepidota Hutton, Ann. Mag. Nat. Hist. (4) xvi, Nov. 1875, p. 316; and Hutton and Ulrich, Rept. Geol. Goldfields Otago, 1875, p. 133, *nom. nud.;* Trans. N.Z. Inst. viii, May 1876, p. 213. Dunedin and Moeraki.

Notothenia parva Hutton, Trans. N.Z. Inst. xi, May 1879, p. 339 and xii, 1880, p. 465. Auckland Islands.

NOTOTHENIA FILHOLI

Notothenia filholi Sauvage, Bull. Soc. Sci. Philom. (7) iv, 1880, p. 228. Campbell Island—*fide* Zool. Record.

NOTOTHENIA COLBECKI

Notothenia colbecki Boulenger, Rept. Nat. Hist. Coll. Southern Cross, 1902, p. 185, pl. xvi. Campbell Island.

Note: Macquarie Id. (Waite).

NOTOTHENIA MACQUARIENSIS

Notothenia coriiceps var. *macquariensis* Waite, Sci. Rept. Austral. Antarc. Exped. (c) iii, 1, Fish., June 30, 1916, p. 64, pl. v, fig. 3 and text-fig. 15. Macquarie Island, *teste* Regan, 1916.

Genus AURION

Aurion Waite, Sci. Rept. Austral. Antarc. Exped. (c) iii, 1, Fish., June 30, 1916, p. 62. Orthotype, *A. effulgens* Waite.

AURION EFFULGENS

Aurion effulgens Waite, Sci. Rept. Austral. Antarc. Exped. (c) iii, 1, Fish., June 30, 1916, p. 63, pl. iv, fig. 3. South-west of Adam's Island, Auckland Islands.

Family BOVICHTIDAE

Genus BOVICHTUS

Bovichtus Cuvier & Valenciennes, Hist. Nat. Poiss. viii, "1831" = Jan. 1832, p. 486. Haplotype, *Callionymus diacanthus* Carmichael.
Emended to *Bovichthys* by Agassiz, Nomencl. Zool., Pisc., 1845, p. 9.

BOVICHTUS PSYCHROLUTES

Bovichthys psychrolutes Gunther, Cat. Fish. Brit. Mus. ii, 1860, p. 250. Antarctic Ocean, 50°S. by 172°W.
Bovichtus psychrolutes Parrott, Rec. Domin. Mus. iii, 1958, pp. 109 & 113.

BOVICHTUS VARIEGATUS ROSEOPICTUS

Horny, Thornfish

Bovichthys variegatus Richardson, Zool. Voy. Erebus & Terror, Fish. 1846, p. 56, pl. xxxiv, figs. 1-4. Port Jackson.
Bovichthis roseopictus Hutton, Trans. N.Z. Inst. xxxvi, Aug. 1904, p. 148. Sumner, N.Z.

Family CALLIONYMIDAE

Genus YERUTIUS

Yerutius Whitley, Rec. Austr. Mus. xviii, 3, March 25, 1931, p. 115. Orthotype, *Callionymus apricus* McCulloch.

YERUTIUS PHASIS

Dragonet

Callionymus phasis Gunther, Voy. Challenger, Zool. i, 6, 1880, p. 28, pl. xv, fig. C. Off Twofold Bay, New South Wales.
Note: Specimens from Oamaru (Otago Museum) and the North Island (Dominion Museum). New record for New Zealand, from which the species was first recognized by J. Moreland (MSS).

Family SARDIDAE

Genus KATSUWONUS

Katsuwonus Kishinouye, Sui. Gak. Ho, i, 1915, p. 21; J. Coll. Agric. Tokyo vii, 1, 1919, p. 1. Orthotype, *Scomber pelamis* Linne.
Kentsuwonia Roule, Ann. Stat. Oceanogr. Salammbo ii, 1926, p. 14. Error.

KATSUWONUS VAGANS

Striped Tuna

Thynnus vagans Lesson, Dict. Class. d'Hist. Nat. xv, May 1829, p. 278. Dangerous Island, near Tahiti; Lesson Voy. Coquille, Zool. ii, 1829, p. 162, pl. xxxii. (*Thynnus pelamys* Anon., Proc. N.Z. Inst. xliv, 1916 (1917), p. 556 from between Napier and Gisborne is doubtless this).

Genus NEOTHUNNUS

Neothunnus Kishinouye, J. Coll. Agric. Univ. Tokyo viii, 3, 1923, pp. 433 and 445. Logotype, *N. macropterus* Temminck and Schlegel.

NEOTHUNNUS MACROPTERUS
Yellowfin Tuna

Thynnus macropterus Temminck & Schlegel, Faun. Japon., Pisc. 1844, p. 98, pl. li. South-western Japan.

Neothunnus itosibi Jordan & Evermann, Occ. Pap. Calif. Acad. Sci. xii, Sept. 30, 1926, p. 22, pl. vi. Honolulu (type) and Japan.

Note: Powell's record was based on a 187 lb. specimen from North Cape, 25/2/1935. He was misled by a fisherman as to its locality.

Genus ALLOTHUNNUS

Allothunnus Serventy, Rec. Canterb. Mus. v, 3, 1948, p. 131. Orthotype, *A. fallai* Serventy. Earlier as a *nomen nudum* in Fisheries Newsletter vi, 1, 1947, p. 23.

ALLOTHUNNUS FALLAI
Falla's Tuna

Auxis sp. nov. Young, Ann. Rept. Otago Univ. Mus. 1921 (1922), p. 12. Moeraki. And New Zealand records of *A. thazard* (*non* Lacepede, 1801).

Allothunnus fallai Serventy, Rec. Canterb. Mus. v. 3, 1948, p. 131, pls. xxviii-xxix. Timaru (holotype), Kaiapoi, and Akaroa; all south of 43°S. lat. Types in Canterbury Museum.

Genus GERMO

Germo Jordan, Proc. Acad. Nat. Sci. Philad. Aug. 7, 1888, p. 180. Tautotype, *Scomber alatunga* Gmelin, Syst. Nat. (Linne) ed. 13, i, 3, 1789, p. 1330. Mediterranean.

GERMO GERMON STEADI
Albacore

Germo germon steadi Whitley, Rec. Austr. Mus. xix, Aug. 2, 1933, p. 81, pl. xi, fig. 1. N.S.Wales.

Genus THINNUS

Thinnus S.D.W., Analyst. v, 1837, p. 208. Logotype, *Scomber thynnus* Linne.

Thunnus South, Encycl. Metropolitana xxv, 12, 1845, p. 620. Tautotype, *Scomber thynnus,* Linne.

THINNUS MACCOYII
Bluefin Tuna, Tunny

Thynnus maccoyii Castelnau, Proc. Zool. Acclim. Soc. Vict. i, July 15, 1872, p. 104. Melbourne Market.

Thunnus phillipsi Jordan and Evermann, Occas. Pap. Calif. Acad. Sci. xii, Sept. 30, 1926, p. 13, pl. ii, fig. 4. Bay of Islands, N.Z.

Thynnus pacificus Thomson and Anderton, Bull. N.Z. Board Sci. Art. 11, 1921, p. 79. *Non* Cuvier. Otago Harbour.

Note: Dr. D. L. Serventy (1942, MS.) states: *"Pelamys chilensis?* Hutton, Fishes of New Zealand, 1872, p. 22, is really *Thunnus maccoyii* (*T. phillipsi*)".

Family SCOMBRIDAE
Genus PNEUMATOPHORUS

Pneumatophorus Jordan & Gilbert, Proc. U.S. Nat. Mus. v, 1883, p. 593, as subgenus of *Scomber*. Tautotype, *Scomber pneumatophorus* De La Roche.

PNEUMATOPHORUS AUSTRALASICUS
Mackerel, Tawatawa

Scomber australasicus Cuvier & Valenciennes, Hist. Nat. Poiss. viii, "1831" = Jan. 1832, p. 49. King George's Sound, Western Australia.

Scomber loo? Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 209, *ex Scomber scombrus* Solander, MS. Queen Charlotte Sound. Not *Scomber*

loo Lesson, Dict. Class. Hist. Nat. xv, 1829, p. 277; and not *Scomber scombrus* Linne, 1758.

Scomber (*Scombrus*) *solandris* Richardson, Rept. 12th. meet. B.A.A.S. 1842 (late 1843), p. 20, *ex Scomber scombrus* Solander, MS., *non* Linne. Virtually a *nomen nudum*. Queen Charlotte Sound.

Scomber pneumatophorus Waite, Rec. Cant. Mus. i, 3, June 24, 1911, p. 233. Palliser Bay; 14 faths. Not *S. pneumatophorus* De La Roche, Ann. Mus. Hist. Nat. Paris xiii, 1809, p. 344.

Family GASTEROCHISMATIDAE
Genus GASTEROCHISMA

Gasterochisma Richardson, Ann. Mag. Nat. Hist. xv, May 1, 1845, p. 346. Haplotype, *G. melampus* Richardson.

Lepidothynnus Gunther, Rept. Voy. Challenger, Zool. xxxi, pref. Jan. 23, 1889, p. 15. Haplotype, *L. huttonii* Gunther.

GASTEROCHISMA MELAMPUS
Butterfly Mackerel

Gasterochisma melampus Richardson, Ann. Mag. Nat. Hist. xv, May 1, 1845, p. 346. Port Nicolson, N.Z.

Lepidothynnus huttonii Gunther, Rept. Voy. Challenger, Zool. xxxi, pref. Jan. 23, 1889, p. 15, pl. vi, figs. A-i. Lyttelton Harbour; driven on shore, April 17, 1887.

Family SCOMBEROMORIDAE
Genus CYBIUM

Cybium Cuvier, Regne Anim. ed. 2, ii, April, 1829, p. 199. Logotype, *C. commersonii* Cuvier = *Scomber commerson* Lacepede, selected by Gill, 1863.

CYBIUM GUTTATUM?
Spanish Mackerel

Scomber guttatus Bloch & Schneider, Syst. Ichth., 1801, p. 23, pl. v. Tranquebar, Madras, India.

Note: The records of this tropical fish from New Zealand and the Chatham Islands are very doubtful.

Family LUVARIDAE
Genus LUVARUS

Luvarus Rafinesque, Carat. n. gen. 1810, p. 22. Type, *Luvarus imperialis* Rafinesque.

LUVARUS IMPERIALIS
Luvaru

Luvarus imperialis Rafinesque, Caratt. n. gen. 1810, p. 22. Sicily, Mediterranean Sea.

Family LAMPRIDAE
Genus LAMPRIS

Lampris Retzius, K. Vet. Ac. Nya. Handl. xx, 1799, p. 97. Type, *Zeus guttatus* Brunnich = *Zeus regius* Bonnaterre (*fide* Jordan, Gen. Fish).

LAMPRIS REGIUS
Moonfish

Zeus regius Bonnaterre, Tabl. Encycl. Meth. Ichth. 1788, p. 72. Torbay, England (Pennant, Brit. Zool.).

Zeus luna Gmelin, Syst. Nat. (Linne) ed. 13, i, 1789, p. 1225. "Habitat in mari Normanniam alluente".

Zeus guttatus Brunnich, Nye, Saml. K. Danske. Skrift. iii, 1788, p. 403—*fide* Sherborn.

Family XIPHIIDAE

Genus XIPHIAS

Xiphias Linne, Syst. Nat. ed. 10, 1758, p. 248; ed. 12, 1766, p. 432. Haplotype, *X. gladius* Linne.

XIPHIAS ESTARA

Broadbill Spearfish or Swordfish; Paea

Xiphias estara Phillipps, N.Z. J. Sci. Tech. xiii, 4, Feb. 1932, p. 231. Hokitika, N.Z. Type figured as *X. gladius* by Phillipps, Trans. N.Z. Inst. lvi, 1926, p. 535, pl. xci.

Family ISTIOPHORIDAE

Genus MARLINA

Marlina Grey, Natural History (New York) xxviii, 1, 1928, p. 47. Haplotype, the N.Z. Form of the Japanese *M. mitsukurii* = *Makaira zelandica* Jordan & Evermann.

MARLINA ZELANDICA

Striped Marlin

Makaira zelandica Jordan & Evermann, Occas. Pap. Calif. Acad. Sci. xii, Sept. 30, 1926, p. 65, pl. xix, fig. 2. Near Russell, Bay of Islands. Holotype in Auckland Museum (Powell, Rec. Auck. Inst. ii, 1941, p. 239).

Genus ISTIOMPAX

Istiompax Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 321. Orthotype, *I. australis* Whitley [= W. S. Wall, 1854].

ISTIOMPAX INDICUS

Black Marlin

Tetrapturus indicus Cuvier & Valenciennes, Hist. Nat. Poiss. viii, "1831" [= 1832], p. 286. Sumatra. Compare Morrow, Copeia, 1959 (4), 1959, p. 347, fig. 1, of holotype.

Tetrapturus australis [Wall,] Illustrated Sydney News, March 11, 1854, with woodcut. Broken Bay, New South Wales. Figure reproduced in Whitley, Austr. Mus. Mag. xi, 9, 1955, p. 292, fig.

Istiompax australis Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 321 and Rec. Austr. Mus. xviii, 1931, p. 148. Off Wollongong, New South Wales.

ISTIOMPAX MAZARA

Howard's Marlin

Tetrapturus mazara Jordan & Snyder, J. Coll. Sci. Imp. Univ. Tokyo xv, 1901, p. 305, pl. ii. Misaki, Sagami, Japan.

Istiompax howardi Whitley, Austr. Zool. xii, 1954, p. 58, pl. iii, fig. 3. Bermagui, New South Wales.

Family TRICHIURIDAE

Genus LEPIDOPUS

Lepidopus Gouan, Hist. Pisc., 1770, pp. 107 & 185. Haplotype, *L. gouani* Gouan.

LEPIDOPUS LEX

Frostfish; Tikati, Para

Lepidopus lex Phillipps, N.Z. J. Sci. Tech. xiii, 4, Feb. 1932, p. 232. "All parts of N.Z."

Genus SCARCINA

Scarcina Rafinesque, Car. n. gen., 1810, p. 20. Haplotype, *S. argyrea* Rafinesque.

Benthodesmus Goode & Bean, Proc. U.S. Nat. Mus. iv, 1882, p. 380. Orthotype, *Lepidopus elongatus* Clarke.

SCARCINA ELONGATA

Slender Frostfish

Lepidopus elongatus Clarke, Trans. N.Z. Inst. xi, May 1879, p. 294, pl. xiv. Hokitika Beach.

Family ACINACEIDAE

Genus LEIONURA

Leionura Bleeker, Nat. Tijdschr. Ned. Ind. xxi, 1860, p. 68, *ex* Kuhl & Van Hasselt, MS. Haplotype, *L. esox* Bleeker.

Thyrsites of authors following Cuvier & Val., not *Thyrsites* Lesson, 1829, sensu stricto.

LEIONURA ATUN DENTATUS

Barracouta; Manga

Scomber atun Euphrasen, K. Vet. Akad. Nya. Handl. xii, 1791, p. 315. Cape of Good Hope (type) and Java.

Scomber dentatus Bloch and Schneider, Syst. Ichth. 1801, p. 24, *ex* Forster, MS. [Queen Charlotte Sound] N.Z.

Scomber lanceolatus Cuv. & Val., Hist. Nat. Poiss. viii, "1831" = Jan. 1832, p. 204, *ex* Forster, MS. Queen Charlotte Sound, N.Z.

Scomber splendens Richardson, Trav. N. Zeal. (Dieff.) ii, Jan. 1843, p. 209; Rept. 12th meet. B.A.A.S. 1842 (1843) p. 20, *ex* Solander, MS. Murderer's Bay, N.Z.

Scomber dentex Richardson, Trav. N.Z. (Dieff) ii, Jan. 1843, p. 209; Rept. 12th meet. B.A.A.S. 1842 (1843) p. 20, *ex* Forster, MS. Queen Charlotte Sound, N.Z. Name preoccupied by *Scomber dentex* Bloch and Schneider, Syst. Ichth. 1801, p. 30.

Genus REXEA

Rexea Waite, Proc. N.Z. Inst. 1910, ii (Publ. Jan. 18, 1911), p. 49. Orthotype, *R. furcifera* Waite = *Gempylus solandri* Cuv. & Val.

Jordanidia Snyder, Proc. U.S. Nat. Mus. xl, May 26, 1911, p. 527. Orthotype, *J. raptoria* Snyder.

REXEA SOLANDRI

Hake; King Barracouta; Southern Kingfish; Smoked Hake; Tikati

Gempylus solandri Cuv. & Val., Hist. Nat. Poiss. viii, "1831" = Jan. 1832, p. 215 "New Holland" = Bay of Islands, N.Z. 2/12/1769.

Scomber macrophtalmus Cuv. & Val., *ibid.* p. 215, *ex* Solander, MS. Preoccupied by *Scomber macrophthalmus* Rafinesque, Ind. ittiol. Sicil. 1810, pp. 20 and 53.

Rexea furcifera Waite, Proc. N.Z. Inst. 1910, ii (Jan. 18, 1911), p. 49; Rec. Canterb. Mus. i, 3, 1911, p. 226, pl. lii, N.Z.

Genus ACINACEA

Acinacea Bory de St. Vincent, Voy. iles. Afriq. i, 1804, p. 93; Dict. Class. Hist. Nat. i, 1822, p. 93, pl. cv. Haplotype, *A. notha* Bory.

Gempylus Cuvier, Regne Anim. ed. 2, ii, April 1829, p. 200. Haplotype, *G. serpens* Cuv.

Lemnisoma Lesson, Voy. Coquille, Zool. ii, 1829, p. 160. Haplotype, *L. thyrsitoides* Lesson, from Pacific Ocean near the Paumotu Archipelago.

Lucoscombrus Van der Hoeven, Handb. Dierkunde ii, 1855, p. 367; Handb. Zool. (ed Clark) ii, 1858, p. 161. Logotype, *Gempylus serpens,* selected by Whitley, Rec. Austr. Mus. xvii, 1929, p. 119.

ACINACEA NOTHA

Scabbard Fish

Acinacea notha Bory de St. Vincent, Voy. iles Afriq., 1804, p. 93; Dict. Class. Hist. nat. i, 1822, p. 93, pl. cv. Tropical Atlantic Ocean.

Gempylus serpens Cuvier, Regne Anim., ed. 2, ii, April 1829, p. 200. Based on "Serpens marinus" Sloane, Voy. Jamaica i, 1707, p. 26, pl. i, fig. 2. About Tropic of Cancer, Atlantic Ocean.

Lemnisoma thyrsitoides Lesson, Voy. Coquille, Zool. ii, 1831, p. 160. Near Paumotu Islands, Pacific: 17°S. x 108°E.

Gempylus coluber Cuvier & Valenciennes, Hist. Nat. Poiss. viii, "1831" = Jan. 1832, p. 211. Tahiti.

Genus RUVETTUS

Ruvettus Cocco, Oss. Pelorit. xiii, 1833, p. 18. Haplotype, *R. pretiosus* Cocco.

RUVETTUS WHAKARI
Oil Fish

Ruvettus whakari Griffin, Trans. N.Z. Inst. lviii, Aug. 15, 1927, p. 146, pl. xv, fig. 7. White Island, Bay of Plenty; hook and line.

Genus MACHAEROPE

Machaerope Ogilby, Abstr. Proc. Linn. Soc. N.S.Wales, Nov. 30, 1898, p. ii; Proc. Linn. Soc. N.S.Wales, xxiii, 4, 1899, p. 736. Orthotype, *M. latispinis* Ogilby.

MACHAEROPE LATISPINIS
Dagger Fish

Machaerope latispinis Ogilby, Proc. Linn. Soc. N.S.Wales, xxiii, 1899, p. 737. Lord Howe Island.

Note: Kermadecs (Waite). Specimen in Canterbury Museum, Christchurch.

Family CHIASMODONTIDAE
Genus CHIASMODON

Chiasmodon Johnson, Proc. Zool. Soc. London 1863 (1864), p. 408. Haplotype, *C. niger* Johnson.

CHIASMODON sp.
Cross-toothed Perch

Chiasmodon sp. Castle ,Evening Post (newspaper, Wellington) 2 Sept. 1957, with fig. S.E. of Cape Palliser, 500 faths.

Family TRICHONOTIDAE
Genus TEWARA

Tewara Griffin, Trans. N.Z. Inst. lxiii, Feb. 28, 1933, p. 174. Haplotype, *T. cranwelli* Griffin.

TEWARA CRANWELLAE

Tewara cranwelli Griffin, Trans. N.Z. Inst. lxiii, Feb. 28, 1933, p. 174, pl. xxv. Smuggler's Bay, Whangarei Heads; sand. Emended to *T. cranwellae* by Whitley in Graham, Treasury N.Z. Fishes, ed. 2, 1956, p. 410.

Note: Differs from *Limnichthys* by having more than 40 anal rays, the last short, head largely scaly, many blotches along back and sides, etc.

Genus HEMEROCOETES

Hemerocoetes Cuv. & Val., Hist. Nat. Poiss. xii, March 1837, p. 311. Haplotype, *Callionymus acanthorhynchus* Bloch & Schneider = *C. monopterygius* Bloch and Schneider.

HEMEROCOETES MONOPTERYGIUS
Opal Fish

Callionymus monopterygius Bloch & Schneider, Syst. Ichth. 1801, p. 41. N.Z. (= South Island; cast ashore after storms.)

Callionymus acanthorhynchus Bloch and Schneider, Syst. Ichth. 1801, p. 41, *ex* Forster, MS. N.Z. (South Island).

Hemerocoetes microps Waite, Rec. Canterb. Mus. i, 3, June 24, 1911, p. 247, pl. liv, fig. 2. Sounds on the South-west coast.

HEMEROCOETES WAITEI
Blue Bonnet

Hemerocoetes waitei Regan, Terra Nova Zool. i, 1, June 27, 1914, p. 18. New name for *H. acanthorhynchus* Waite (Rec. Canterb. Mus. i, 3, June 24, 1911, p. 245, pl. liv, fig. 1) *non* Bloch & Schneider. (Southern Stations of the N.Z. Govt. Trawling Exped.)

HEMEROCOETES PAUCIRADIATUS

Hemerocoetes pauciradiatus Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 1, 1914, p. 15. Cape North; 70 faths.

HEMEROCOETES MACROPHTHALMUS

Hemerocoetes macrophthalmus Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 1, 1914, p. 15. Cape North; 70 faths.

Family LIMNICHTHYIDAE

Genus LIMNICHTHYS

Limnichthys Waite, Rec. Austr. Mus. v, 3, March 11, 1904, p. 178. Haplotype, *L. fasciatus* Waite.

LIMNICHTHYS RENDAHLI

Limnichthys rendahli Parrott, Rec. Domin. Mus. iii, July 1958, pp. 109 & 116. Auckland Islands (type in Canterbury Museum, Christchurch) and New Zealand localities.

Family GOBIIDAE

Genus ACENTROGOBIUS

Acentrogobius Bleeker, Arch. Neerl. Sci. Nat. ix, 1874, pp. 292, 298 & 321. Orthotype, *Gobius chlorostigma* Bleeker, Verh. Bat. Gen. xxii, 1849, Gob., p. 27, from Surabaya.

ACENTROGOBIUS LENTIGINOSUS

Goby

Gobius lentiginosus Richardson, Zool. Voy. Erebus & Terror, Fish., 1844, p. 3, pl. i, figs. 5-6. Bay of Islands.

Genus CALLOGOBIUS

Callogobius Bleeker, Arch. Neerl. Sci. Nat. ix, 1874, p. 318. Orthotype, *Eleotris hasseltii* Bleeker.

CALLOGOBIUS ATRATUS

Callogobius atratus Griffin, Trans. N.Z. Inst. lxiii, Feb. 28, 1933, p. 176, pl. xxv. Cable Bay, Mangonui County; rock-pools.

Genus FAVONIGOBIUS

Favonigobius Whitley, Austr. Zool. vi, 2, Jan. 14, 1930, p. 122. Orthotype, *Gobius lateralis* Macleay, Proc. Linn. Soc. N.S.Wales v, May 20, 1881, p. 602, from King George's Sound, Western Australia.

FAVONIGOBIUS OBLIQUUS

Gobius lateralis var. *obliquus* McCulloch & Ogilby, Rec. Austr. Mus. xii, 10, July 14, 1919, p. 249, pl. xxxiv, fig. 4. Parramatta River and Rose Bay, New South Wales (Sydney).

Family GOBIOMORIDAE

Genus GOBIOMORPHUS

Gobiomorphus Gill, Proc. Acad. Nat. Sci. Philad., Nov. 28, 1863, p. 270. Orthotype, *Eleotris gobioides* Cuv. & Val.

Note: Mr. C. S. Woods considers there are 8 species of *Gobiomorphus* in New Zealand. One has 2 subspecies, another has 2 ecological races and he has 3 new species to be described. Radiographs of old holotypes have revealed long-standing errors of identification by authors and, according to Mr. Woods's demonstration at the A.N.Z.A.A.S. Congress in Christchurch in 1968, all the species require to be known by names other than those in current use.

GOBIOMORPHUS GOBIOIDES

Giant Bully, Toitoi, Kokopu

Eleotris gobioides Cuv. & Val., Hist. Nat. Poiss. xii, March 1837, p. 247. Bay of Islands (freshwater).

GOBIOMORPHUS BASALIS
Common Bully

Eleotris basalis Gray, Zool. Misc. (5), June 1842, p. 73. Thames River. Type in British Museum.

GOBIOMORPHUS HUTTONI
Red-finned Bully

Eleotris huttoni Ogilby, Proc. Linn. Soc. N.S.Wales (2) ix, 1894, p. 369. Waikato River. Type in Australian Museum, Sydney, figured by Whitley & Phillipps, 1939. See also Stokell, Trans. Roy. Soc. N.Z., lxxxvii, 1959. p. 269, pl. xxii, fig. 2 and McDowall, Trans. Roy. Soc. N.Z., Zool. iii (2), 1962, p. 1, figs. 1-3.

Gobiomorphus stokelli Whitley, Proc. Roy. Zool. Soc. N.S.Wales 1954-55 (April 10, 1956), p. 36. Type-locality, by present designation, Boat Creek, mouth of the Rakaia River, Canterbury.

GOBIOMORPHUS sp.
Maui's Gudgeon
(Figure 2)

Gobiomorphus sp. Woods, Native and introduced freshwater fishes, 1963. p. 41, fig. Throughout the North Island.

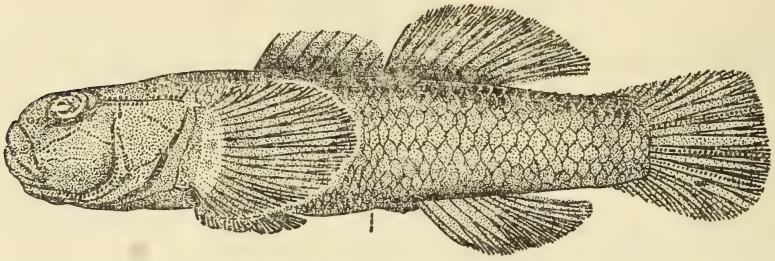

Figure 2.—Te ika a Maui, Maui's Gudgeon, *Gobiomorphus* sp.
After C. S. Woods.

GOBIOMORPHUS ALPINUS
Alpine Bully

Gobiomorphus alpinus Stokell, Trans. Roy. Soc. N.Z., Zool. ii (3), March 28, 1962, p. 33, pl. i, upper figure. Bowscale Tarn, Tarndale, Marlborough; 3,400 feet.

GOBIOMORPHUS BREVICEPS
Upland Bully

Philypnodon breviceps Stokell, Trans. Roy. Soc. N.Z. lxix, June 1939, p. 131, pl. xv, figs. 1 & 3. Kowai River, Canterbury.

GOBIOMORPHUS HUBBSI
Blue-gilled Bully

Philypnodon sp. nov. Stokell, Freshwater fishes of N.Z., 1955, p. 59, pl. xx, *ex* Carl L. Hubbs, MS. Ashley River, Canterbury & Westland Rivers.

Philypnodon hubbsi Stokell, Trans. Roy. Soc. N.Z. lxxxvii, Nov. 1959, p. 267, pl. xxii, figs. 1 & 3, for above. Ashley River, Canterbury & Westland Rivers.

Genus GRAHAMICHTHYS

Grahamichthys Whitley, Proc. Roy. Zool. Soc. N.S.Wales 1954-55 (April 10, 1956), p. 34. Orthotype, *Eleotris radiata* Cuv. & Val.

GRAHAMICHTHYS RADIATUS
Graham's Gudgeon, Kurahina

Eleotris radiata Cuv. & Val., Hist. Nat. Poiss. xii, March 1837, p. 250, *ex* Quoy & Gaimard, MS. Thames River [i.e. marine, at the mouth of the Waihou River—*fide* McDowall, 1962].

Family BLENNIIDAE (including CLINIDAE, etc.)
Genus BLENNIUS

Blennius Linne, Syst. Nat., ed. 10, 1758, p. 256; ed. 12, 1766, p. 441, *ex* Artedi, Ichth. 1738, gen. xxii, p. 26. Logotype, *B. galerita* Linne.

BLENNIUS MAORICUS
Maori Blenny

Blennius maoricus Kner, Sitzb. Akad. Wiss. Wien. li, 1, May or later, 1865, p. 503. Auckland, N.Z. Figured by Kner, Reise Novara, Zool. i, Fische, 1865, p. 195, pl. viii, fig. 3.

Genus ERICENTRUS

Ericentrus Gill, Mem. Nat. Acad. Sci. Wash. vi, 1893, pp. 119 & 123. Orthotype, *Sticharium rubrum* Hutton.

ERICENTRUS RUBER

Sticharium rubrum Hutton, Cat. Fish. N.Z., Feb. 1872, p. 33. Wellington Harbour. Type rediscovered by Phillipps, Rept. Dept. Intern. Affairs, N.Z., 1919, Museum, p. 6.

Ophioclinus venusta Griffin, Trans. N.Z. Inst. lviii, Aug. 15, 1927, p. 149, pl. xvii, fig. 9. Bay of Islands; rockpool. New synonym, *teste* Mr. J. Moreland.

Genus COLOGRAMMUS

Cologrammus Gill, Mem. Nat. Acad. Sci. Wash. vi, 1893, pp. 119 and 124. Haplotype, *Sticharium flavescens* Hutton.

COLOGRAMMUS FLAVESCENS

Sticharium flavescens Hutton, Cat. Fish. N.Z., Feb. 1872, p. 33. Cook Straits.

Genus CRISTICEPS

Cristiceps Cuvier & Valenciennes, Hist. Nat. Nat. Poiss. xi, July 1836, p. 402. Haplotype, *C. australis* Cuv. & Val.

Phillippsichthys Whitley, Mem. Qld. Mus. xi, 1937, p. 143. Orthotype, *Auchenopterus aysoni* Hector.

CRISTICEPS AUSTRALIS
Crested Weed Fish

Cristiceps australis Cuvier & Valenciennes, Hist. Nat. Poiss. xi, July 1836, p. 402, pl. cccxxxvi. Tasmania (type) and N.Z.

CRISTICEPS AURANTIACUS

Cristiceps aurantiacus Castelnau, Proc. Linn. Soc. N.S.Wales iii, May, 1879, p. 386. Kiama, New South Wales.

Auchenopterus aysoni Hector, Trans. N.Z. Inst. xxxiv, July 1902, p. 240, pl. xv. Bay of Islands. Types rediscovered by Phillipps, Rept. Dept. Intern. Affairs N.Z., 1919, Museum, p. 6. Mr. J. Moreland discovered that these are malformed *Cristiceps*.

Genus GILLOBLENNIUS

Gilloblennius Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, Sept. 1939, p. 235. Orthotype, *Blennius tripennis* Bloch & Schneider.

GILLOBLENNIUS TRIPENNIS
Threepenny

Blennius tripennis Bloch & Schneider, Syst. Ichth., 1801, p. 174, *ex* Forster, MS. N.Z. = South Island.

Tripterygion forsteri Cuvier & Valenciennes, Hist. Nat. Poiss. xi, July 1836, p. 415. No locality [probably N.Z.].

[*Blennius*] *tripinnis* Gill, Mem. Nat. Acad. Sci. Wash. vi, 1893, p. 94, footnote: Emendation for *B. tripennis* Bloch & Schneider. Equals *Blennius tripinnis* Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 212, *ex* Forster, MS.

GILLOBLENNIUS DECEMDIGITATUS

Trypterygion decemdigitatus Clarke, Trans. N.Z. Inst. xi, May 1879, p. 292, pl. xv. Dusky Sound.

Note: A good species according to Mr. J. Moreland, MS., who has been revising, in press, several unrecognized species of the old *"Tripterygion"* group, of which several new ones are to be named.

Genus FORSTERYGION

Forsterygion Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, Sept. 1939, p. 236. Orthotype, *Blennius varius* Bloch & Schneider.

Note: Mr. J. Moreland has in preparation a review of this and other blennies.

FORSTERYGION VARIUM
Cockabully

Blennius varius Bloch & Schneider, Syst. Ichth., 1801, p. 178, *ex* Forster, MS. N.Z. = South Island.

Tripterygion nigripenne Cuvier & Valenciennes, Hist. Nat. Poiss. xi, July, 1836, p. 413, pl. cccxxxix. Rivers of N.Z. (Lesson & Garnot).

Tripterygion capito Jenyns, Zool. Voy. Beagle, Fish., 1841, p. 94, pl. xix, fig. 1. Bay of Islands; tidal rocks.

Trypterigium robustum Clarke, Trans. N..Z Inst. xi, May, 1879, p. 292, pl. xv. Jackson's Bay.

Tripterygium jenningsi Hutton, Trans. N.Z. Inst. xi, May 1879, p. 339. Auckland Is.

Genus NOTOCLINOPS

Notoclinops Whitley, Mem. Qld. Mus. x, Aug. 28, 1930, p. 20. Orthotype, *Tripterygion segmentatum* McCulloch & Phillipps.

NOTOCLINOPS BUCKNILLI

Tripterygion bucknilli Griffin, Trans. N.Z. Inst. lvi, April, 26, 1926, p. 544, pl. xcvii. Mount Maunganui, Bay of Plenty.

NOTOCLINOPS SEGMENTATUS
Banded Blenny

Tripterygion segmentatum McCulloch & Phillipps, Rec. Austr. Mus. xiv, Feb. 28, 1923, p. 20, pl. iv, fig. 3. Otago.

Genus HELCOGRAMMA

Helcogramma McCulloch & Waite, Rec. S. Austr. Mus. i, 1, May 24, 1918, p. 51. Orthotype, *H. decurrens* McCulloch & Waite.

HELCOGRAMMA MEDIUM
Twister

Tripterygium medium Gunther, Cat. Fish. Brit. Mus. iii, July 1861, p. 278. N.Z. (Haslar Collection).

Trypterygium dorsalis Clarke, Trans. N.Z. Inst. xi, May 1879, p. 291, pl. xv. Mouth of Hokitika.

Enneapterygius mortenseni Rendahl, Vidensk. Medd. Dansk. nat. Foren lxxxi, Oct. 30, 1925, p. 11, figs. 3-4. Queen Charlotte Sound (T. Mortensen).

Genus NOTOCLINUS

Notoclinus Gill, Mem. Nat. Acad. Sci. Wash. vi, 1893, pp. 100, 119 & 124. Haplotype, *Tripterygion fenestratum* of authors = *Blennius fenestratus* Bloch & Schneider.

NOTOCLINUS FENESTRATUS

Topknot; Hetarua

Blennius fenestratus Bloch & Schneider, Syst. Ichth., 1801, p. 173, *ex* Forster, MS. N.Z. = South Island.

Trypterygion compressum Hutton, Cat. Fish. N.Z., Feb. 1872, p. 32. Wellington Harbour.

Genus ZEABLENNIUS

Zeablennius Whitley, Mem. Qld. Mus. x, Aug. 28, 1930, p. 20. Orthotype, *Blennius laticlavius* Griffin.

ZEABLENNIUS LATICLAVIUS

Blennius laticlavius Griffin, Trans. N.Z. Inst. lvi, April 26, 1926, p. 542, pl. xcvi, fig. 1. Mount Maunganui, Bay of Plenty.

Genus ASPIDONTUS

Aspidontus Quoy & Gaimard, Voy. Astrolabe, Zool., iii, 1835, p. 719, *ex* Cuvier, MS. Haplotype, *A. taeniatus* Quoy & Gaimard.

ASPIDONTUS RHINORHIJNCHOS

Petroskirtes rhinorhijnchos Bleeker, Nat. Tijdschr. Ned. Ind. iii, 1852, p. 273. Ceram, Indonesia.

Aspidontus rhinorhynchos Tomiyama, Fish. Japan (Tanaka) lv, 1956, p. 1128, pl. ccxxii, fig. 573.

Note: Meyer Island, Kermadecs (Waite, Trans. N.Z. Inst. xlii, 1910, p. 380).

Family PYRAMODONTIDAE

Genus CYNOPHIDIUM

Cynophidium Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 1, 1914, p. 16. Orthotype, *C. punctatum* Regan.

CYNOPHIDIUM PUNCTATUM

Cusk

Cynophidium punctatum Regan, Ann. Mag. Nat. Hist. (8) xiii, Jan. 1, 1914, p. 16. Cape North; 70 faths. ("Terra Nova").

Pyramodon ventralis Smith, Ann. Mag. Nat. Hist. (12) viii, 1955, p. 545, figs. 1-2. Not of Smith & Radcliffe?

Family ZOARCIDAE

Genus HYPOLYCODES

Pseudolycodes Hector, 15th. Ann. Rept. Colon. Mus., 1880, p. 20. Haplotype, *P. haastii* Hector. *Nomen nudum.*

Hypolycodes Hector, Trans. N.Z. Inst. xiii, April 1881, 194. Haplotype, *H. haastii* Hector.

HYPOLYCODES HAASTII

Pseudolycodes haastii Hector, 15th. Ann. Rept. Colon. Mus., 1880, p. 20. *Nomen nudum.* N.Z.

Hypolycodes haastii Hector, Trans. N.Z. Inst. xiii, 1881, p. 194, pl. iii, fig. 1. Waimarama, East Coast, Wellington.

Genus MELANOSTIGMA

Melanostigma Gunther, Proc. Zool. Soc. Lond., June 1, 1881, p. 20. Haplotype, *M. gelatinosum* Gunther.

MELANOSTIGMA FLACCIDUM

Ragfish

Melanostigma flaccidum Waite, Trans. N.Z. Inst. xlvi, June 15, 1914, p. 129, pl. vi. Kaikoura, South Island; surface.

Family BROTULIDAE
Genus DINEMATICHTHYS

Dinematichthys Bleeker, Nat. Tijdscr. Ned. Ind. viii, 1855, p. 318. Haplotype, *D. iluocoeteoides* Bleeker.

DINEMATICHTHYS CONSOBRINUS

Dinematichthys consobrinus Hutton, Trans. N.Z. Inst. viii, May 1876, p. 217. Cape Campbell. Type figured by Hector, Trans. N.Z. Inst. ix, May 1877, p. 466, pl. ix, fig. 77a.

Genus DERMATOPSIS Ogilby, 1896

Dermatopsis Ogilby, Proc. Linn. Soc. N.S.Wales xxi, 2, Sept. 23, 1896, p. 138. Haplotype, *D. macrodon* Ogilby.

DERMATOPSIS MACRODON
Fleshfish

Dermatopsis macrodon Ogilby, Proc. Linn. Soc. N.S.Wales xxi, 2, Sept. 23, 1896, p. 140. Maroubra, New South Wales. Type figured by Whitley, Rec. Austr. Mus. xix, 1935, p. 239, fig. 8. Figured from a New Zealand specimen by Cohen, 1966.

Genus BASSOGIGAS

Bassogigas Goode & Bean, Spec. Bull. U.S. Nat. Mus. ii (Oceanic Ichth., 1896), p. 328, *ex* Gill, MS. Logotype, *B. gillii* Goode & Bean, selected by Boulenger, Zool. Record 1896 (1897), Pisces, p. 28.

BASSOGIGAS sp.

Bassogigas sp. Nybelin, 14th Int. Congress Copenhagen I.U.B.S. 1953, Deep Sea Colloqu. (unpaged). North of N.Z.: *c*.2,000 metres ("Dana").

Genus et sp. innom.
Blind Brotulid

"Blind halvgennemsigtig brotulid fisk" Bruun, Galatheas Jordomsejling, 1953, p. 187, fig. North-east of N.Z.; 4,410 metres.

Famliy CARAPIDAE
Genus ECHIODON

Echiodon Thompson, Proc. Zool. Soc. London, v, Dec. 1837, p. 55. Haplotype, *E. drummondii* Thompson.

ECHIODON RENDAHLI
Messmate Fish; Fierasfer

Fierasfer sp. Rendahl, Vidensk. Medd. Dansk. nat. Foren. lxxxi, Oct. 30, 1925, p. 13. Campbell Island.

Carapus rendahli Whitley, Austr. Zool. x, 1941, p. 40, fig. 27. New South Wales.

Note: In his Catalogue, Gunther wrongly listed New Zealand [error for New Ireland] under the genus *Fierasfer* [= *Carapus*]. However, Rendahl mentions a fish "which Dr. Mortensen received from the shepherds on Campbell Island, who had found it at the shore of Perseverance Harbour. It is an extremely elongate and attenuated, naked *Fierasfer*-like form, 190 mm. long, and with the ventral part of the body greatly extended as a protruding sac. The tail is very long and tapers to a thread-like tip. The shepherds stated that it had a long spine at the anterior end of the dorsal fin; this is not found on the specimen. One might suggest that it was rather a soft appendix like that of the *Fierasfer* larva."

Family OPHIDIIDAE
Genus GENYPTERUS

Genypterus Philippi, Arch. Naturg. (Wiegmann) xxiii, 1, 1857, p. 268. Haplotype, *G. nigricans* Philippi.

GENYPTERUS BLACODES
Ling; Hokarari

Ophidium blacodes Bloch and Schneider, Syst. Ichth. 1801, p. 484, *ex* Forster, MS., see p. 583. N.Z. = South Island (Forster's drawing, no. 174 in Brit. Mus. seen.).

GENYPTERUS MICROSTOMUS

Genypterus microstomus Regan, Ann. Mag. Nat. Hist. (7) xi, 1903, p. 599. Tasmania, Dunedin and Stewart Island.

Family ECHENEIDAE
Genus REMOROPSIS

Remoropsis Gill, Proc. Acad. Nat. Sci. Philad. 1863, p. 88; 1864, p. 60. Orthotype, *Echeneis brachypterus* Lowe.

REMOROPSIS BRACHYPTERUS
Sucking Fish

Echeneis brachyptera Lowe, Proc. Zool. Soc. Lond. vii, 77, Oct., 1839, p. 89. Madeira.

Genus PHTHEIRICHTHYS

Phtheirichthys Gill, Proc. Acad. Nat. Sci. Philad. 1862 (1863), p. 239. Orthotype, *Echeneis lineata* Menzies.

PHTHEIRICHTHYS LINEATUS
Louse Fish

Echeneis lineata Menzies, Trans. Linn. Soc. Lon. i, 1791, p. 187, pl. xvii, fig. 1. Tropical Pacific Ocean; adhering to a turtle.

Family SCORPAENIDAE
Genus HELICOLENUS

Helicolenus Goode & Bean, Spec. Bull. U.S. Nat. Mus. ii (Oceanic Ichth., 1896), p. 248. Orthotype, *Sebastes dactylopterus* De La Roche. The N.Z. species may be subgenerically distinct.

HELICOLENUS PAPILLOSUS
Sea Perch; Pohuikaroa

Synanceja papillosus Bloch and Schneider, Syst. Ichth. 1801, p. 196, N.Z. (March 30, 1773). See also *ibid* p. xxxvii.

Scorpaena cottoides Bloch and Schneider, Syst. Ichth. 1801, p. 196, *ex* Forster, MS. N.Z. Schneider adds, "Percam cercyrum dixerat Forsterus piscem ibidem alio tempore captum . . .", but I know nothing of such a species.

Sebastes percoides Richardson, Ann. Mag. Nat. Hist. ix, July 1, 1842, p. 384; Voy. Erebus and Terror, Fish. 1845, p. 23, pl. xv, figs. 1-2. N.Z.

Scorpaena percoides Richardson, Ann. Mag. Nat. Hist. ix, July 1, 1842, p. 384. Voy. Erebus and Terror, Fish. 1845, p. 23, *ex* Solander, MS. N.Z.

Scorpaena barathri Hector, Ann. Mag. Nat. Hist. (4) xv, Jan. 1875, p. 80 and Trans. N.Z. Inst. vii, June 1875, p. 245, pl. x, fig. 15a. Off Cape Farewell ("Challenger" Exped.).

Sebastodes maccullochi Phillipps, Trans. N.Z. Inst. lviii, Aug. 15, 1927, p. 127, pl. iii, fig. 2. Cook Strait; from stomach of Red Cod.

Genus PTEROIS

Pterois Schinz, Das Thierreich (Cuvier) ii, 1822, p. 463. Logotype, *P. volitans* (Linne).

PTEROIS VOLITANS
Butterfly Cod

Gasterosteus volitans Linne, Syst. Nat. ed. 19, 1758, p. 296; ed. 12, 1766, p. 491. Amboina, Indonesia.

Genus SCORPAENOPSIS

Scorpaenopsis Heckel, Ann. Wiener Mus. ii, 1837, p. 158. Orthotype, *Scorpaena nesogallica* Cuv. & Val., *fide* Jordan, Gen. Fish.

SCORPAENOPSIS CIRROSUS

Perca cirrosa Thunberg, K. Vet. Ac. Nya Handl. xiv, 1793, p. 199, pl. vii, fig. 2. Japan.

Note: Obtained by H.M.S. "Herald" at Raoul Id., Kermadecs—Gunther, Cat. Fish. Brit. Mus. ii, 1860, p. 120.

Genus RUBORALGA

Ruboralga Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 326. Orthotype, *Scorpaena jacksoniensis* Steindachner.

RUBORALGA CARDINALIS

Red Rock Cod; Hapuku's Grandfather; Matuawhapuku

Scorpaena cardinalis Richardson, Ann. Mag. Nat. Hist. ix, May 1, 1842, p. 212, *ex* Solander, MS. Motuaro, Queen Charlotte Sound, N.Z. Solander's description is reproduced.

Scorpaena plebeia Richardson, Ann. Mag. Nat. Hist. ix, May 1842, p. 214, *ex* Solander, MS., Tolaga Bay.

Scorpaena cruenta Richardson, Ann. Mag. Nat. Hist. ix, May, 1842, p. 217. *ex* Solander, MS. Cape Kidnappers, N.Z.

Scorpaena militaris Richardson, Trans. Zool. Soc. Lond. iii, June, 1842, p. 90. Tasmania.

RUBORALGA COOKII

Scorpaena cookii Gunther, J. Mus. Godeffroy ii, (Fische der Sudsee i) 1873, p. 78, pl. lv (not text-fig). Raoul Island, Kermadec Is. Described from Kermadec specimens but figured from a different Hawaiian fish referable to *S. cacopsis* Jenkins, *fide* Jordan and Evermann.

Genus SEBASTAPISTES

Sebastapistes Streets, Bull. U.S. Nat. Mus. vii, 1877, p. 62, *ex* Gill, MS. Logotype, *S. strongia* Cuv. & Val.

SEBASTAPISTES BYNOENSIS

Scorpaena bynoensis Richardson, Voy. Erebus and Terror, Fish. 1845, p. 22, pl. xiv, figs. 3-5. North-west Australia.

Family CONGIOPODIDAE

Genus ZANCLORHYNCHUS

Zanclorhynchus Gunther, Rept. Voy. Challenger, Zool. i, 6, 1880, p. 15. Haplotype, *Z. spinifer* Gunther.

ZANCLORHYNCHUS SPINIFER

Spiny

Zanclorhynchus spinifer Gunther, Rept. Voy. Challenger, Zool. i, 6, 1880, p. 15, pl. viii, fig. A. Kerguelen Island; in trawl.

Note: Recorded from Macquarie Island by Waite in 1916 and obtained there since.

Genus ALERTICHTHYS

Alertichthys Moreland, Rec. Domin. Mus. iii, 3, April 1960, p. 241. Orthotype, *A. blacki* Moreland.

ALERTICHTHYS BLACKI

Alert Pigfish

Alertichthys blacki Moreland, Rec. Domin. Mus. iii, 3, April 1960, p. 243, figs. 1-7. East of Otago Peninsula; 250-300 fathoms, also off Timaru in about 50 faths. Types in Dominion Museum, Wellington.

Genus CONGIOPODUS

Congiopodus Perry, Arcana, Feb. 1, 1811, sign. Dd 8, pl. lv. Haplotype, *C. percatus* Perry.

CONGIOPODUS LEUCOPAECILUS
Pigfish; Puramorua

Agriopus leucopaecilus Richardson, Zool. Voy. Erebus & Terror, Fish., 1846, p. 60, pl. xxxvii, figs. 4-5. South Australian Sea.

Family OPLICHTHYIDAE
Genus RHINHOPLICHTHYS

Rhinhoplichthys Fowler, Proc. U.S. Nat. Mus. lxxxv, 1938, p. 100. Orthotype, *Hoplichthys haswelli* McCulloch.

RHINHOPLICHTHYS HASWELLI
Deepsea Flathead

Hoplichthys haswelli McCulloch, Rec. Austr. Mus. vi, 5, July 18, 1907, p. 351, pl. lxiv. East of Port Jackson, N.S.Wales; 800 faths.

Family NEOPHRYNICHTHYIDAE
Genus NEOPHRYNICHTHYS

Neophrynichthys Gunther, Ann. Mag. Nat. Hist. (4) xvii, May 1, 1876, p. 395; Trans. N.Z. Inst. ix, May 1877, p. 470. Haplotype, *Psychrolutes latus* Hutton.

NEOPHRYNICHTHYS LATUS
Toadfish

Psychrolutes latus Hutton, Ann. Mag. Nat. Hist. (4) xvi, Nov. 1875, p. 316 and Trans. N.Z. Inst. viii, May 1876, p. 214. Dunedin and Bluff Harbours.

Family LIPARIDAE
Genus CAREPROCTUS

Careproctus Kroyer, Nat. Tidskr. i, 1861, p. 257. Orthotype, *C. reinhardti* Kroyer.

CAREPROCTUS KERMADECENSIS
Deepsea Tadpole Fish

Careproctus kermadecensis Nielsen, Galathea Rept. vii, 1964, p. 113, figs. 4, 5, 6 & 7. Kermadec Trench.

Family COTTIDAE
Genus ANTIPODOCOTTUS

Antipodocottus Bolin, Vidensk. Medd. Dansk. Naturh. Foren., 114, Nov. 20, 1952, p. 431. Orthotype, *A. galatheae* Bolin.

ANTIPODOCOTTUS GALATHEAE
Sculpin

Antipodocottus galatheae Bolin, Vidensk. Medd. Dansk. Naturh. Foren., 114, Nov. 20, 1952, p. 432, fig. 1. "Galathea" Station 626. Tasman Sea [west of South Island of N.Z.]. Lat. 42°10'S. x Long. 170°10'E.; 594 metres. Types in Zool. Mus., Copenhagen.

Family TRIGLIDAE
Genus CURRUPISCIS

Currupiscis Whitley, Austr. Zool. vi, Feb. 31, 1931, p. 327. Orthotype, *C. volucer* Whitley.

CURRUPISCIS KUMU
Kumukumu

Trigla kumu Lesson, Voy. Coquille, Poiss., 1829, p. 214, pl. xix. Bay of Islands. *Id.* Cuvier & Valenciennes, Hist. Nat. Poiss. iv, Nov. 1829, p. 50. N.Z.

Trigla papilionacea Cuvier & Valenciennes, Hist. Nat. Poiss. iv, Nov. 1829, p. 50, *ex* Parkinson, MS. N.Z.
Trigla kumoides Steindachner, Anzeiger Akad. Wiss. Wien, 37th year, no. xvi, 1900, p. 175; Denkschr. Akad. Wiss. Wien lxx, 1900 (1901), p. 498, pl. i, figs. 2, 2a. N.Z.

Genus PARATRIGLA

Paratrigla Ogilby, Ann. Qld. Mus. No 10, Nov. 1, 1911, p. 56. Orthotype, *Trigla pleuracanthica* Richardson = *T. papilio* Cuv. & Val.
Aoyagichthys Whitley, Proc. Roy. Zool. Soc. N.S.Wales 1956-57 (1958), p. 46. Orthotype, *Trigla vanessa* Richardson.

PARATRIGLA (AOYAGICHTHYS) VANESSA
Butterfly Gurnard

Trigla vanessa Richardson, Proc. Zool. Soc. Lond. vii (78), Nov. 1839, p. 97. Port Arthur, Tasmania.

Genus LEPIDOTRIGLA

Lepidotrigla Gunther, Cat. Fish. Brit. Mus. ii, 1860, p. 196. Logotype, *Trigla aspera* Cuv. & Val.

LEPIDOTRIGLA BRACHYOPTERA

Lepidotrigla brachyoptera Hutton, Cat. Fish. N.Z., Feb. 1872, p. 27. Wellington Harbour.

Genus PTERYGOTRIGLA

Pterygotrigla Waite, Austr. Mus. Mem. iv, 1, Dec. 23, 1899, p. 108. Orthotype, *Trigla polyommata* Richardson.

PTERYGOTRIGLA PICTA ANDERTONI
Spotted Gurnard

Trigla picta Gunther, Rept. Voy. Challenger, Zool. i, 6, 1880, p. 24, pl. xiii, fig. A. Juan Fernandez.
Pterygotrigla andertoni Waite, Proc. N.Z. Inst. 1910, i, Sept. 10, 1910, p. 26. Bay of Plenty.

Family GOBIESOCIDAE
Genus GASTROCYMBA

Gastrocymba Briggs, Stanford Ichth. Bull. vi, Sept. 1955, p. 11. Orthotype, *Diplocrepis 4-radiatus* Rendahl.

GASTROCYMBA QUADRIRADIATA
Clingfish

Diplocrepis 4-radiatus Rendahl, Vidensk. Medd. Dansk. Natur. Foren. lxxxi, 1925, p. 8. Port Ross, Auckland Islands.
Gastrocymba quadriradiata Briggs, Stanford Ichth. Bull. vi, Sept. 1955, p. 11, fig. 14, map 2.

Genus DELLICHTHYS

Dellichthys Briggs, Stanford Ichth. Bull. vi, Sept. 1955, p. 14. Orthotype, *D. morelandi* Briggs.

DELLICHTHYS MORELANDI

Dellichthys morelandi Briggs, Stanford Ichth. Bull. vi, Sept. 1955, p. 14, figs. 16 & 82, map 2. Lottin Point.

Genus TRACHELOCHISMUS

Trachelochismus Brisout de Barneville, Rev. Zool. (Soc. Cuvier.) ix, 1846, p. 212. Logotype, *Cyclopterus pinnulatus* Forster = *Lepadogaster pinnulatus* Bloch & Schneider.
Oliverichtus Whitley & Phillipps, Trans. Roy. Soc. N. Zeal. lxix, 1939, p. 236. Orthotype, *Trachelochismus melobesia* Phillipps.

TRACHELOCHISMUS PINNULATUS
Lump Fish, Mohiaru

Lepadogaster pinnulatus Bloch & Schneider, Syst. Ichth., 1801, p. 2. "Habitat mare indicum juxta Novam Zeelandiam inter lapides litoreos ad ostia rivulorum" (Forster) = Queen Charlotte Sound (*fide* Richardson, Trav. N. Zeal. (Dieffenbach) ii, 1843, p. 225).

Trachelochismus guttulatus Hutton, Cat. Fish. N.Z. 1872, p. 41. Wellington Harbour.

Crepidogaster simus Hutton, Trans. N.Z. Inst. xxviii, 1896, p. 316. Lyttelton Harbour and Chatham Islands.

Diplocrepis tumidus Griffin, Trans. N.Z. Inst. lix, 1928, p. 385, pl. lxix, fig. 9. Ponui Id., Auckland Harbour; rock-pools.

TRACHELOCHISMUS MELOBESIA

Trachelochismus melobesia Phillipps, Trans. N.Z. Inst. lviii, 1927, p. 130, pl. v, fig. 5. Wellington; rock-pools.

Genus HAPLOCYLIX

Haplocylix Briggs, Stanford Ichth. Bull. vi, Sept. 1955, p. 21. Orthotype, *Cyclopterus littoreus* Bloch & Schneider.

HAPLOCYLIX LITTOREUS
Clingfish

Cyclopterus littoreus Bloch & Schneider, Syst. Ichth. 1801, p. 199, *ex* Forster, MS. South Island of N.Z.; affixed to stones.

Genus DIPLOCREPIS

Diplocrepis Gunther, Cat. Fish. Brit. Mus. iii, 1861, p. 506. Haplotype, *Lepadogaster puniceus* Richardson.

DIPLOCREPIS PUNICEUS
Sucker, Clingfish

Lepadogaster puniceus Richardson, Zool. Voy. Erebus & Terror, Fish. 1846, p. 71, pl. xliii, figs. 1-7. N.Z. (Hooker).

Diplocrepis puniceus Briggs, Stanford Ichth. Bull. vi, Sept. 1955, p. 42, figs. 23 & 52, map 7 (refs. and review).

Genus GASTROSCYPHUS

Gastroscyphus Briggs, Stanford Ichth. Bull. vi, Sept. 1955, p. 45. Orthotype, *Crepidogaster hectoris* Gunther.

GASTROSCYPHUS HECTORIS

Crepidogaster hectoris Gunther, Ann. Mag. Nat. Hist. (4) xvii, 1876, p. 396; Trans. N.Z. Inst. ix, 1877, p. 471. Cook Strait (southern shore).

Gastroscyphus hectoris Briggs, Stanford Ichth. Bull. vi, Sept. 1955, p. 46, figs. 6 & 25, map 7.

Genus GASTROCYATHUS

Gastrocyathus Briggs, Stanford Ichth. Bull. vi, Sept. 1955, p. 46. Orthotype, *G. gracilis* Briggs.

GASTROCYATHUS GRACILIS

Gastrocyathus gracilis Briggs, Stanford Ichth. Bull. vi, Sept. 1955, p. 47, figs. 26, 55 & 87, map 7. Island Bay.

Family ANTENNARIIDAE
Genus PHRYNELOX

Phrynelox Whitley, Austr. Zool. vi, Feb. 13, 1931, p. 328. Orthotype, *Lophius striatus* Shaw & Nodder.

PHRYNELOX STRIATUS
Striped Angler Fish

Lophius striatus Shaw & Nodder, Nat. Miscell. v, May 1, 1794, pl. clxxv. "Circa litora Australasiae" (Banks) = Botany Bay, N.S.Wales.

Family SACCARIIDAE
Genus SACCARIUS

Saccarius Gunther, Cat. Fish. Brit. Mus. iii, July 1861, p. 183. Haplotype, *S. lineatus* Gunther.

SACCARIUS LINEATUS

Saccarius lineatus Gunther, Cat. Fish. Brit. Mus. iii, July 1861, p. 183. Bay of Islands, N.Z.

Family MELANOCETIDAE
Genus MELANOCETUS

Melanocetus Gunther, Proc. Zool. Soc. Lond., July 7, 1864, p. 302. Orthotype, *M. johnsonii* Gunther.

MELANOCETUS JOHNSONII
Deepsea Angler Fish

Melanocetus johnsonii Gunther, Proc. Zool. Soc. Lond., July 7, 1864, p. 302, pl. xxv. Madeira.

Family HIMANTOLOPHIDAE
Genus HIMANTOLOPHUS

Himantolophus Reinhardt, Afhandl. K. Danske Vid. Selsk. vii, 1838, pp. 116 & 136. Haplotype, *H. gronlandicus* Reinhardt.

Aegeonichthys Clarke, Trans. N.Z. Inst. x, May 1878, p. 245. Haplotype, *A. appelii* Clarke.

HIMANTOLOPHUS APPELII

Aegeonichthys appelii Clarke, Trans. N.Z. Inst. x, May 1878, p. 245, pl. vi. "Seas of New Zealand" = Hokitika. Type also figured by Whitley, Austr. Mus. Mag. iii, 1927, p. 105, fig.

Family CERATIIDAE
Genus CERATIAS

Ceratias Kroyer, Overs. K. Danske Vid. Selsk. Forhandl. (8), 1844, p. 140 and Naturhist. Tidsskrift (2) i (6), 1845, p. 639, *fide* Sherborn, Index Anim. (wrongly as Crustacean). Haplotype, *C. holbolli* Kroyer.

CERATIAS HOLBOLLI TENTACULATUS

Ceratias holbolli Kroyer, Overs. K. Danske Vid. Selsk. Forhandl. (8), 1844, p. 140. Europe.

Mancalias tentaculatus Norman, John Murray Exped. Fish., vii, 1, 1930, p. 355, fig. 45. South Atlantic.

Mancalias bifilis Regan & Trewavas, Dana Rept. 2, 1932, p. 100, pl. vi, fig. 1. N.Z.

Genus CRYPTOPSARAS

Cryptopsaras Gill, Forest and Stream, Nov. 8, 1883, p. 284. Orthotype, *C. couesi* Gill, *fide* Goode & Bean, Oceanic Ichth. 1896, p. 491.

CRYPTOPSARAS PENNIFER

?Cryptopsaras couesii Gill, Forest and Stream, Nov. 8, 1883, p. 284. Gulf Stream; "Albatross" Station 2101.

?Ceratias carunculatus Gunther, Rept. Voy. Challenger, Zool. xxii, 1887, p. 55, pl. xi, fig. D. South of Yeddo, Japan; 345 fathoms.

Cryptopsaras pennifer Regan & Trewavas, Dana Rept. ii, 1932, p. 98, fig. 157. North of N.Z.

Family LINOPHRYNIDAE
Genus LINOPHRYNE

Linophryne Collett, Proc. Zool. Soc. Lond. 1886, p. 138. Haplotype, *L. lucifer* Collett.

LINOPHRYNE ARBORIFER

Linophryne arborifer Regan, Ann. Mag. Nat. Hist. (9) xv, 1925, p. 564. North Atlantic.

Genus HAPLOPHRYNE

Haplophryne Regan, Ann. Mag. Nat. Hist. (8) ix, March 1, 1912, p. 289. Orthotype, *Aceratias mollis* Brauer.

HAPLOPHRYNE TRIREGIUM

Three Kings Angler

Haplophryne triregium Whitley & Phillipps, Trans. Roy. Soc. N.Z. lxix, Sept. 1939, p. 232. Based on *Haplophryne mollis* Regan, Terra Nova Zool. i, 4, 1916, p. 148, pl. x, fig. 2. Surface off Three Kings Is. Not *Aceratias mollis* Brauer, Zool. Anzeiger, xxv, April 1902, p. 297 from the middle of the Indian Ocean (between New Amsterdam and Cocos Id.); 2,200 metres, *fide* Brauer, Wiss. Ergebn. Deutsch. Tiefsee-Exped. Valdivia, 1906, p. 324, pl. xvi, fig. 10.

Hyaloceratias sp. Bertin, Dana Rept. 39, 1951, pp. 13 et seq., fig. 1b. N.Z.

Family OGCOCEPHALIDAE

Genus HALIEUTAEA

Halieutaea Cuvier & Valenciennes, Hist. Nat. Poiss. xii, March 1837, p. 455. Haplotype, *Lophius stellatus* Vahl.

HALIEUTAEA MAORIA

Batfish

Halieutaea maoria Powell, Trans. Roy. Soc. N.Z. lxvii, 1937, p. 81, pl. xviii, fig. 2. Off White Island, Bay of Plenty.

Family ALEUTERIDAE

Leatherjackets

Genus ALLOMONACANTHUS

Allomonacanthus Fraser-Brunner, Ann. Mag. Nat. Hist. (11) viii, Sept. 1941, p. 185, as subgenus of *Navodon*. Orthotype, *Monacanthus convexirostris* Gunther.

ALLOMONACANTHUS CONVEXIROSTRIS

Monacanthus convexirostris Gunther, Cat. Fish. Brit. Mus. viii, 1870, p. 248. George Town, Tasmania and N.Z. (Dr. Sinclair).

Genus NELUSETTA

Nelusetta Whitley, Rec. Austr. Mus. xx, March 31, 1939, p. 277. Orthotype, *Monacanthus vittatus* Richardson.

NELUSETTA ANALIS

Pseudomonacanthus analis Waite, Rec. Austr. Mus. v, 1904, p. 173, fig. 32. Lord Howe Island.

Cantherines analis Waite, Trans. N.Z. Inst. xliv, 1910, p. 378. Emended description and recorded from the Kermadecs.

Genus PARIKA

Parika Whitley, Austr. Zool. xii, 2, July 18, 1955, p. 111. Orthotype, *Balistes scaber* Bloch & Schneider.

PARIKA SCABRA

Trigger Fish, Leatherjacket; Kokiri

Balistes scaber Bloch & Schneider, Syst. Ichth., 1801, p. 477, *ex* Forster, MS. "Pacific Ocean" = Queen Charlotte Sound (type-loc.) and the Society Iss. (*vide* Forster, Descr. Anim., 1844, p. 152).

Balistes unicornu Richardson, Rept. 12th meet. Brit. Assn. Adv. Sci. 1842 (1843), p. 29, *ex* Solander, MS. Cape Kidnappers.

Balistes scabrosus Richardson, Zool. Voy. Erebus & Terror, Fish., 1846, p. 65, *ex* Solander, MS. Motuaro.
Monacanthus parika Taylor, Te Ika a Maui, ed. 2, 1870, p. 625. *Nomen nudum.* N.Z.
Monacanthus serrasquamosus Hollard, Ann. Sci. Nat. (4) ii, 1854, p. 345. Bay of Islands (M. Arnoux [? misprint for Verreaux . . . G.P.W.]).

Genus ALEUTERUS

Aleuterus Bosc, Nouv. Dict. Hist. Nat. i, Sept. 1816, p. 302, *ex* Cuvier, MS. Haplotype, *Balistes monoceros* Linne.

ALEUTERUS MONOCEROS

Balistes monoceros Linne, Syst. Nat. ed. 10, Jan. 1, 1758, p. 327. Asia [near Hong Kong].

Genus NAVODON

Navodon Whitley, Austr. Zool. vi, 2, Jan. 14, 1930, p. 179. Orthotype, *Balistes australis* Donovan.

NAVODON AUSTRALIS

Balistes australis Donovan, Natur. Repository iii, May 1, 1824, text to pl. lxxvi. Van Diemen's Land.
Monacanthus rudis Richardson, Proc. Zool. Soc. Lond. viii, 1840, p. 27. Port Arthur, Tasmania.

Family OSTRACIIDAE
Genus PARACANTHOSTRACION

Paracanthostracion Whitley, Rec. Austr. Mus. xix, Aug. 2, 1933, p. 105. Orthotype, *Ostracion lindsayi* Phillipps.

PARACANTHOSTRACION LINDSAYI
Boxfish

Ostracion lindsayi Phillipps, N.Z. J. Sci. Tech. xiii, 4, Feb. 1932, p. 233, fig. 4. Otago.

Genus OSTRACION

Ostracion Linne, Syst. Nat. ed. 10, 1758, p. 330; ed. 12, 1766, p. 407. Logotype, *O. cubicus* Linne.

OSTRACION ECO

Ostracion hexagonus Phillipps, Trans. N.Z. Inst. lviii, Aug. 15, 1927, p. 134, pl. viii, fig. 9. Pahia, Bay of Islands; on beach. Preocc. by *O. hexagonus* Thunberg, D. D. Mus. Ac. Upsal., 1787, p. 30; Bloch & Schneider, Syst. Ichth., 1801, p. 502.
Ostracion eco Phillipps, N.Z. J. Sci. Tech. xiii, 4, Feb. 1932, p. 233. New name for *O. hexagonus* Phillipps, preocc.

Family LAGOCEPHALIDAE
Genus SPHAEROIDES

Sphaeroides Anon., Allg. Lit. Zeit., Sept. 24, 1798, p. 676, *ex* Lacepede, vernac. Haplotype, later named *Orbis tuberculatus* Latreille, Nouv. Dict. Hist. Nat. ed. 1, xxiv, March 1804, p. 75.
Note: The Zoological Record for 1914 wrongly recorded from N.Z. the American species, *S. harperi* Nichols.
Pending critical revision, the following three species are united in one genus, *Sphaeroides.*

SPHAEROIDES HAMILTONI
Toado, Toadfish

Tetraodon hamiltoni Gray & Richardson, Trav. N.Z. (Dieffenbach) ii, Jan. 1843, p. 226. Port Jackson, New South Wales.

SPHAEROIDES NITIDUS

Spheroides nitidus Griffin, Trans. N.Z. Inst. liii, Aug. 31, 1921, p. 356, pl. lv, fig. 2. Auckland (type) and Tauranga Harbours.

SPHAEROIDES CHEESEMANI

Tetrodon cheesemani Clarke, Trans. N.Z. Inst. xxix, June 1897, p. 248, pl. xv. Moturoa, Taranaki.

Genus CONTUSUS

Contusus Whitley, Austr. Zool. xi, 1947, p. 147. Orthotype, *Tetrodon richei* Freminville.

CONTUSUS RICHEI

Globefish

Tetrodon richei Freminville, Nouv. Bull. Sci. Soc. Philom. iii, April 1813, p. 250, pl. iv, fig. 2. Nuytsland, South Australia.

Genus BOESEMANICHTHYS

Boesemanichthys Abe, Jap. J. Ichth. ii, 1, 1952, p. 40. Orthotype, *Tetraodon firmamentum* Temminck & Schlegel.

BOESEMANICHTHYS GILLBANKSII

Tetrodon gillbanksii Clarke, Trans. N.Z. Inst. xxix, June 1897, pp. 244 & 245, pl. xiv. Moturoa, Taranaki.

Genus TAKIFUGU

Takifugu Abe, Bull. Biogeogr. Soc. Japan xiv, 1949, p. 90, as subgenus of *Sphoeroides*. Haplotype, *Tetrodon oblongus* Bloch.

TAKIFUGU OBLONGUS

Tetrodon oblongus Bloch, Nat. Ausl. Fische ii, 1786, p. 6, pl. cxlvi, fig. 1. Surate, Indonesia.

Note: Kermadecs—Waite, 1910.

Genus LIOSACCUS

Liosaccus Gunther, Cat. Fish. Brit. Mus. viii, 1870, pp. 272 & 287. Logotype, *Tetrodon cutaneus* Gunther.

LIOSACCUS AEROBATICUS

Liosaccus aerobaticus Whitley, Rec. Austr. Mus. xvi, 4, March 28, 1928, p. 237, pl. xvi, fig. 2. Off Montague Island, New South Wales. A specimen in the Dominion Museum, Wellington, seen in 1957, came from the Bay of Plenty. New record for New Zealand. Others have been received since.

Family CANTHIGASTERIDAE

Genus CANTHIGASTER

Canthigaster Swainson, Nat. Hist. Classif. Fish. Amphib. Rept. ii, July, 1839, p. 194. *Genus caelebs*. Logotype, *Tetraodon rostratus* Bloch.

CANTHIGASTER CALLISTERNUS

Clown Toado

Tetrodon callisternus Ogilby, Austr. Mus. Mem. ii, 1889, p. 74 (26 of reprint), pl. iii, fig. 5. Lord Howe Island.

Note: Recorded from Kermadecs as *C. caudofasciatus* by Waite (not of Gunther), and from Poor Knights Islands, Whangarei, in "Dive" v (6) 1966, p. 6—Whitley, Proc. Roy. Zool. Soc. N.S.W. 1966-67 (1968), p. 40.

Family DIODONTIDAE

Genus DIODON

Diodon Linne, Syst. Nat., ed. 10, 1758, p. 334; ed. 12, 1766, p. 412. Logotype, *D. hystrix* Linne.

DIODON HYSTRIX
Porcupine Fish

Diodon hystrix Linne, Syst. Nat., ed. 10, 1758, p. 335; ed. 12, 1766, p. 413. India.
(Kermadecs).

Genus ALLOMYCTERUS

Allomycterus McCulloch, Rec. Austr. Mus. xiii, 4, April 12, 1921, p. 141. Orthotype, *Diodon jaculiferus* [McCulloch, non] Cuvier = *Allomycterus pilatus* Whitley, Rec. Austr. Mus. xviii, 1931, p. 125.

ALLOMYCTERUS WHITLEYI

Diodon globulas Taylor, Leaf Nat. Hist. N.Z., 1849, p. 13; Te Ika a Maui, ed. 2, 1870, p. 625 (*Diodon* sp. in ed. 1, 1855, p. 411). *Nomen nudum.* N.Z.

Allomycterus whitleyi Phillipps, N.Z. J. Sci. Tech. xiii, 4, Feb. 1932, p. 234, fig. 5. N.Z. waters.

Family MOLIDAE
Genus MOLA

Mola Cuvier, Tab. Elem. 1798, p. 323. Tautotype, *Tetraodon mola* Linne, Syst. Nat. ed. 10, 1789, p. 334.

MOLA MOLA

Tetraodon mola Linne, Syst. Nat. ed. 10, 1758, p. 334. Mediterranean.

MOLA RAMSAYI
Sunfish; Ratahuihui

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Genus TRIURUS

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Ranzania Nardo, Atti i Riun, Sci. Ital. ed. 2, 1840, p. 165. Orthotype, *R. typus* Nardo (*fide* Sherborn, Ind. Anim.).

TRIURUS LAEVIS
Oblong Sunfish

Ostracion laevis Pennant, Brit. Zool. ed. 4, iii, 1776, p. 129, pl. xix, fig. 54. Plymouth, England.

Tetrodon truncatus Retzius, K. Vet. Akad. Nya Handl. vi, 1785, p. 121. Brazil.

Triurus bougainvilleanus Lacepede, Hist. Nat. Poiss. ii, 1800, p. 200. Indian Ocean, well to west of Western Australia: between 26° and 27°S. lat. and 103° or 104° [E. of Paris] long.; in stomach of mackerel-like fish, Feb. 1768.

Ranzania makua Jenkins, Proc. Calif. Acad. Sci. (2) v, Oct. 31, 1895, p. 779, coloured frontispiece. Pearl Harbour, Hawaii.

HISTORICAL

The history of New Zealand's ichthyology differs from that of Australia in that there was not the competition amongst foreigners to describe and name the species in the early years. New Zealand was discovered by a Dutchman, Tasman, in pre-Linnean days. Some manuscripts and drawings of Cook's naturalists were utilized by Broussonet, Gmelin, Bloch and Schneider, but the squabbles of the Forsters seem to have kept the books of science closed. However, Madame Bowdich made copies of Forster's drawings for Cuvier, Lichtenstein edited Forster's *Descriptiones Animalium* for publication in 1844 and John Richardson in the 1840's made use of the notes of the Cookian naturalists. Not many species emerged as a result of the French naturalists and explorers (Marion du Fresne, Quoy and Gaimard, Lesson and Garnot) but some were described after the visit of the Austrian vessel "Novara". Richardson's *Zoology* of the voyage of the "Erebus" and "Terror" (1844-48) is still a classic work on Australasian fishes. It is now difficult to understand the inactivity of William Swainson who was perhaps too busy farming in New Zealand to continue his former spate of finely illustrated publications.

The 1870's saw the arrival of H.M.S. "Challenger" and the beginning of deep-sea research. By then the New Zealand school of workers in ichthyology had arisen and is happily still flourishing. Hutton and Hector produced a Catalogue of New Zealand fishes. Gunther had completed the great Catalogue of the Fishes in the British Museum and was working on the "Challenger" material; and he included fishes from the Kermadecs in his *Fische der Sudsee*. It was then possible for students in the Antipodes to classify their fishes and describe new ones. Hutton, Hector, Haast, Campbell, Colenso, Clark, Kirk, Parker, Arthur, Sherrin and Forbes contributed papers in the nineteenth century. In 1901, Hamilton produced the first bibliography of New Zealand fishes which was followed in 1904 by Hutton's Index to the Fauna. Benham, Hamilton, Chilton and others produced good work but a special palm should be awarded to Waite who worked out the trawled fishes and catalogued, described and fully illustrated practically all the species known locally at his time. A landmark was Phillipps' *Bibliography of New Zealand Fishes* (1927). For the rest, the following rough and well-nigh chronological list of workers may provide the bare bones which may some day be fleshed into a history of the science of ichthyology in New Zealand, a science which now shows signs of enormous expansion. Students of the pioneers should also consult Fell and others, *First century of New Zealand zoology, 1769-1868*, issued by the University at Wellington in 1953.

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* Hugo Schauinsland's biography has been written by Abel, Veroffent. Ubersee-mus. Bremen, B, ii(1), 1967, pp. 19-44, portrait.

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INDEX TO PRINCIPAL GENERA

HYASTENUS HILGENDORFI DE MAN, A MAJID SPIDER CRAB NEW TO AUSTRALIA

by D. J. G. Griffin
(Australian Museum, Sydney.)

(Plate 1, text-figure 1.)

SUMMARY

Twenty-one specimens of *Hyastenus hilgendorfi* are recorded from northern Australia. Additional figures are provided and the specimens are compared with those previously recorded from throughout the Indo-West Pacific and eastern Mediterranean Sea.

INTRODUCTION

The genus *Hyastenus* is taxonomically one of the more difficult groups of Indo-Pacific majid crabs. Balss in 1935 listed all the species known at that time but the majority await detailed description. Thirteen species have been recorded from Australia so far and a key to their identification was given by Griffin (1966: 280-282).

During an examination of collections of Brachyura in Australian Museums in 1966-67, specimens of a species of *Hyastenus* which appeared to be distinct from those previously recorded from Australia were found in the Queensland Museum (QM), Australian Museum (AM) and South Australian Museum (SAM). These proved to be referable to *H. hilgendorfi,* originally described by De Man (1887) from the Mergui Archipelago in the Bay of Bengal. In the present paper these specimens are compared with previous descriptions of *H. hilgendorfi.*

Terminology follows Griffin (1966). The measurement given is carapace length (c.l.) including the length of the rostrum and was taken with dial calipers.

Family MAJIDAE.
Genus *Hyastenus* White, 1847.
Hyastenus hilgendorfi De Man.
(Pl. I, and text-figure 1.)

Hyastenus hilgendorfi De Man, 1887: 14-18, pl. i, figs. 3, 4. Alcock, 1895: 209-210. Chopra & Das, 1937: 388-9. Buitendijk, 1939: 242, figs. 9, 10. 1950: 64. Stephensen, 1945: 107, figs. 20D.E. Holthuis, 1956: 328-329. Lewinsohn & Holtuis, 1964: 62.

Halimus hilgendorfi Laurie, 1906: 376. Rathbun, 1906: 881.

MATERIAL EXAMINED: Queensland Museum. Murray Id., Torres Strait, Queensland (no other data), associated with specimens of *Hyastenus diacanthus* and *H. spinosus,* 6♂♂, 9 ♀♀, c.l. 21.2-32.2 mm (W.2527).

Australian Museum—Murray Id., Torres Strait, October 1928, Melbourne Ward collection, 3♂♂. 1♀ (dry), c.l. 25.7-31.0 mm. Nr. Field's Reef, Port Denison, Queensland, intertidal, among stones, pres. E. H. Rainford, before 1924, 1 ♀ (ovig.), c.l. 18.8 mm (P.7041).

South Australian Museum—Palmerston [now Darwin], Northern Territory, P. Foelsche, November, 1890, 1♀ (ovig.) (dry), c.l. 22.3 mm, det. W. H. Baker as *Hyastenus hilgendorfi* (C.1121).

REMARKS: All these specimens are clearly referable to *H. hilgendorfi*. The male first pleopod is long, weakly curved, slender and distally weakly expanded with a membranous flap laterally, as previously described and figured by Buitendijk (1939) and Stephensen (1945).

Of the 21 specimens, the ovigerous females from Palmerston, Northern Territory (SAM C1121) and Port Denison, Queensland (AM P.7041) agree most closely with that originally figured and described by De Man in having

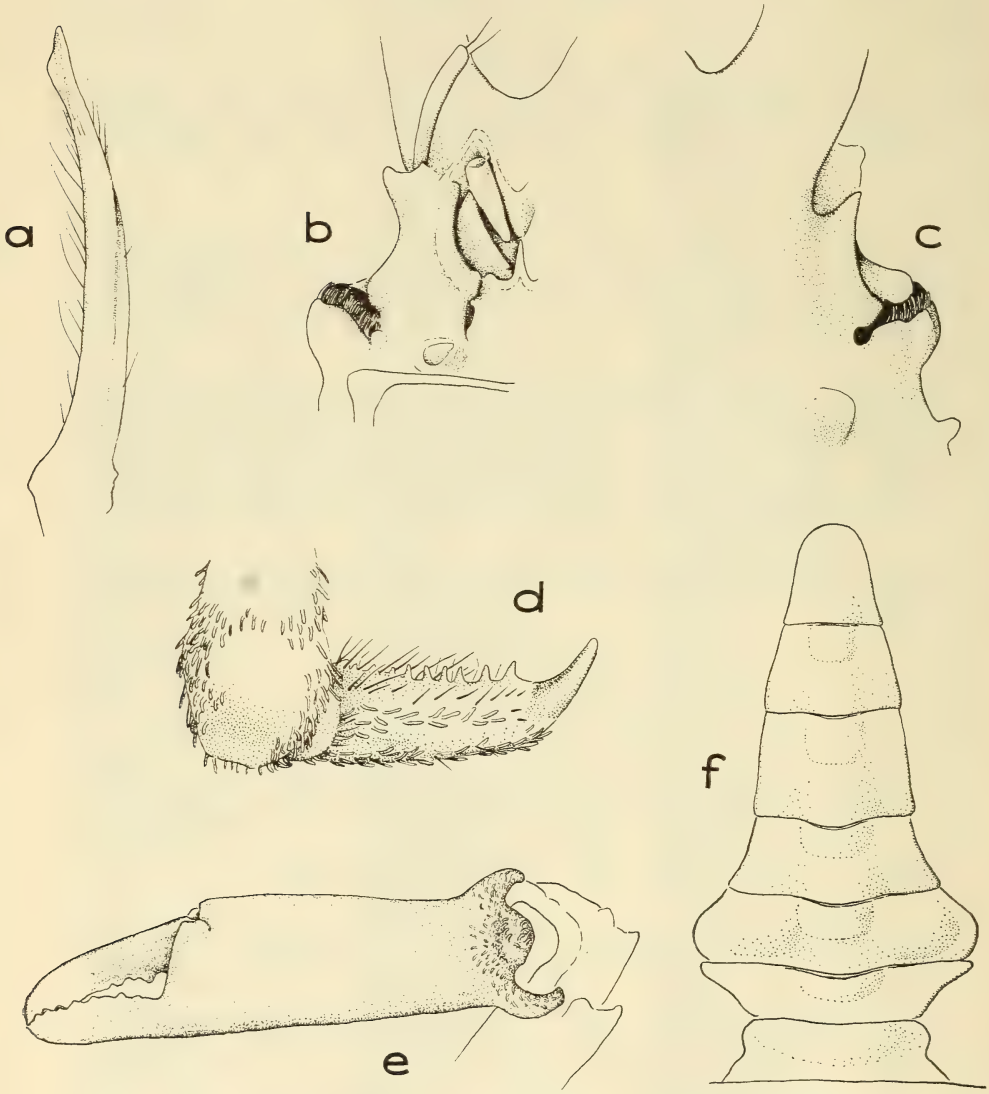

Figure 1. *Hyastenus hilgendorfi*, ♂, c.l. 32.2 mm, Murray Id., Queensland (QM W.2527): a, right first pleopod, abdominal aspect; b, orbit and antennal region, ventral aspect; c, orbit, dorsal aspect; d, dactyl of fourth left ambulatory leg, posterior aspect; e, left chela, outer aspect. f, abdomen.

the rostral spines almost straight and the epibranchial spines sharp and upcurved. In the other specimens the rostral spines are weakly curved and distally sub-parallel in males and straight or weakly outwardly curved in females and the epibranchial spines are blunt and shorter than shown in De Man's figure. In all specimens there are prominent medial gastric, cardiac and intestinal elevations, the gastric surmounted centrally by a small tubercle. All specimens agree with the original description in having a large number of low tubercles on the dorsal surface and margins of the carapace. Usually, there area pair of protogastrics anteriorly, three very small ones in a weakly curved, transverse row between these two and up to six mesobranchial in a curved row on each side of the midline, the first, third and fifth very small, the fourth (opposite the epibranchial spine) and the last (above the intestinal margin near the junction of the cardiac and intestinal regions) subequal and larger than any other in the series. There is a row of up to five tubercles close to the posterolateral margin and there are up to eight on the anterior part of the branchial margin, two of which are larger than the others. There is a small tubercle on the hepatic region laterally, one suborbital and two large ones on the pterygostomian regions as described by De Man. The dorsal surface of the merus of the cheliped sometimes possesses two to four low tubercles proximally in addition to the two distal ones described by De Man. The chelae in the males are long and in the larger specimens the fingers gape slightly in their proximal half and the dactyl bears a tooth at the base slightly larger than any of the others. The ambulatory dactyls are stout and bear many blunt to sharp spines in a row ventrally, about 10 on the fourth leg; the spines increase in length distally.

Laurie (1906) and Chopra & Das (1937) noted sexual dimorphism in the shape and length of the rostral spines in this species. Variation in the size and arrangement of carapace tubercles has been previously noted in *H. hilgendorfi* by Rathbun (1906), Buitendijk (1939) and Lewinsohn & Holthuis (1964).

In the key given by Griffin (1966), *H. hilgendorfi* comes out at the second part of couplet 54 near *H. auctus* Rathbun, from the Philippines and north-western Australia, which differs from *H. hilgendorfi* most noticeably in lacking tubercles around the branchial margin, in the intestinal region not being at all tumid and bearing only a small tubercle, in the gastric region bearing only a single central tubercle and in the carapace being narrower across the branchial regions (carapace width less than $\frac{3}{4}$ post-rostral carapace length in *H. auctus,* more than $\frac{3}{4}$ postrostral length in *H. hilgendorfi*).

DISTRIBUTION: Widespread Indo-West Pacific: Iranian Gulf, Ceylon, Ganjam (India), Nicobar Ids., Mergui Archipelago, Singapore, Straits of Malacca, Timor, Amboina and Hawaii. Also found in the Suez Canal and in the eastern Mediterranean Sea off the coast of Israel. Lewinsohn & Holthuis (1964) state that this species has been recorded from the Red Sea and according to Balss (1935) this species is known from Madagascar. I can find no substantiation in the literature for this species having been recorded from these two localities. In view of its very wide distribution the presence of this species in Australian waters is not unexpected.

ACKNOWLEDGEMENTS

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EXPLANATION OF PLATE I

Hyastenus hilgendorfi, ♂, c.l. 32.2 mm, Murray Id., Queensland. (QM W2527), dorsal aspect.

Photo.—C. V. Turner.

THE COWRY, **Ravitrona poraria theoreta** (Iredale).

By N. S. Gomersall

In 1939, Iredale (Austr. Zool. 9, p. 305, pl. 27, figs. 11-12) allocated the name *theoreta* to the subspecies of *Erosaria poraria* from Clarence River Heads, New South Wales. Recently a specimen of this mollusc was taken alive at that locality by Mr. & Mrs. R. Allgood of Iluka, who were good enough to send the shell to me to be photographed.

The specimen measures 24.3 mm. in length and 15.5 mm. in breadth, the height being 12 mm.

The outer lip in front is declivous, the labial teeth numbering 19, including 2 small ones at the posterior outlet. Columellar teeth number 16 and the terminal ridge is strong. Five teeth extend the full depth of the fossula. The teeth are creamy white on the base and pure white on the fossula.

Both the left and right sides are margined, the left margin being bent up. The margins are pitted apart from in the region of the bent up portion mentioned.

The base, margins and both extremities are mauve, the ground colour of the dorsum being brown. There are numerous dull white spots, a concentration of which runs the length of the well defined dorsal line. However at least half of the spots are ocellated, the colour of the surrounding ring being dark brown. To this extent the markings on this shell differ from those on the type specimen on which none of the spots were ocellated.

According to Joyce Allan (1956, Cowry Shells of World Seas, p. 97), the type-specimen is somewhat diseased.

Authors alone are responsible for the opinions expressed and for the accuracy of the facts in their contributions.

Spider Crab, *Hyastenus hilgendorfi.*

ROYAL ZOOLOGICAL SOCIETY OF NEW SOUTH WALES

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PUBLICATIONS

The Australian Zoologist, published at irregular intervals since 1914.
Proceedings, published since 1933-34.

AUSTRALIAN ZOOLOGICAL HANDBOOKS AND SPECIAL REPRINTS.

"Bibliography of Australian Entomology, 1775-1930", by A. Musgrave, 1932.

"A Check List of the Birds of Paradise and Bower Birds", by T. Iredale, 1948.

"Revision of the New South Wales Turridae", by C. F. Laseron, 1954.

"The Published Writing of Tom Iredale, with an Index of his new Scientific Names", by D. F. McMichael & G. P. Whitley, 1956.

"A Reclassification of the Order Odonata", by F. C. Fraser, 1957.

"Dragonflies of Australia", by F. C. Fraser, 1960.

"A Catalogue of the Psocoptera of the World", by C. N. Smithers, 1967.

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CONTENTS OF THIS PART

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THE AUSTRALIAN ZOOLOGIST

VOL. XV PART 2

DR. JAN DANYSZ AND THE RABBITS OF AUSTRALIA

by

LECH PASZKOWSKI

(Plate II)

The first few wild rabbits which were brought to Australia in 1859, multiplied with such fertility, that, already on 31st August, 1887, the Government of New South Wales offered a reward of £25,000 to anyone who could suggest a practical method of exterminating them. But all the remedies were rather limited in results until Australian scientists successfully introduced bacteriological warfare and Myxomatosis in the 1950's.

The initial attempt to make a bacteriological assault on the Australian rabbit population was made in 1888. As the result of the previously mentioned reward the famous French bacteriologist, Louis Pasteur, sent three representatives of the then recently established Pasteur Institute of Paris to Australia. According to James Matthams, *The Rabbit Pest in Australia* (Melbourne, 1921, pp. 121-122), these three men conducted experiments with chicken-cholera on Rodd Island, in Sydney Harbour. The experiments indicated that the introduced infection did not spread readily among the rabbits, and the bacillus of chicken-cholera was not sufficiently contagious to have the desired effect. However, the modern *Australian Encyclopaedia* (1958) gives a slightly different account of the same event (vol. 7, p. 346): "The first visit was rather a fiasco, because the quarantine authorities would not permit the entry and use of the organism (which was that of chicken cholera) . . ."

Eighteen years later another attempt to contain the rabbits with an introduced bacillus was made in New South Wales. In 1906 the Rabbit Destruction Fund Committee invited the eminent bacteriologist, Dr. Jan Danysz, of the Pasteur Institute in Paris, to conduct experiments in Australia with an introduced infection.

Introducing Dr. Danysz

Before discussion of this event, it seems necessary to introduce Dr. Danysz to Australian readers.

Jan (Jean, John) Danysz was born in 1860, at Chylin in Western Poland, then under German rule. He attended the high school at Ostrów, but did not reach matriculation standard. Feeling uneasy under the Prussian oppression of Poles he emigrated to France, at the age of nineteen, and was naturalized there. In 1882, Danysz graduated from the faculty of Physics and Mathematics at the University of Sorbonne in Paris. He also studied philosophy at Caen. Later he supplemented his education in the fields of anatomy and histology at the Museum of Natural History under Prof. Pouchet, where he published his first work, dissertation on the tape worm. He became interested in parasitism, particularly in agriculture and forestry. As a result of his microbiological investigation, *Bacillus rati* Danysz was discovered in the paratyphoid group. As a result of this discovery the celebrated Professor, Ilya Metchnikov, engaged him to work in the Pasteur Institute in 1893. After a short time he was appointed to take charge of the Microbiological Department of the Institute. While there he published several works on the subjects of diseases in mice, harmful insects and infective fungi. He became a personal friend of Pierre Curie and was one of the very first scientists who ever experimented with the effects of radiation (Radium) on the living animals. The fame he rapidly acquired occasioned invitations from several Governments to fight epizootics

in agriculture and forestry. Thus Danysz spent the years 1896-1897 in South Africa, mainly in Transvaal, fighting with a remarkable success the cattle plague (*Pestis bovina*). In 1899 he was invited to Portugal to save the forests of cork-trees (*Quercus suber*) from their parasites. In 1902 he went to Russia, as an expert and adviser, to fight the insect *Cleonus punctiventris* menacing the plantations of sugar beet. Most important of all his discoveries was the "Phenomenon Danysz", explaining the relation of toxins to antitoxins which radically facilitated the vaccine treatment. He also dedicated himself to research on allergies and intestinal flora. Danysz also wrote philosophical essays on such matters as the "Relation of Man to Nature", "Psychical Energy" and the "Biological Meaning of Suffering and Health". During World War I he exterminated rats in the French trenches and was decorated with the Legion d'Honneur for this work. Danysz wrote several works in Polish. He founded the "Spójnia (Joint)" for the Poles in France and cared for the Polish students there. He supported the cause of creation of the Polish Army in France, in 1917, and was an initiator of the Committee for Polish Volunteers. In his day he was often referred to as an unofficial Polish Ambassador in France. In 1921, the University of Poznan offered him the chair of bacteriology, which he refused on account of ill health. The Polish Government honoured Dr. Danysz with the title of Commander of the Order of "Polonia Restituta". He died on 14th January, 1928. Danysz was devoted to science, possessed a creative intuition, a discerning approach to problems and had a vast range of interests. However, his achievements were not so strong in numbers as in their high quality and originality.

Dr. Danysz in Australia

Dr. Danysz arrived in Melbourne in June, 1906, accompanied by his son, George, a painter. He was met there by Dr. Frank Tidswell, Principal Assistant Medical Officer of the Government of N.S.W., and Microbiologist to the Board of Health.

The first experiments were carried out in Sydney in the laboratory attached to the Board of Health, in order to establish whether the virus brought by Dr. Danysz would satisfactorily infect rabbits without being dangerous to other animals. After three months Dr. Tidswell produced the "Report on the Virus proposed for use" in which he stated, "that there would be no danger from such experiments being carried out upon Broughton Island".

The island, which is about 1,000 acres in extent, is situated some 18 miles to the North of Port Stephens and about a mile and a half off shore. It is hilly and treeless, but is covered with long grass. Wood and iron buildings were erected on the island for the accommodation of those engaged in the experiments. Communication with the mainland was maintained by a fishing cutter, fitted with an auxiliary motor.

The experiments were started on 20th October, 1906. Besides several hundred rabbits, a horse, cattle, sheep, goats, pigs, poultry, pigeons and kangaroos were also taken to the island.

One month later Dr. Danysz and others on the island were seized by a serious illness, as a consequence of which, two medical officers were dispatched from Newcastle to assist the sufferers. On their arrival, they found Dr. Danysz seriously ill, the symptoms indicating ptomaine poisoning. Those affected recovered after treatment. Dr. Danysz was the chief sufferer and he was compelled to leave the Island and proceed to a sanatorium in the Blue Mountains to recuperate. Mushrooms, the water in the new galvanized iron tank and the eating of tinned meat of a toxic nature were one after the other suspected to be the cause of the trouble.

In the meantime experiments had brought rather disappointing results. The critics of Dr. Danysz complained, that, during the experiments, such common domestic animals as the dog and cat were absent, the pigeons flew to the mainland, while the whole of Australia's fauna was represented by three kangaroos.

After his recovery Danysz returned to the Island and controlled further experiments till 1st May, 1907. He then left the experimental station in charge of his assistant, Monsieur A. Latapie, and sailed for Europe.

The Hostile Campaign

It is interesting to examine the attitude of the Australian Press to his experiments. Danysz's stay and experiments in Australia called forth a great deal of controversy and a hostile campaign was waged against him, which was not without some calumniatory overtones. This type of climate created by the articles in the Press certainly discouraged Dr. Danysz in his further experiments to fight the rabbit pest. In contrast to the impartial reports of Dr. Frank Tidswell, a clear cut campaign against Dr. Danysz was launched by the editor of *Faulding's Medical and Home Journal* in Adelaide. Several months before Dr. Danysz even landed in Australia, a most violent attack against the experiments appeared in that periodical.

In June, 1906, shortly after his arrival Danysz gave the following statement to the Press:

"When I sailed for Australia I had no idea that I would find here such a considerable and organised opposition against my work . . .

". . . I could not suppose that I would have to face such formidable obstacles in this country, which, from a social point of view, has gone ahead so rapidly, and which finds itself with some of its institutions at the head of progress. And why is this? Because I want to start an experimental study, which, whatever the result will be, cannot be of any danger to anybody.

". . . The first point I should like to make clear is, then, that studies and laboratory experiments entrusted to competent men cannot become a public danger. In the letters published by the Australian press, before and since my arrival in Sydney, the destruction of rabbits by means of a microbe is criticised from two points of view, different and somewhat opposed. It has been said that it is impossible to destroy rabbits with a disease, and it has often been said in the same article that the introduction of a contagious disease for rabbits could become dangerous to useful animals, perhaps even to men. Such arguments contradict one another; it is, therefore, better to discuss them seriously. The merest commonsense tells us that if a disease special to rabbits cannot really stop their multiplication, by what special property could it then become a danger to animals which, so far, have always shown themselves refractory? The foremost condition of the actual undertakings was to find a disease infectious for rabbits, and only for rabbits.

". . . I have said already that it is possible to experiment with all diseases without any fear. I am only asking at present to try these first experiments, which will show—(1) Whether the microbes are 'really disease-producing' and mortal for the rabbits; (2) whether they are innocuous to other animals in Australia. Until we get the results of these experiments, discussion is only waste of time. What we know about the general properties of these microbes amongst rabbits gives us very useful indications, but no absolute certainty until proved scientifically.

". . . *I do not think I have ever hoped to completely destroy the rabbits in Australia with a disease.* What I hope is that the diseases introduced and kept going will check their exceptional multiplication, and enormously decrease their numbers, and that they will take the place of the methods now in use, which are dangerous and not efficacious."

The Commission of the South Australian Government

The previously mentioned editor of *Faulding's Medical and Home Journal*, W. J. P. Giddings, together with Dr. E. Angas Johnson were sent to Broughton Island, in April, 1907, as the Commissioners of the Government of South Australia. Their report, which was highly unfavourable to the experiments made by Dr. Danysz, caused many comments in the Australian Press:

The Pastoralists' Review (Melbourne), September, 1906.

"After a considerable delay, the South Australian Government has accepted the invitation of the Premier of New South Wales to appoint representatives to watch the Danysz experiments. Two gentlemen have been chosen—Dr. E. Angas Johnson and Mr. W. J. P. Giddings—but those responsible for the selection of the latter gentleman could not surely have known that he has shown such strong antagonism to Dr. Danysz's scheme that he reported adversely upon the whole thing even before he knew the character of the proposed disease.

To appoint a man with such a strong bias against the proposed undertaking is nothing less than a scandal and the committee would have been perfectly justified in protesting against the appointment . . ."

The Sydney Morning Herald, May 22, 1907.

"Too much light cannot be thrown on the experiments conducted by Dr. Danysz on Broughton Island. Every expert criticism is to be welcomed, and so the report of the Commission appointed by the South Australian Government, and comprising Dr. E. Angas Johnson and Mr. W. J. P. Giddings, F.J.I., editor of *Faulding's Medical Journal,* will be read with avidity by all interested in the efforts of the French scientist to prove the effectiveness of his virus against the rabbits. The Commission visited Broughton Island and spent several days there while the experiments were in progress. Their report is distinctly hostile, but it is only fair to point out that *Faulding's Journal* has been from the outset an uncompromising opponent to the Danysz theory, and has published a number of attacks upon it. Thus, Mr. Giddings could scarcely be considered an impartial investigator."

The Daily Telegraph (Sydney), May 22, 1907.

"The South Australian Royal Commissioners on the Danysz experiments in rabbit destruction are unreservedly unfavourable, as will be seen from the extracts from their report, which we publish this morning . . . Dr. Danysz is one of the leading bacteriologists of the world, whose researches and training entitle his opinions to great respect. Of the gentlemen who impugn it, one, although the editor of a medical journal, signs as 'F.J.I. (Eng.),' which presumably means Fellow of the Institute of Journalists—an excellent diploma of its class, no doubt, but not suggestive of its possessor's qualification to meet Dr. Danysz in that sphere of science where he is a notable specialist. The other Commissioner is a medical man, which may or not mean that his opinion on this subject should carry weight. When Dr. Tidswell reports on the result of the experiments he has been conducting at Broughton Island in continuance of those made by Dr. Danysz, his verdict will naturally be respected—for one reason, because he is a specialist; for another, because he is not a visitor at the island, but a participator in what has been done there."

The Register (Adelaide), May 28, 1907.

". . . Despite the scepticism of the South Australian Commissioners—who seem to have devoted much attention to the matter—and the critical attitude adopted by Professor Stuart, the Rabbit Destruction Fund Committee is still hopeful that good results will follow from the experiments. It would be a matter for regret, however, if a purely scientific investigation should be made the subject of political controversy. The Chairman of the Pastures' Protection Board stated at a meeting held last week that not only was the Labour Party hostile, but 'Sir William Lyne had also proved himself to be entirely out of touch with the men on the land.' The solution of the rabbit problem is a matter of national concern; and, in consideration of the fact that Dr. Danysz's experiments have already cost the pastoralists thousands of pounds, it would be manifestly unfair to allow party prejudice to place unnecessary obstacles in the way of a conclusive test. Dr. Danysz has been for several years Director of the Laboratory of Agricultural Micro-Biology at the Pasteur Institute in Paris, and his status as a bacteriologist entitles him to expect that his work shall be judged solely by the results of technical investigation conducted by competent scientists. At the same time the people of Australia have a right to demand that the most stringent precautions shall be enforced until the points raised by local critics can be finally settled."

The Statement by Mr. J. A. Gunn

The Chairman of the Rabbit Destruction Fund Committee published the following statement in the Sydney morning newspapers of 13th June, 1907:

"Much comment has been caused and such surprise expressed in many quarters that the report of the South Australian Commissioners should have been allowed to go unanswered so long by the Committee in charge of the experiments. In explanation of this I may say at once that while they would gladly have welcomed an unprejudiced scientific commission to watch the

whole experiment on behalf of the Australian Governments, they were from the first strongly opposed to the constitution of this South Australian Commission, consisting of two gentlemen, of whom one was the editor of a journal in which a most violent attack had been made on the whole experiment before Dr. Danysz landed in Australia. As was well said lately by Mr. Kidd, the Vice-Chairman: 'It was a surprise to the Committee that, holding the opinion he did, he should have accepted the position of a neutral judge at all, and equally surprising that the South Australian Government should have appointed him to such a position under the circumstances.' While his motives may have been above exception, he was clearly not unprejudiced. Under these circumstances the Committee have never attached the slightest weight to the report of the Commission, but preferred to depend on the pronouncement of a scientist of the standing of Dr. Danysz, whose reputation depends on his accuracy, and to wait patiently for the conclusions of Dr. Tidswell, as to its safety where our domestic animals are concerned . . .

". . . The Commissioners then go on apparently to vitiate Dr. Danysz's figures as to contagion by including experiment No. 11 from those from which an average is to be taken, instead of confining the average basis to the four experiments taken as typical by Dr. Danysz himself. The utter fallacy of this method of arriving at a conclusion is apparent when it is remembered that this experiment was never for one moment intended to demonstrate the spread of disease from contagion among rabbits, but was designed solely to prove the safety of the microbe where domestic and other animals are concerned. Rabbits to the number of 320 were placed in a three-acre enclosure with numbers of domestic and other animals and poultry, and infected lucerne at intervals placed in the paddock. This was eaten freely by all the larger animals, and, of course, by some of the rabbits; but doubtless many of the latter lived on the natural grass without touching the infected food. The gist of this experiment was that for months these other animals lived in daily contact with dead and dying rabbits, and were fed on food directly infected with the microbe, without showing the slightest symptom of disease, while many of the sheep that were for this long period exposed to every chance of infection, and had been fed on food sprinkled with the germ, were then used for mutton; and I think I am right in saying that the Commissioners when on the island enjoyed the mutton from this source. To take an experiment of this nature (which was of the utmost value in demonstrating the safety of the germ where other animals are concerned, and which was the sole object for which it was planned), and to use it in calculating the average of infection, with genuine infection experiments, is surely a travesty of scientific criticism . . .

". . . Now we come to a part of the report on the propagation of the virus so ridiculous in its assumptions, and so utterly absurd in its figures, that, were it not for the harm it is calculated to do in prejudicing the public, who are unacquainted with methods of rabbit-destruction, against the Danysz virus, it might well be left unanswered. First, the Commissioners, taking as a basis Dr. Danysz's statement that it will be easy to infect rabbits by putting virus in water, and that a pint of virus is sufficient to infect two or three gallons, enter into an elaborate calculation as to 330,000 rabbits having to be thrown into a large dam every 24 hours; and they ask how long it would take to transform that dam into a seething mass of corruption. They go on to emphasize the scare thus attempted to be created by moralizing on the dams being the sole source of water for the settler and his stock. They preface this by saying: 'As is well known, the methods of rabbit-destruction by means of water at the present time, is to fence in a dam or waterhole with wire-netting, leaving small apertures for the rabbits to enter, but through which they cannot return.' Now this, on the face of it, is the statement of men who know nothing of present-day methods of rabbit-destruction, and yet it is hard to believe the Commissioners can really be so ignorant of what is every-day practice throughout the dry and rabbit-infested parts of Australia. The method so gravely quoted is, as everyone conversant with the matter knows, one used for rabbit-trapping only, while for poisoning rabbits with water, it is also a matter of common knowledge that the rodents are carefully barred from the dams or other sources of water-supply, and the poisoned water is put in small

troughs or receptacles, holding a gallon or so, which will poison hundreds of rabbits. It is to this Dr. Danysz alludes. Instead of the hundreds of thousands of minced rabbits so luridly pictured by the Commissioners as hurled into the dams and water-supplies, all that Dr. Danysz intends (or what is needed), is that the virus should take place of poison in these small receptacles at a much cheaper rate than the present poison, while not only the rabbits that drink would die, but probably also a large number from infection. The doctor's proposal would constitute a most practicable and valuable means of disseminating the disease . . .

". . . In conclusion, the Committee wish to state that, while not fulfilling the extravagant expectations of some, they believe that we have in this disease a means (if ready methods of disseminating it are found) which will be far more efficient than any we have yet discovered for combating this rabbit plague. If only the results certified to by Dr. Danysz, as shown on the island, can be reproduced on the mainland, and he hopes to do much better there, we have a material that, while costing less than the poison in use, can be laid in our paddocks at all times without fear of either destroying stock or birds as present poisons do wholesale, and also without fear of the bushfires caused in numberless instances by the poison now in use. If for every rabbit taking a bait two or three others die, the Danysz method will be several hundred per cent, more efficacious than the existing methods. The Committee, therefore, while considering that the whole question is still on trial, believe also that the results are such as to justify a fair hope of success; and to fully justify that experiment on the mainland, which alone can prove its value for the destruction of the pest."

The Onslaught of the Press

The majority of Australian newspapers were never in agreement with Mr. Gunn and the Rabbit Destruction Fund Committee. Here are the typical comments on the experiments:

The Age (Melbourne), May 22, 1907.

"Dr. Danysz and his gruesome scheme of rabbit infection have come in for a good deal of discredit of late—so much so that he left Australia in a wailing mood, while his critics follow him with peals of increduous laughter. The only claim he had for any kind of hearing at all was that his plan of spreading infection was a sure one, and as safe as it was sure. He was ready to demonstrate to the scientists and to the practical men of Australia that he held the only true and reliable patent for rabbit extinction; that the pastoralists had only to adopt his methods, and they need no longer trouble about killing the rabbits; the rabbits would extinguish themselves, and that in such an expeditious and summary fashion as would take the shine out of any Suicide Club ever invented. He guaranteed that Brer Rabbit, out of pure altruism, would breed microbes by the billion, and that the said microbes would be such as would kill nothing but their breeders. They would be so well conducted that, though the country might be full of them, fiercely intent on fresh victims to slaughter, they would rigidly pass by fowls, sheep, guinea pigs, all domestic animals, and every living thing, and fix their sole and undivided attention on the rabbit. Finally, when the rabbits were all dead, then the microbes, conscious of having fulfilled their patriotic mission, would die off too, claiming no toll, no reward, and leaving Australians their eternal debtors. That was what Dr. Danysz claimed as a set-off to the ghastliness of his discovery. It had to be admitted that there was something frightfully repulsive about a wholesale propagation of disease, even though it were only a rabbit plague. To cover the sweet earth with a filthy virus which living animals are to communicate to one another is a horrible idea.

Nevertheless, it was claimed that any plan which would cheaply and certainly cleanse the Australian pastures of these vermin must not be scrutinised too sentimentally. So Dr. Danysz got the New South Wales Government to lend him Broughton Island as a safe and suitable place in which he could demonstrate the obedient ferocity of his well-trained microbes. He has been at

work there for more than six months; he has sowed his paddocks with lucerne, and sprinkled the succulent feed with his microbe slaves. In order that there should be no mistake about it, he first killed two rabbits by means of his most approved infection, then made a kind of hell-broth of the delectable carcasses, minced the flesh, and, by these ingredients from his witches' cauldron, thoroughly saturated the lucerne, as a tempting bait for 320 rabbits cast loose upon the treacherous herbage . . .

". . . The South Australian Commissioners declare the experiments to be a 'waste of time and money,' and they assert 'the common methods for coping with the pest by means of poison, traps, and wire-netting seem to be more reliable than the Danysz virus has proved itself to be, so far, at any rate. While the methods named present no element of danger to the public health and welfare, we cannot say the same of anything in the nature of disease.' After this it is very unlikely that Australia will be worried again by the ghoulish proposal to cultivate wildernesses of plague-scattering microbes as a means of coping with the rabbit pest."

The Melbourne Weekly Times, May 25, 1907.

"Dr. Danysz, who for many months has been experimenting at Broughton Island, on the New South Wales coast, has successfully demonstrated that his rabbit-destruction process is a failure. His method bears a likeness to that recommended by the seller of a vermin destroyer at a fair. The price of a boxful was only sixpence, and, having caught the insect, you simply crammed the poison down his throat . . .

". . . It is a simple sum in arithmetic to prove that Australia can never be cleared of rabbits by such methods. It would be easier and cheaper to desert the place and shift the population to the centre of Africa or to the South Pole. Nor have the experiments demonstrated that Dr. Danysz's rabbit virus is harmless to our domestic animals. Dr. Tidswell, of New South Wales, is satisfied that pigeons at least may be infected, and if pigeons, why not poultry and other animals as well. Nor has Dr. Danysz demonstrated the immunity of human beings. He has made no experiments to show that, and has not been sufficiently heroic in the cause of science to try the rabbit virus on himself."

The Bulletin (Sydney), May 30, 1907.

"Danysz, the French faddist, who was going to exterminate Australia's rabbits by the simplest and safest means on earth, has vanished in a cloud of dust Francewards. His words on parting would indicate that he intended to return and finish the diseasing of poor bunny; but Australia need have no fear. Danysz, in all probability, is gone for good, and sufficient reason for his departure is shown in the report of the two South Australian expert commissioners who watched his work on Broughton Island and published the results of their watchings just as Danysz was waving his hand to the Leeuwin in token of farewell. The report of the Commissioners alleges Danysz to have exaggerated without compunction, and to be grossly inaccurate and fatuously optimistic . . .

". . . There seems to be no doubt whatever that the folk who brought Danysz out here have wasted their money. Australia wouldn't have any Danysz, anyhow, and it owes a big debt of gratitude to Bill Lyne for holding him up in the first place, and insisting on restrictions, when Carruthers would have gaily let him loose on the land."

The Chronicle (Adelaide), June 1, 1907.

"After all, the rabbit question has ever been one for the consideration of the pastoralist rather than of the farmer. The latter has a never-failing weapon of defence against encroachments—that of closer settlement, and what that cannot effect wire-netting and trapping can. Hence, if farmers, as a body,

have not betrayed an excess of interest in Dr. Danysz and his rabbit disease, they have taken enough to concern themselves lest at one stage of the experiment the administrator of the virus should have fallen a victim to this new disease. The scientist certainly at one time had some mysterious illness, which his best friends explained as having been contracted from tinned meat, presumably tinned rabbit."

The Newsletter (Sydney), June 1, 1907.

"Australia's Narrow Escape.—Dr. Danysz done.—Fearful Exposures.—The most sensational official document concerning Australia ever issued, we believe, is the report of the South Australian Commissioners, specially appointed to watch the Danysz experiments with rabbits at Broughton Island. And the astounding thing is that it has been suppressed by all the Sydney daily newspapers—a most shocking circumstance, considering the issue involved. The South Australian Commissioners' report bears the stamp of impartiality and research on its every feature, and the conclusions arrived at are consequently of g reat value. Briefly stated, the report sweeps Dr. Danysz into the sea as far as Australia is concerned, and it is pretty certain his return from France will be looked for in vain. The report opens with scathing, though simple, exposures of the utterly unreliable data set forth in Dr. Danysz's experiments, and it is pungently remarked that the inaccuracies will not satisfy the demands of scientific investigation . . .

". . . The Commissioners say it would be waste of time and money for Dr. Danysz to proceed further with his experiments. And they finally and significantly hint that the quarantine at Broughton Island was a sham, indicating that any mad pastoralist, gone cranky on the Danysz microbe, could have abstracted a few infected bunnies and put them loose inland."

The Last Interview

On 20th May, 1907, Dr. Danysz passed through Fremantle as a passenger on the S.S. *India.* While in the harbour he gave an interview to a reporter of the *West Australian,* expressing his own views on the Broughton Island experiments and also on the future solution of the rabbit problem in Australia:

". . . You see, the outside public does not know everything, but when I tell you that the chief of the South Australian Commission was a Labourist, of which party members are directly opposed to me and my experiments, that will explain much. I say it is a most scandalous thing that mere laymen, such as the South Australian Government sent to Broughton Island to judge the work of a scientist, should be allowed to condemn the work of experts. They knew nothing of what they talked about, and, therefore, how can they condemn me and my work? It is most absurd. The Commissioners stayed with me on Broughton Island for some days, and their superficial knowledge is exhibited in the report which they furnished to their Government, particulars of which appeared in a condensed form in your local Press. They state that the virus kills cats and other domestic animals, while the propagation and spread of virus is not confined exclusively to rabbits. We have tried experiments with the virus on nearly every animal which Australia produces, and the virus has been proved beyond all doubt to have no effect on animals other than the rabbits. The virus which I have experimented with comes from rabbits in the first instance, and was found in several parts of France; but in the areas we had placed at our disposal my assistant, Mons. Latapie, and I set loose a number of rabbits, which were in a healthy condition, and subsequently we let loose a number of rabbits infected with the virus, and the mortality showed that one infected rabbit would convey the sickness to four or five of the healthy rabbits, which becoming inoculated, died from the toxic effects produced. The conditions in regard to the microbes cannot be very different wherever you go, whether it be in the torrid, temperate, or tropical zones. In some places the disease will spread more rapidly than in other parts of the State, and therein lies the only difference in the effect of the virus. The

disease is not dangerous except to rabbits, and I say emphatically that it does not spread to other domestic animals. The opinions of the world's leading bacteriologists do not differ materially as to the interchangeable infectivity of hemorrhagic septicaemia, as it is stated they do, and they certainly are impressed with its efficacy, to such an extent that they are watching my experiments with every interest. As far as I can, I have set out to prove that the virus will cope with the rabbits in the comparatively confined area of Broughton Island, and it remains to be seen what will be the effect when the experiments are extended to the mainland. Personally, I have no doubt about the matter, and am fully convinced that the virus, if employed, will absolutely exterminate the rabbits. I am at present on my way back to the Pasteur Institute in Paris. The Commonwealth Government has to decide the question as to whether I may later continue my experiments on the mainland; but, as far as that goes, I do not anticipate hearing from the Government inside six months. At the end of that period, should the Government's consideration be favourable, I may probably return and continue my investigations, which, in the meantime, during my absence, will be carried on by my assistant, M. Latapie."

[Question:] "Are you satisfied with the results of your visit and experiments?"

"I came to Australia in June last, so that I have spent the best part of a year in your delightful country. During that time, however, I have had to contend with a peculiar element of local prejudice in New South Wales, and, as a matter of fact, a whole year has been employed in fighting more against opposition of a political and financial character than against the real enemy, the rabbit. That was bad enough, as you may well imagine. but as my experiments proved more and more absolutely that the virus was not dangerous to any animals other than rabbits, the opposition became even more acute. When beaten on the grounds of facts, the hostile critics—comprising to a great extent the members of the Labour Party—sought to make capital out of imaginary dangers which they prophesied."

[Question:] "Did the scientists of Sydney afford you any help?"

"On the contrary, to my great surprise, the attitude of some of your Australian scientists was unfriendly. Take Professor Stuart, for instance, and you will find that that gentleman predicts that a disease such as I use could never exterminate an animal species, and he has tried to exercise a baneful intimidating influence over the squatters and farmers by threatening them with a possible contagion of their sheep. But that is, according to my experiments, an impossibility. The Professor will not engage in a scientific discussion, in which I should be only too delighted to engage with him. Professor Stuart has used baseless arguments, and does not in any way prove that the virus is dangerous to sheep. On the contrary, I have proved that it is not so. His deductions are emphatically premature and anti-scientific."

When referring to the future of Australia, Dr. Danysz expressed the opinion that agriculture, and especially stock-raising, would be, to a large extent, the mainstay of progress and economic advancement of the Commonwealth. He also stated that rabbits would remain the principal bar to such progress as long as the public refrained from adopting a means to fight them more effectively than those used up to the present time. The matter should be dealt with on a larger scale and differently to what had been done in the past. The necessity for the establishment of a permanent laboratory, in which all diseases of animals might be studied, was stressed by Dr. Danysz:

"Such an institution, would last for ever, and every new phase in connection with the animal life of Australia would be investigated not only for experiments in rabbit-extermination, but it should be a thoroughly equipped laboratory, quite free and open to all people interested in learning, such as students of the agricultural colleges, veterinary surgeons, and rabbit and stock inspectors, who should spend some months in such an institution, so that they would

get to know all about microbes. Then you will be able to deal with the rabbits effectively."

The Official Report by Dr. Tidswell

In November, 1907, Dr. Tidswell presented to the Government of Australia his report summing up the experiments on Broughton Island. This document was written in the following form:

Department of Public Health, New South Wales,
Sydney, 16th November, 1907.

VIRUS FOR DESTRUCTION OF RABBITS: BROUGHTON ISLAND EXPERIMENTS

Gentlemen,

In support of the proposal to use for the destruction of rabbits the virus brought by Dr. Danysz, it was urged that whilst efficacious for rabbits the microbe was harmless to other animals. When, many months ago, I became your representative in the matter it became my privilege to advise you that if these things were so they could be scientifically demonstrated, and, with your concurrence, the opportunity for providing the necessary evidence was furnished at Broughton Island.

The work done is discussed duly and fully in the account which I now have the honour to present, and I have here only to formulate the conclusions that emerge from the results, and which are, namely:-

(1) That the efficacy of the virus as a destroyer of rabbits has not been demonstrated.

(2) That although the microbe could be made to infect certain small animals there is no reason to apprehend danger from its practical use.

I have the honour to be, Gentlemen,
Your obedient Servant,
FRANK TIDSWELL.
Acting Chief Medical Officer of the Government.

In the report Dr. Tidswell thanked, among others, Dr. Danysz for "all courtesy", Monsieur Latapie for "obliging help on every possible occasion". Mr. R. Etheridge, of the Australian Museum, Sydney, "for advice upon some special points" and at least a dozen Australian scientists, experts and doctors.

This report did not close the great controversy, as Danysz's assistant, Monsieur A. Latapie, performed further experiments on Broughton Island until April 1908, under the supervision of Dr. Tidswell. M. Latapie left Australia on board the S.S. *Himalaya* on April 17, 1908.

Summary and Conclusions

A large volume could be filled with articles from the Australian Press, written on this subject, in the years 1906-1908. To a modern reader, from the perspective of sixty years, the great quarrel sounds somewhat ridiculous: good "Billy" Lyne saving Australia from the "French faddist" and his "gruesome scheme", "filthy virus", "hell-broth", "witches' cauldron" and "ghoulish proposal". This invective, of course, did not affect Danysz's standing as an eminent biologist of his time.

It seems that Australia was not yet ready for bacteriological warfare against the pest and had to wait another half a century for Myxomatosis. However, the introduction of Myxomatosis also provoked some protests in the Press although there was not such a bitter controversy as the one launched by *Faulding's Medical and Home Journal* of Adelaide, in 1906.

It would be useless to speculate here, as to whether or not, Danysz could have made a major breakthrough if he had been allowed to continue with the experiments on the Australian mainland. Apparently his virus of *Pasteurella* type was not potent enough. The bacteriology of sixty years ago was not that of today, which is still regarded as a very recent science. The progress of modern science has always been based on trial and error. As Robert Oppenheimer once remarked—"it is the business of science to be wrong". For the sake of the history of scientific research in Australia it has perhaps been worth recalling this early attempt to exterminate the Australian rabbit by means of an introduced virus.

Acknowledgements

I am particularly indebted to the efficient assistance given to me by Mr. J. Dabrowski, a Librarian of the National Library, Canberra, who actually drew my attention to Dr. Danysz in 1958; my sincere thanks for kind help are extended to Miss Krystyna Lopuszyńska, Warsaw, and Mr. Bernard K. Pilewski, London. I have also received much help from the staff of the National Library, Canberra; the State Library of Victoria and the La Trobe Library, Melbourne.

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1923. *Geneza energii psychicznej* [Genesis of the Psychical Energy], Poznan.
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WHO WAS "MICROZOON"?

by G. P. Whitley

In the 1860's and 1870's, a naturalist writing over the pseudonym "Microzoon" published, in the Melbourne weekly newspaper, *The Australasian,* an excellent series of articles on the animals of Victoria which, though incomplete, must still be of some value as an early review of part of the zoology of that colony. The articles nearly always appeared in a column headed "The Naturalist" which had previously been compiled from overseas sources. Indeed, as late as June 1871, "The Naturalist" comprised an article by the famous French author and poet Théophile Gautier concerning the Animals in Paris during the siege. The articles by "Microzoon" therefore were refreshingly Australian, a pioneer ornithology of Victoria, and included here or there some rare or novel species of bird or reptile.

For years, I wondered who "Microzoon" was. From internal evidence in the articles themselves, he was obviously a member of the Acclimatisation Society in Melbourne, on the staff of or closely connected with the National Museum, and not a young man. I asked naturalist friends in Melbourne and Sydney, without success, but the late D. J. Dickison (*Bird Watcher,* June 1960, p. 78) thought that "Microzoon" was Frederick McCoy (to whom "Microzoon" referred in the third person). I feel that Dickison's theory was right and that "Microzoon" was not Gerard Krefft or any other natural history writer of the period, as I had suspected. McCoy had named new species of birds in *The Australasian* in 1866 and 1867 (Dickison, *Emu,* 31, 1932, p. 191).

Newspapers have been consulted in the Mitchell Library and Public Library of New South Wales, Sydney, to which my grateful acknowledgments are due. An incomplete series of "Microzoon's" articles in newscuttings is in the library of Mr. Tom Iredale of Harbord, New South Wales.

The following is a list of "Microzoon's" articles so far noted. There may of course be others in earlier or later years or in other Melbourne newspapers. In the 1860's and early 1870's, apart from newspapers and periodicals, there was no opportunity for publishing scientific papers in Australia so authors often sent their papers to London or Europe for printing.

The order is chronological. There are no illustrations. *Aus.* = *The Australasian.*

Teredos in Hobson's Bay. *Australasian* (new series), vol. 7, no. 176, August 14, 1869, p. 200.

Diamond hunting, Pearls [and] Enemies of the Orange in Queensland. *Aus.,* Aug. 21, 1869, p. 230.

Pre-historic Tasmanian Devils. *Aus.,* Aug. 28, 1869, p. 264.

The new Australian cassowary. *Aus.,* Sept. 4, 1869, p. 295.

Our coast fishes. No. 1. Flatheads [also a note on appearance of fairy martins and swallows in Melbourne]. *Aus.,* Sept. 11, 1869, pp. 326-327.

Our colonial birds—No. 1—Eagles and falcons. *Aus.,* Sept. 25, 1869, pp. 390-391.

September insects.—The plague of brown moths.—The Vine Moth. *Aus.,* Oct. 9, 1869, p. 455.

Diamond-hunting. *Aus.,* Oct. 16, 1869, p. 487.

Our colonial birds.—No. II.—Falcons [and] hawks. *Aus.,* Oct. 30, 1869, p. 550.

Our colonial birds.—No. III.—Sparrow-hawks and Goshawks. *Aus.,* Nov. 6, 1869, p. 582.

Our colonial birds.—No. IV.—Buzzards, kites, and harriers. *Aus.,* Nov. 20, 1869, p. 648.

Our colonial snakes. No. I. *Aus.,* Dec. 4, 1869, p. 711.

Our colonial snakes. No. 2. Sea snakes and pythons. *Aus.,* Dec. 18, 1869, pp. 774-775.

Our colonial snakes. No. 3. Brown, black and tiger snakes. *Aus.,* Jan. 1, 1870, p. 8.

Our colonial snakes. No. IV. *Aus.,* Jan. 15, 1870, p. 72.

Our colonial birds. No. V. Harriers and owls. *Aus.*, Jan. 22, 1870, p. 104.

Our disorderly insects—The Cicadae. *Aus.*, Jan. 29, 1870, p. 134.

Our colonial birds. No. VI. Goatsuckers. *Aus.*, Feb. 19, 1870, p. 232.

Our colonial birds. No. VII. Swifts. *Aus.*, March 5, 1870, p. 295.

Our colonial birds. No. VIII. Swallows. *Aus.*, March 12, 1870, p. 326.

Our colonial snakes. No. V. Conclusion. *Aus.*, March 19, 1870, p. 358 [Includes *Vermicella occipitalis*].

Our colonial birds. No. IX. Bee-eaters and kingfishers. *Aus.*, April 2, 1870, p. 422.

Our colonial birds. No. X. Laughing jackass and wood swallows. *Aus.*, April 9, 1870, p. 455.

Our colonial birds. No. XI. Honey-eaters. *Aus.*, April 16, 1870, p. 486.

Our colonial reptiles. No. VI. Chelonia, or turtles. *Aus.*, April 30, 1870, p. 550.

Our colonial birds. No. II [error for XII]. Honey-eaters. *Aus.*, May 7, 1870, p. 583.

Our colonial birds. No. 12 [should have been XIII—G.P.W.]. Ptilotis (Honey-eaters). *Aus.*, May 21, 1870, p. 646. [In this article "Microzoon" refers to Professor McCoy in the third person, and observes, "*Meliphaga* (*Ptilotis*) *leadbeateri* . . . was first described in the columns of this journal, afterwards in the *Annals* and *Magazine of Natural History* for December 1867 . . . subsequently figured by Gould as *P. cassidix* . . ."]

Our colonial birds. No. 13. Wattle-birds and miners. *Aus.*, June 18, 1870, p. 776.

Our colonial mollusca. No. I. Oysters. *Australasian*, (n.s.) vol. 9 (222), July 2, 1870, p. 6.

Our colonial birds. No. 14. Bell-birds and tree-creepers. *Aus.*, July 23, 1870, pp. 110-111.

Why is Australia odd? *Aus.*, Aug. 6, 1870, p. 168.

Our colonial birds. No. 15. Tree creepers. *Aus.*, Aug. 13, 1870, p. 199.

Our colonial birds. No. 16 [No sub-title, but deals with the lyre bird, certain wrens and the Lineated Grass Warbler.—G.P.W.] *Aus.*, Sept. 3, 1870, p. 296.

Why is Australia odd? (Continued). *Aus.*, Sept. 17, 1870, p. 359.

Why is Australia odd? (Continued). *Aus.*, Sept. 24, 1870, p. 392.

Our colonial birds [not numbered].—Warblers. *Aus.*, Oct. 1, 1870, p. 423.

Our colonial birds.—Superb Warblers. *Aus.*, Oct. 15, 1870, pp. 486-487.

Our colonial birds.—Bristle birds. *Aus.*, Nov. 5, 1870, p. 584.

Why is Australia odd? (Continued). *Aus.*, Dec. 3, 1870, pp. 710-711.

Why is Australia odd? (Concluded). *Aus.*, Dec. 17, 1870, p. 774.

What is a marsupial? *Aus.*, 10 (249), Jan. 7, 1871, p. 7.

Our colonial birds (Continued)—Robins. *Aus.*, Jan. 14, 1871, p. 38.

Our colonial birds (Continued). Reed warblers and robins. *Aus.*, Feb. 11, 1871, p. 166.

Geological walks and talks at large. *Aus.*, Feb. 25, 1871, p. 232.

Geological walks and talks at large (Continued). No. II. *Aus.*, March 4, 1871, p. 262.

Our acclimatised sparrows and Minahs. *Aus.*, March 25, 1871, p. 358.

Our colonial birds (Continued). Sericornis and Acanthiza. *Aus.*, April 15, 1871, p. 455.

Our colonial birds (Continued). [No sub-title; continues Acanthiza, etc.—G.P.W.] *Aus.*, April 29, 1871, p. 519.

Geological walks and talks at large (Continued). Post-office to Royal Park. *Aus.*, May 13, 1871, p. 582.

Geological walks and talks at large—Royal Park (Continued). *Aus.*, May 27, 1871, p. 648.

["The Naturalist" column then lapses until Dec. 1871 when it is once more copied from overseas sources.

It is of interest to note in the *Aus.*, Aug. 26, 1871, p. 264, a review, not by "Microzoon", of "The Land Shells of Tasmania" by William Legrand, a "home made book on shells" as Iredale (1958, *Proc. Roy. Zool. Soc. N.S.Wales*, 1956-57, p. 58) has called it in a bibliographical discussion thereon.]

Having established that "Microzoon" was not Krefft, and that his articles need not be added to the latter's bibliography, I nonetheless found two overlooked articles of Krefft's which I now take this opportunity to add to the bibliography of him I recently provided (Whitley, *Proc. Roy. Zool. Soc., N.S.W.*, 1967-68 (1969) pp. 38-42):

1868 Remedies for snake poisoning.
The Australasian (newspaper, Melbourne), (n.s.) 4 (109), May 2, 1868, pp. 570-571. [Krefft's experiments with snakes biting men and various animals.]

1868 The Dingo, &c. *Aus.*, July 25, 1868, p. 102.

There is an anonymous review of Krefft's 1868 "Notes on the Fauna of Tasmania" in *The Australasian*, 5 (118), July 4, 1868, p. 8, in which the reviewer truly prophesied, "Mr. Gerard Krefft must wait for a remote posterity before his merits are sufficiently recognised."

A NORTHERN EXTENSION OF THE RANGE OF THE POTOROO, POTOROUS TRIDACTYLUS KERR, IN QUEENSLAND

by Harry Frauca

(Plate III)

Conservationists will be pleased to know that the range of the potoroo, *Potorous tridactylus,* has been found to extend over 200 miles north of where it had been previously recorded. Two colonies of these macropodids have been found by this writer respectively in the Boolboonda Range, near Mount Perry, Queensland, and in Mount Walsh National Park, Bluff Range, Biggenden, Wide Bay Area, Queensland. Until the discovery of these two colonies, the northernmost range of the potoroo in eastern Australia was south-east Queensland, possibly the Yandina-Maroochydore district.

Characteristics

One of the smallest species in the Macropodidae, the potoroo measures about 16 inches along head and body, with a 9 inch long tail and weighs about or over 3 pounds. It is dark grey dorsally, pale grey ventrally, the ears are short and round, the fingers are provided with long claws and there is a patch of naked skin on top of the muzzle. The animal's gait provides a good identification feature in the field; it runs in rapid hops with the body held more or less *horizontally* to the ground as is shown in Plate III here, so that it seems to be galloping rather than hopping in the macropodid fashion.

Natural History

Hughes called the potoroo "omnivorous" and it is known to feed on snails, insects, grasses, the roots of some plants, cranberry seeds and in captivity it has thrived on wheat biscuit waste, dehydrated meat and fruit, mainly apples.

The female is polyoestrus and monovular, her oestrous cycle being 42 days, her gestation period 38 days. At birth the young is ¾ inches long and spends 126 days in the pouch. Thereafter, until weaning, it suckles milk from an elongated teat outside the pouch.

Shortly after parturition the female becomes oestrus (ready to mate) again and has a mating. The blastocyst of the fertilized egg, however, becomes unimplanted (or in "suspended animation") in the uterus and completes development when the young ceases suckling milk or is lost by misadventure. This is called delayed implantation or embryonic diapause and, with variations, it has been found to operate in all of the macropodids studied so far. Thus the development of the blastocyst of the post-partum mating, is inhibited by lactation of the young.

Distribution

The known geographical distribution of the potoroo is like this; it is common in Tasmania, rare in Victoria, rare in New South Wales where between 1913 and 1958 only one specimen was recorded, however, later on, Calaby (1966) discovered two colonies of potoroos in his survey area in the Upper Richmond and Clarence Rivers. Longman recorded the potoroo for south east Queensland in his *Marsupials of Queensland* published by the Queensland Museum in 1930. Between 1928 and 1964 several specimens obtained in various localities of south east Queensland, were given to the Queensland Museum. However, neither Troughton nor Iredale recorded the potoroo for Queensland in their standard works on marsupials. Marlow in *Marsupials of Australia* (1962) and Frauca, in *The Book of Australian Wild Life* (1965) also failed to record the potoroo for Queensland.

In recent years, 1966, it was Calaby who first pointed out the existence of the potoroo in the south-east of this State. Subsequently, Lyne (1967) recorded the potoroo for south-east Queensland in his *Marsupials and Monotremes* Kirkpatrick (1966) in his survey of mammals in the Warwick district,

south Queensland (see Kirkpatrick, Qld. Dept. Primary Industr., Division of Plant Industry Bulletin 380) recorded the potoroo on two occasions in the margins of rainforest.

Personal Observations

November 12th, 1968. Boolboonda Range, near Mount Perry, central Queensland. The afternoon was drawing to a close as we climbed a hill covered with woodland or open forest. As we approached the base of a bloodwood which had been charred by a bushfire and there was a cave-like hollow at the base, a small macropodid "popped out" of the ground like the proverbial jack-in-the-box. Dark grey in colour, it fled in a rapid hopping gait with the body held horizontally to the ground. A few moments later, another macropodid, smaller than the former, sprang from the ground too and fled in the direction that the first one had taken. During my four years in Tasmania I became fairly familiar with the potoroo so I could easily identify the two macropodids we had flushed. They were potoroos. They had been hiding in a form or scrape thatched over with she-oak-needles, grasses and some leaves, dug in the cave-like hollow at the base of the bloodwood. The form was about 12 inches long, 8 inches wide and 5 inches deep at its deepest. The thatch was about 4 inches thick and about 12 inches across. Examination of the thatching materials showed that they had been gathered in small bundles which may have been transported "tied" up in the tail as other rat-kangaroos are known to do. Examination of the area around the hideout showed two signs of animal feeding behaviour: a number of deep, funnel-shaped holes mainly where there had been ants' nests indicated that an echidna had fed there recently; and a series of shallow scrapes and scratches, none deeper than 3 inches could have been done by the potoroos as they dug out plant roots. That part of the Boolboonda Range consists of open forest mainly of Ironbark, Spotted Gum and Bloodwood some of which rise to about 100 feet and form a thin canopy overhead. There is a second storey of scattered she-oaks, *Casuarina,* wattles, *Acacia,* and a few Stringy-bark gums none of which reach the height of the trees mentioned above. The shrub layer is very poor or non-existent. There are some patches of short grasses, a few zamias (*Macrozamia paulo-guillenii*) a few blackboys (*Xanthorrhoea*) and some dogwood (*Jacksonia scoparia*). There are also some fallen tree-limbs and logs. The ground layer consists of fallen leaves, strips of bark, twigs etc. In 1968 there was absolutely no water in that part of the Range.

January 8th, 1969. Mount Walsh National Park, Bluff Range, Biggenden. As we were descending into the Rock-Pool Gorge, through a very steep and thickly-vegetated hillside, a potoroo flushed about four paces in front of us, hopped across a clearing between two shrub-patches, about 12 feet long, and disappeared. It had been hiding under a shrub and there was no sign of a form. That part of Mount Walsh National Park consists mainly of shrubs, blackboy trees, some banksia (*Banksia collina*), with a few stunted bloodwoods. A large section of the hillside on which the potoroo was seen, is covered with enormous boulders and some slabby cliffs. The potoroo was flushed about 600 feet above permanent waterpools which are a part of the Rock-Pool Gorge.

April 5th, 1969, Bluff Range, Biggenden. We were hiking in woodland on the foothills of the Range, and as we approached a tree stump, a potoroo sprang from the ground about three paces in front of us, and fled in rapid hops. The animal had been hiding in a thatched form dug in the ground between two stones and backed by the stump. The form was about 10 inches long by 8 inches wide and about 5 inches deep. The thatch consisted of grasses and leaves and did not look as though it had been gathered up in small bundles. By the appearance of this thatch, it seemed as though it had been the ground debris under which the potoroo had dug the form. The environment here was similar to that of Boolboonda consisting of open forest or woodland but the shrub layer was relatively thick and high in places and there were patches of relatively high grass (about 15 inches). There was a dry creek about 20 yards north of the potoroo's hideout. The

distance between this hideout and the spot in which we flushed the potoroo on January 8th, would be about half a mile in a straight line. In a year of good rainfall, there is water in the nearby creek.

April 19th, 1969, Boolboonda Range. Returning to the hill on which we had flushed the two potoroos on November 12th, we examined the area carefully and found a second form, thatched over with she-oak-needles, grasses and some leaves, under a log about 100 yards from the potoroos' hiding place found on November 12th. Much evidence of recent feeding behaviour in the form of shallow ground scratches at the foot of plants, was observed within a radius of 100 yards from the two forms. No signs of the two potoroos having returned to Form Number One, were visible.

Discussion

The presence of two potoroos in Form Number One on November 12 suggests that they were a female with her joey-at-foot. Bearing in mind that the pouch-life of this species is 126 days, then that young must have been born in July or August. The presence of the potoroo in the extremely dry environment of that part of the Boolboonda Range suggests that the species is adapted to survive dry conditions and that it may do without water for long periods. Assuming that the potoroo feeds on occasional snails in the wild, then this might be important as an adaptation to avoid water-loss. Snails are very common in the Boolboonda Range and, as is well known, they contain large quantities of fluid.

Conservation

The potoroos in the Mount Walsh National Park and in the foothills of the Bluff Range bordering with the Park boundaries should be safe from interference for the time being at least. There are neither motorable nor walking tracks into this area and access is only possible by foot. The situation in the Boolboonda Range is similar, most of this area being Forestry Department Reserve. Access to the potoroo habitat is only possible by foot or on horseback in each case, however, it is a long and arduous journey. Perhaps the fact that each area has suffered little or no intereference by man, is the reason for the survival of these two colonies. Let us hope that both areas remain undisturbed forever. The mainland potoroo is regarded as a "relict species" so all efforts to save and preserve the few existing colonies should be made. At present the writer is doing a study of these two colonies and will write up the results of his work in due course.

Suggested Reading

Hughes, R. L., 1962.—Reproduction in *Potorous tridactylus. Aust. J. Zool.,* Vol. 10, N. 2.

Calaby, J., 1966.—Mammals of the Upper Richmond and Clarence Rivers of New South Wales. *CSIRO Tech. Paper,* 10.

THE DISTRIBUTION OF TERRESTRIAL AND FRESHWATER BIRDS ON NORFOLK ISLAND

By C. N. Smithers and H. J. de S. Disney
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(Figure 1)

Introduction

During a previous visit made by one of us to investigate the conservation of the fauna and flora of Norfolk Island (Turner, Smithers and Hoogland, 1968) it became clear that several zoological problems needed more detailed investigation. One of these was the changes which had taken place in the bird fauna consequent upon the alteration of the original habitats and the introduction of foreign bird species.

The object of this paper is to present and discuss the results of subsequent observations made on the island between 16th November and 1st December, 1968, observations made mainly to determine the present distribution of the terrestrial and freshwater species of birds in relation to habitats. The small size of the island, five by three miles, makes it an admirable area for such a study.

Methods

The previous visit had provided an opportunity for preliminary study and definition of habitats; it was possible, therefore, to plan an intensive programme of observation to use the short time available on the island to best effect. Accordingly, the day was divided into four periods. 1. An early morning bird census in a given habitat. 2. A morning study period in a given area. 3. Afternoon netting. 4. A night period when certain areas were examined by torch light for roosting or active birds.

Visits were made also to Philip and Nepean Islands.

Specimens of a few selected species were collected for comparison with Australian and New Zealand forms and their stomach contents retained for analysis. A few external parasites were collected and some banding carried out. Nelson (1969, Austr. Zool. 15:199-200) reports on the external parasites collected.

Vegetation

When Norfolk Island was discovered in 1774, it was completely covered by forest. Today it presents a very different and varied appearance. It is clear from early descriptions that the vegetation cover over the island was fairly uniform and consisted of a rainforest or "brush" type of community, through which projected tall Norfolk Island Pines (*Araucaria heterophylla* (Salisb.) Franco). The main departure from this vegetation type was to be found in the gullies where ferns and palms occurred in greater numbers and where fewer pines pierced the canopy. This forest has most recently been briefly described in Turner, Smithers and Hoogland (loc. cit. p. 11 et seq.). Around most of the island, cliffs fall to a rocky coast; in one or two places, e.g. Anson Bay and Emily Bay, there are sandy beaches.

The classification of plant communities as bird habitats does not always coincide with the communities which would be defined by a plant ecologist; in many cases general physiognomy is a more important factor in determining the suitability of an area as a bird habitation than the species of plants present. Also, it is sometimes necessary to distinguish areas as habitats for birds which would be meaningless to a student of natural plant communities, e.g. urban environments.

In its original condition the island seems to have presented a remarkably simple situation with only five habitats of any significance. These were:

1. Rainforest—pine association
2. Fern-palm association
3. Sandy beach
4. Rocky shore
5. Cliffs.

The first two habitats, which occupied the greater part of the island, have been extensively altered by human interference which started immediately on arrival of the first settlers. The other habitats have been much less disturbed although extension of sandy dune areas near the coast followed forest clearing.

It is necessary to understand the causes of the changes which have resulted in the present condition of the land surface in order to understand changes in the present distribution of the bird species. By inspecting the present varied plant communities of the island, investigating the history of the activities of the settlers and subsequent human occupants of the island and considering early descriptions of the vegetation and fauna it is possible to trace the sequence of events leading to the present conditions. The existing habitats can be described and their origins traced (figure 1).

Original Habitats

1. *Rainforest—pine association* (e.g. Mt. Pitt Reserve area)

This association occurred mainly on the ridges and hillside slopes and extended to the tops of the cliffs at the coast. Its appearance and structure were somewhat unusual in that what would normally have been considered as the canopy, in this case at a height of up to about 60 feet, was pierced, as it were, by closely spaced pines. The main storey consisted of several species of hardwood trees including *Lagunaria patersonia* (Andr.) Endl. (White Oak), *Nestegis apetala* (Vahl.) L. Johnson (Ironwood), *Acronychia simplicifolia* (Endl.) Stend (Big Yellow-wood), *Zanthoxylum pinnatum* (Forst. et f.) Druce (Little Yellow-wood), *Baloghia lucida* Endl. (Bloodwood), *Dysoxylum patersonianum* (Endl.) Maiden (Sharkwood), *Elaeodendron curtipendulum* Endl. (Maple), *Celtis paniculata* Planch. (Whitewood), *Streblus pendulinus* (Endl.) F. Muell. (Sias's Backbone) and *Meryta angustifolia* (Endl.) Seem. Creepers such as *Melodinus baueri* Endl. (Big Creeper), *Capparis nobilis* (Endl.) Benth. (Devil's Guts) and *Jasminium volubile* Jacq. (Jasmine) festooned the upper storey. The lower storey consisted of smaller trees and shrubs, such as *Cordyline obtecta* Bak. (Raa Ti), *Pisonia umbellifera* (Forst. et f.) Seem. (Waiwai), *Ungeria floribunda* Schott and Endl. (Bastard Oak), *Wickstroemia australis* Endl. (Kurrajong), *Alyxia gynopogon* Roem and Schult, *Boehmeria australis* Endl., *Rapanea crassifolia* (R.Br.) Mez. (Beech), *Exocarpus phyllanthoides* Endl. and *Coprosma pilosa* Endl.

Epiphytic ferns, orchids, liverworts and mosses were present in abundance with a ground storey of numerous species of ferns, (*Psilotum rudum* (L.) Beauv.) and other small terrestrial plants.

2. *Fern-palm association* (e.g. Fern Tree Gully)

This community occurred in the valleys and on the steeper slopes with *Rhopalostylus baueri* (Hook. f.) Wendl. and Drude (Norfolk Island Palm) as a major second storey plant. In the deeper valleys the overtopping pines were fewer and *Cyathea brownii* Domin. and *C. australis* ssp. *norfolkensis* Holtt. (Tree ferns) occurred in numbers. As on the slopes and ridges there was a ground layer of ferns and other small shade-loving plants. The fern-palm community was associated with the creeks and seasonal drainage streams.

3. *Sandy beach* (e.g. Emily Bay)
4. *Rocky shore* (e.g. Cascades)
5. *Cliffs* (e.g. Cascades).

These three habitats need little description. The rocky shore consists of boulders derived from the basaltic rocks forming the cliffs above. Their size varies from enormous boulders to stones, these occasionally forming small stony beaches e.g. in Cascade Bay.

Secondary Habitats

The original forest habitats, or remnants recognizable as being derived from these, now remain only in limited areas, mainly in the Mount Pitt and Mount Bates area and the associated Forestry Reserve; small, isolated patches of similar forest are scattered over the island as well as patches clearly derived from them in various stages of degradation. The major part of the island, however, is now covered with considerably different vegetation derived from the original forest through two processes, namely, clearing and the introduction of foreign plants. The derived vegetation represents stages in

a process of continuous change, the degree of which depends on the nature of land treatment.

Habitats derived from the Fern-Palm Association

By clearing along streamsides and gullies and with the introduction of pasture grasses and grazing cattle there is produced an *Open streamside* (6) habitat in which there are remnants of the fern-palm association; this is frequently in the form of isolated or grouped ferns over a damp pasture. Further clearing and over-grazing in the upper steeper stream reaches, results in *Eroded gullies* (7) and on the lower flatter levels in silted *Open Wet Flats* (8) subject to periodic flooding. The process of silting was observed during our visit. The early part of our stay was rain-free and the damp areas of Kingston common had largely dried up or become thickly muddy. A downpour of rain resulted in open areas of water appearing on the flats and some areas of the overgrazed grass becoming covered with a layer of silt overnight. In areas of more permanent water produced by draining and silting, *Marsh* areas (9) with sedges (Cyperaceae), water hyacinth (*Eichhornia crassipes* (Mart.) Solms), and taro (*Colocasia esculenta* (L.) Schott) have developed.

Clearing of the lower storeys of rainforest-pine association in the areas near beaches resulted in a park-like pasture which with further clearing and removal of ground cover resulted in extensive *Dune* formation (10). This process has been reversed by a programme of reclamation using grasses, such as *Ammophila arenaria* (L.) Link. and by replanting pines. The present habitat may be termed *Reclaimed Pine-pasture* (11) (e.g. Emily Bay). Small areas of this habitat are to be found near Kingston. The habitat resembles *Pine-Pasture* (12) (e.g. Headstone Point) but differs mainly in that the grasses have not been grazed into lawn-like evenness and the pine stand is regular, but of variously aged trees, depending on the period at which reclamation took place. With the grass are found pasture plants, which, because of lack of grazing are taller than in the pine-pasture habitat.

The secondary habitats mentioned so far occur over relatively small areas of the island. More extensive are the areas which have been found suitable for pasture development or other farming activities. By partial clearing, that is, by clearing the lower storeys and more or less of the upper storeys, with grazing of the pasture, there results a park-like pasture habitat consisting of the remaining trees, usually pine or *Lagunaria* or a mixture of the two, standing in various degrees of density over the pasture. This is here referred to as *Pine-pasture* or *Lagunaria-pasture* (12) (e.g. Point Blackbourne). Clearing of the remaining trees (a practice still going on) results in simple *Open Pasture* (13). Where this process has been carried out to this extent near the cliff tops it may be called *Coastal Pasture* (14) (e.g. Captain Cook memorial) but the distinction is mainly a geographical one. The coastal pastures tend to be more windswept and this affects the form of subsequently regenerating flora, wind-moulding of trees, whether indigenous or introduced, being common. Overgrazing of the pasture has led to erosion and bare *Eroded Areas* (15) (e.g. southern slopes Flagstaff Hill) especially on some of the steeper slopes. At any point in the process leading from initial clearing to the formation of the eroded areas, weed introduction has occurred, depending upon the point at which proper management ceased.

Immediately on opening up the rainforest, whether by felling large pines or by track or road making, weed invasion begins. The main weeds under these conditions are *Psidium guajava* L., *Rhodomyrtus psidioides* Benth., *Solanum mauritianum* Scop., *Eupatorium riparium* Reed and *Ageratum conyzoides* L. Some of these, e.g. *P. guajava* seem to penetrate into the forest itself quite rapidly and occupy the lower storey. *Citrus limon* (L.) Burm. does likewise, but slowly and does not form the dense stands which the other weeds form. In the more open areas, *Olea africana* Mill. and *Lantana camara* L. occur as well as most of the species already mentioned. *L. camara,* however, does not appear to be able to invade the forest and, in areas where forest regeneration has been actively encouraged, appears to be eliminated by shade.

By allowing pasture, whether pine pasture, *Lagunaria* pasture or open pasture to degenerate through poor management there results a habitat which is referred to here as *Pasture with thicket* (16) (e.g. Between Broken Bridge Creek and New Cascade Road). This consists of grassy areas, usually heavily overgrazed and often tending to erode, in which thickets of the woody weed species have developed to varying degree. In some cases the thicketting may be slight, or individual plants may be scattered through the pasture. At the other extreme is the condition in which the pasture has been almost taken over by the thicket plants and the area may consists virtually of thicket penetrated by cattle tracks and with small areas of poor, overgrazed pasture remnant.

The uncontrolled grazing of cattle is the main cause of prevention of regeneration of pine, *Lagunaria* and other indigenous plants. The weeds which penetrate the pastures are those which can withstand grazing as seedlings. In areas where there has been complete protection of the flora from cattle, regeneration takes place. This is so, to some extent, at Rocky Point Reserve and although in no area has a return to the rain forest-pine association yet been achieved it is possible to distinguish a distinct habitat in which there is an abundance of pine regeneration. This is referred to as *Regenerating Forest* (17) (e.g. Rocky Point Reserve).

It may be mentioned here that areas of thicketted pasture which have been reclaimed by weed control and sound agricultural practice are indistinguishable as a habitat, from pasture which has never been permitted to degenerate.

In some areas *Eucalyptus* trees have been planted (18). Plantations consist of a few acres only and examples of these can be seen at the far west point of Mt. Pitt Reserve, Rocky Point Reserve and on the side of Flagstaff Hill on Kingston common. These form a distinct habitat of closely spaced trees with no understorey, completely foreign to the island. One of the plantations by the west point of Mt. Pitt was examined. The trees were 30-40 feet high and 5-6 inches stem diameter and about 9 feet apart. No insects were seen on them and no "nuts" underneath. They had apparently not flowered and appeared to have no food for birds.

Finally an *Urban* or domestic habitat (19) (e.g. Burnt Pine) has developed in settled areas and around farm houses. We may, then, in simple and general terms, for practical purposes, recognize the following habitats:

Original habitats.

1. Rainforest-pine
2. Fern-palm
3. Sandy beach
4. Rocky shore
5. Cliffs

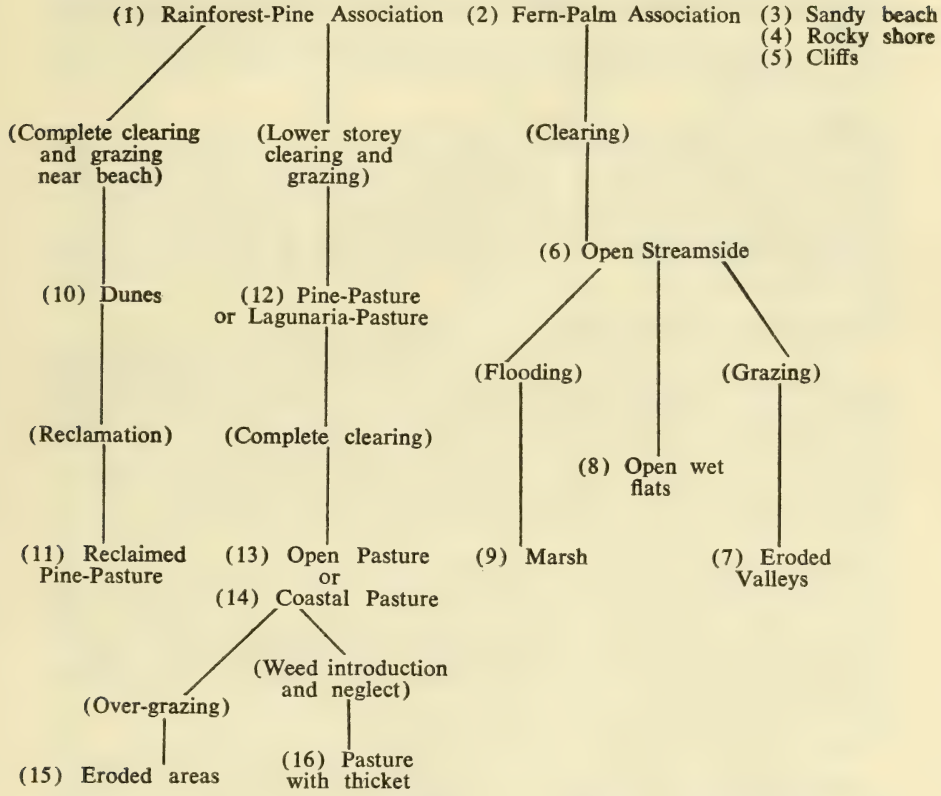
Secondary habitats.

6. Open streamside
7. Eroded gullies
8. Open wet flats
9. Marsh
10. Dunes
11. Reclaimed pine pasture
12. Pine (or *Lagunaria*) pasture
13. Open pasture
14. Coastal pasture
15. Eroded areas
16. Pasture with thicket
17. Regenerating forest
18. *Eucalyptus* plantations
19. Urban habitat.

Figure 1 indicates the probable derivation and relationships of present habitats on Norfolk Island.

Figure 1

DERIVATION OF BIRD HABITATS ON NORFOLK ISLAND



(17) Regenerating Forest—derived from (12), (13), (14) or (16) by protection from grazing and weed control.

(18) *Eucalyptus* plantation

(19) Urban habitat

Birds

A summary of the birds seen in each habitat is given in Table 1. In considering this table it should be remembered that:

(1) The table gives no indication of relative or absolute abundance of species.

(2) The table records observations made only during the period 16th November, 1968 to 1st December, 1968.

(3) Only terrestrial and freshwater birds are included. Also, it should be remembered that the observations were made at a time when several species had begun nesting activities but that few young had left their nests. This meant that for many species there was a preponderance of male birds in evidence; this was observed in the field and confirmed by the sexing of netted birds.

With these comments we may now consider the bird fauna in relation to the habitats.

White Faced Heron, *Ardea novaehollandiae*

The White Faced Heron is fairly common in suitable habitats, which are not extensive. One or two were regularly seen by the drain on the open wet flats on Kingston Common. Four were seen after 2½ inches of rain on the common and one by a rain pool in Pine Pasture along Rooty Hill Road. Wakelin (1968) records 10 sitting on fence posts on the common after flooding in August 1967 and mentioned that when the tide was out they fed on the coral reef by cemetery beach.

Black Duck, *Anas superciliosa*

Black Duck are present in small numbers frequenting marshes and streams and were seen at Bumbora Swamp, by the Melanesian Mission and Watermill Creek. They congregate on open standing water on Kingston Common after flooding. Up to 40 were seen on a pool formed after 2½ inches of rain during our visit and Wakelin (loc. cit.) recorded 52 in August 1967 on two pools, one on the golf course and one near the Administrator's residence. As a breeding species their numbers must be fairly limited owing to the relatively small areas of suitable habitat which are nevertheless more extensive now than originally.

Californian Quail, *Lophortyx californica*

The Californian Quail is a common species of more open habitats, such as pastures with thickets, open wet flats (provided cover is near by) and the more open areas of regenerating forest. It was recorded either singly or in pairs at the Melanesian Mission Swamp, Kingston Cemetery, Rocky Point Reserve, near Burnt Pine (a pair with about 8 chicks) and at Point Howe (a pair with about 10 chicks).

Eastern Swamphen, *Porphyrio porphyrio melanotus*

The Eastern Swamphen is associated with marsh areas where cover is provided for escape. It was seen feeding in open pastures and in a small wheat field near marshes. It was not seen beside the drain on Kingston Common. This is kept cleaned out and there is, apparently, insufficient cover. It was regularly seen at Bumbora Swamp and the Melanesian Mission, where a pair were seen with a young bird about one-third the size of the adults. It would seem unlikely that there were suitable habitats for breeding and feeding before human settlement with consequent clearing of creeks and streams followed by the growth of suitable cover, such as sedges and bullrushes.

Spotless Crake, *Porzana tabuensis*

This bird was said to be found in the swamp below the Mission chapel but we did not see any and no birds were found when a net was put across this swamp and the area thoroughly driven with the help of some of the island boys.

Golden Plover, *Pluvialis dominica*

These were found in open pastures, streamside areas, on the aerodrome and also the beach and wet flats. Up to 14 were seen on Kingston Common and 50 resting behind Point Hunter at high tide; they were also seen near the swamp at the Melanesian Mission.

Curlew, *Numenius madagascariensis*

One was seen on the sandy beach of Emily Bay on 18/11/68 and one on 26/11/68 on the beach near Kingston harbour. Two were on Kingston Common 29/11/68 after 2½ inches of rain.

Whimbrel, *Numenius phaeops*

One was recorded behind cliffs of Point Hunter with other resting waders, such as Golden Plover and Turnstones.

Bar-tailed Godwit, *Limosa lapponica*

Eight were seen feeding at Emily Bay, where the drain from Kingston Common enters the sea. Forty were seen on Kingston Common after 2½ inches of rain.

Turnstone, *Arenaria interpres*

Three were seen feeding with Godwits at Emily Bay and 15 were noted on Kingston Common after rain.

Red-necked Stint, *Calidris ruficollis*

One was seen on Kingston Common after the rain.

The above migrant species are all associated with open flat areas and beaches, some, such as the Golden Plover, were frequently on open pastures, open stream side areas or on the aerodrome.

Tattler, *Heteroscelus* sp.

A Tattler was seen in its typical habitat feeding on the rocky shore of Point Hunter on 19/11/68. It could not be identified to species.

White Tern, *Gygis alba royana*

The White Tern nests in the pine trees, but also uses other tall trees with suitable horizontal branches. It does not usually nest on the coast, but inland where there is some shelter; many nests are placed well inland far from the coast. It is reported to be much less common than in earlier times.

Domestic Pigeon, *Columba livia*

The Domestic Pigeon occurs near buildings and was seen in the open streamside habitat at Kingston Gaol and the Melanesian Mission. It nests in colonies in caves in the shore cliffs, such as near Cascade Harbour. It is not present in great numbers, and is on the official list of protected birds. Presumably lack of abundant suitable food and lack of nesting sites prevent its increasing.

Green Winged Pigeon, *Chalcophaps indica*

The Green Winged Pigeon is a bird of the forest like its Australian relative, but is found wherever there are trees giving heavy shade.

It was seen by us throughout the Mt. Pitt Reserve, Rocky Point Reserve and was seen near Burnt Pine. It was once a very plentiful bird but it has been harassed and is now less abundant.

Rosella, *Platycerus elegans*

The Rosella (or Crimson Rosella of Australia) is common in all habitats. Besides feeding in the trees it also feeds on the ground and was seen on Kingston Common perching on the wall of the prison ruins. It also visits the islands a few yards off shore and was seen on the island opposite Captain Cook's Monument. Besides nesting in holes in trees they also nest in chimneys (Wakelin, 1968). This species is well known to be pugnacious when breeding in captivity and it is almost certainly competing for nesting sites with the Norfolk Island Parakeet (Green Parrot, *Cyanoramphus novaezelandiae*) and is probably responsible for the retreat of this latter species.

Green Parrot, *Cyanoramphus novaezelandiae verticalis*

The Green Parrot is now very uncommon and is restricted to rainforest areas, except when fruit trees are in fruit, when it enters gardens. It is particularly fond of peaches. It has been reported as occurring in *Eucalyptus* plantations adjacent to rainforest.

It was seen by us only in Palm Glen on the Mt. Pitt Reserve where its call, rather like a weak Kookaburra call (Wakelin 1968) can regularly be heard, but when the peaches are ripe it visits gardens on the northwest of Mt. Pitt Reserve and elsewhere. This species must be in competition with the Rosella and the spread of the latter appears to be a factor in the restriction of the Green Parrot. It is unlikely that there are more than a few resident pairs remaining on the island and these are normally restricted to the Mt. Pitt Reserve.

Long Tailed Cuckoo, *Eudynamis taitensis*

One reported visiting a garden.

Shining Bronze Cuckoo, *Chalcites lucidus*

One of this species was seen near the Melanesian Mission Swamp. It is a migrant from New Zealand but also breeds on the island, laying its eggs in the nest of the warbler (North, 1889). Its call has been heard frequently by islanders.

Boobook Owl, *Ninox boobook royana*

This species was not heard by us but local naturalists still hear it.

Norfolk Island Sacred Kingfisher, *Halcyon sancta norfolkiensis*

The Kingfisher is fairly common and seen in a variety of habitats; the only requirement seems to be the availability of reasonably high perches from which to sight prey. It was observed feeding on crabs on the rocky shore of Cascade, on insects at Kingston Common, Bumbora Reserve and elsewhere, and diving into the stream at the Melanesian Mission in typical kingfisher fashion.

Banks of suitable soil provide nesting sites, as at the base of the cliffs at Cascade Harbour. There were probably ample suitable sites originally on the island and man's alteration to the environment has not adversely affected the species as its habits suit it for feeding and nesting in a variety of habitats. Habitat alteration may, in fact, have increased its numbers.

Spine Tailed Swift, *Hirundapus caudacutus*

Spine Tailed Swifts were seen over the summit of Mt. Pitt throughout our stay from 16th-29th November, with a maximum of 12 at any one time.

Grey Headed Blackbird, *Turdus poliocephalus poliocephalus*

The Grey Headed Blackbird is now seldom seen by islanders. Two males were observed in the rainforest by the Mt. Pitt - Mt. Bates road junction and two males netted in the same area. At one time this species was a common bird all over the island and was the most familiar garden bird. It is now rare. It is found only in the rainforest. The reduction in area of rainforest has restricted its range. When, previously, there were fairly extensive areas of rainforest remnant adjacent to settlement it was a garden inhabitant. With the reduction in extent of these areas its range has become restricted to rainforest. It seems that it requires larger remnant areas for survival than does the Robin. The behaviour of this species appears, from the casual observations made, to resemble those of the Blackbird (*Turdus merula*) to which it is very similar. These two species undoubtedly come into direct competition with each other and the retreat from the garden and rainforest remnant habitats by the Grey Headed Blackbird is probably as much due to the pressure of competition from the Blackbird as it is to the removal of rainforest. It is significant that the Blackbird is now found within the forest although the major part of the large population is in other habitats. It is found in the rainforest in small numbers so that it is probably competing with the Grey Headed Blackbird.

Blackbird, *Turdus merula*

The European Blackbird is very common in all cultivated and pasture areas, including gardens. Many more males than females were in evidence; the latter were in the initial stages of nesting. The penetration of this species into the rainforest, as mentioned under Grey Headed Blackbird, has taken place in small numbers and it was found in the same area as the latter, also in Palm Glen and the forest at Rocky Point Reserve. It is common in open areas although needing at least scattered bushes for nesting.

Song Thrush, *Turdus philomelos*

The Song Thrush is common but not as abundant as the Blackbird. It, too, is found in the forest, a bird being caught together with a Blackbird in the same area as the Grey Headed Blackbirds on Mt. Pitt. In general, however, it is more common in the open habitats such as pastures. It was the only species seen in a *Eucalyptus* plantation where it was nesting 20 feet up. It is found in the pasture with thicket habitat where a nest was found only 18 inches above ground in a small evergreen bush.

Warbler, *Gerygone modesta*

The Warbler is common wherever there is some tree or shrub growth. It is found in the rainforest, thickets, gardens and *Lagunaria* pasture. It was not seen in Pine-pasture. It is successfully inhabiting a wide range of habitats. It has been recorded as acting host to the Bronze Cuckoo (North, 1899).

Robin, *Petroica multicolor multicolor*

The Robin is essentially a forest bird and the comments made below covering the Tamey apply also to this species. It can be found quite easily in the rainforest and in some fairly small forest remnants but was not seen beyond this habitat. It was not seen in regenerating forest. It frequently feeds on the ground and a habitat with low, horizontal perches appears necessary; it seldom clings to thin vertical stems (the Tamey does). There do not appear to be any introduced species which would compete closely with it and reduction in number is clearly a direct result of breeding habitat alteration. Its distribution on the island may be more extensive in non-breeding periods.

Fantail, *Rhipidura fuliginosa pelzelni*

The Fantail is very common and is found in any habitat in which trees or shrubs are available. Clearing of forest and alteration of environment appears to have little effect on this species, as it has been able to adapt itself to all in which some tall vegetation has remained or into which it has penetrated as tall weed growth.

Tamey or Norfolk Island Whistler, *Pachycephala xanthoprocta*

The present distribution of the Tamey is interesting. It is a bird of the lower storeys of the rainforest-pine habitat and is fairly common in this situation. It also occurs in other habitats in which there is deep thicket having the same physical structure as the rainforest. Thus, it occurs in remnants of the rainforest, in garden shrubbery and in regenerating forest. It is reported to be less common in gardens than it was; this retreat is not due to its being molested as it is a universally popular bird; this restriction must be due to other factors. Patches of rainforest remnant are being reduced in many areas and it seems that these reservoirs, once close to dwellings, are now generally fewer. Although widely distributed over the island, this species is clearly unable to adapt to habitats other than those resembling its original habitat. Excessive clearing, therefore, is reducing its distribution. It is capable of maintaining itself in relatively small patches of suitable habitat, such as small groups of rainforest trees left near the stream behind the Melanesian Mission Church.

Eastern Silvereye, *Zosterops lateralis*

The Eastern Silvereye is very common, usually ocurring in small flocks (at the time of our observations). It is far more common than the two other species of Silvereye and found in the pasture with thicket habitat as well as being found in any other closely wooded habitat. It was first recorded on the island in 1904 (North, 1904).

Long Billed Silvereye, *Zosterops tenuirostris*

The Long Billed Silvereye was seen in the same habitats as the Eastern Silvereye and, although fairly common, occurred in smaller groups (of three or four) mainly in the rainforest and rainforest remnant. Mutual preening was seen several times. Breeding may well start a little earlier in this species

than in the Eastern Silvereye and our observations suggest that it has greater preference for the rainforest habitat.

White Breasted Silvereye, *Zosterops albogularis*

Only one certain sighting of the White Breasted Silvereye was made; this was in a small patch of remnant rainforest in which the lower storeys had been thinned and from which most ground vegetation had been removed. Two birds were observed preening each other. This species is certainly not common and the fact that it was not seen in any of the more open habitats suggests that it is restricted to the rainforest habitat. With the small numbers seen, however, it is not possible to be dogmatic on this point.

Greenfinch, *Chloris chloris*

These were seen at Ball Bay and 12 were seen in the same area in November 1965 (Wakelin 1968). It was also seen crossing Mt. Pitt road.

Goldfinch, *Carduelis carduelis*

Some specimens, with some young birds, were seen feeding on thistles near the Melanesian Mission.

Sparrow, *Passer domesticus*

The House Sparrow is abundant in urban areas, around homesteads and in paddocks. It is the only bird seen in the Reclaimed Pine-pasture areas at Emily Bay. As well as nesting in holes it sometimes nests in trees near buildings. It was seen feeding at the flowers of the introduced *Grevillea robusta.*

Starling, *Sturnus vulgaris*

The European Starling is extremely abundant. It has invaded many of the habitats and was seen nesting in holes in trees and in banks and along the cliffs. It has not invaded the rainforest habitat although a few specimens were seen in the treetops from time to time. It also was seen feeding at the flowers of *Grevillea robusta.*

Norfolk Island Starling, *Aplonis fuscus*

This was not seen.

Conclusions

The original rainforest-pine association which covered the island provided suitable habitat for a relatively small bird fauna. The species included the Tamey, Robin, Fantail, Silvereyes (two of the three species), Warbler, Grey Headed Blackbird, Green Winged Pigeon, Green Parrot, Black and White Sparrow (*Lalage leucopyga*), Norfolk Island Starling, Boobook Owl, White Tern and the now extinct Norfolk Pigeon (*Hemiphaga argetraea*) and Philip Island Parrot (*Nestor productus*). The Kingfisher was probably also fairly widely distributed but may have been restricted to the coast and to streamsides. From time to time the Bronze Cuckoo and the Long Tailed Cuckoo (*Eudynamis taitensis*) were present as migrants, the former sometimes breeding. The fern-palm association has very few bird inhabitants; in fact, only the Long Billed Silvereye was seen in the pure stands of palm and fern, which occur within the rain forest area, although the immediately surrounding rainforest carried a large bird population. The ferns and palms seem to be avoided as a habitat although, of course, birds occur in it from time to time. The reduction of the rainforest area has meant the reduction in range of those species which have not been able to adapt to or stay in the newer habitats provided through man-made changes. These species include the Robin, Long Billed Silvereye, White Breasted Silvereye, Grey Headed Blackbird and Green Parrot. Clearly, the Black and White Sparrow and the Norfolk Island Starling should be included here; they have not been seen for many years and it is doubtful whether they exist now on the island. Other rainforest birds have been able to survive the changes and take up habitation in the new environment with varying degrees of success. These include the Fantail, Green Winged Pigeon and Warbler which are now found in a variety of habitats. The

Kingfisher has probably taken advantage of cleared areas as a food producing habitat, it occupies a wide range of habitats for feeding and is probably restricted more by breeding sites than other factors. The Tamey, although widespread on the island, seems to be associated still only with rainforest remnants or shrubberies having a similar structure. The Boobook Owl has become much reduced in numbers in recent years.

The opening up of streamsides and the formation of wet flats and marshes has given opportunity for colonization and increase in numbers of birds associated with these habitats. Black Duck, Swamphens and White Faced Herons are probably more abundant now than earlier. They can take advantage of extended open streamside and marsh habitats and the Black Duck and White Faced Heron also find extended feeding areas on the open wet flats; the Swamphen however, requires more cover than the other two species. The present status of the Spotless Crake (*Porzana tabuensis*) and the Banded Land Rail (*Rallus philippensis*) is not known. They have not been recorded for many years and some local naturalists have never seen them at all. They are probably very unccomon, if present at all.

Many species of Waders have been recorded from Norfolk Island. The island probably always provided some areas suitable for their short periods of stay. The increase in the areas of open wet flats has clearly provided them with greater feeding grounds and some species, such as the Golden Plover and Godwits, have also taken advantage of other open areas for feeding, such as on the aerodrome. With further observation more species will undoubtedly be recorded but an increase in recorded species under these circumstances indicates an increase in observations rather than an increase in the number of species visiting the island. From published records the Whimbrel would be expected to be the most common Wader and the Bar Tailed Godwit would be expected to be rare. Our observations indicated precisely the opposite. This is probably due to the time of year at which recorded observations have been made and is of little significance so far as general suitability or changes of habitat are concerned.

The group of species which has most gained advantage from the changes in habitats on the island is that of the introduced birds.

Many species would certainly not have become established without removal of the rainforest and establishment of other habitats. The Rosella has occupied many habitats, and can be found over most of the island. It occurs in the rainforest and probably competes strongly with the Green Parrot for food and nesting sites. It is possible that competition for nesting sites between the Rosella and Boobook Owl has resulted in the reduction in numbers of the latter although competition for food with feral cats could well be another major factor affecting the owl populations.

It is, however, in the introduced European species that we see the extensive occupation of the more open habitats. The Blackbird, Song Thrush, Starling and Sparrow have developed large populations in habitats similar to those to which they have become so thoroughly adapted in Europe. The Sparrow, as usual, is for the most part closely associated with human dwellings but can be seen in grain crop fields (of which there are few on Norfolk Island) and searching the pines in Pine Pasture. The Blackbird, Song Thrush and Starling are widely distributed and present in large numbers in urban and agricultural habitats with the Blackbird and Song Thrush showing signs of being sparsely scattered in the rainforest. The Blackbird is probably responsible for the reduction in numbers and retreat of the Grey Headed Blackbird. The Goldfinch and Greenfinch, being seed eaters, have not become so numerous as some of the other introduced birds; this may well be due to shortage of suitable seeds for food. The main pasture grasses are Buffalo (*Stenotaphrum secundatum* (Walt.) O. Kuntze) and Couch (*Cynodon dactylon* (L.) Pers.) and these are almost everywhere close-cropped by grazing. Buffalo Grass seldom seeds and the quantities of seed produced by the Couch Grass would be small and seasonal as are weed seeds.

It is interesting to note that those indigenous rainforest species which have survived the changes in habitat and have occupied the new habitats do not come into direct competition with the introduced birds in these habitats. The Warbler, Fantail and Tamey are insect feeders in the trees. Silvereyes are arboreal with a wider food range. The most successful introduced birds, other than the Starling, are mainly "insectivorous" ground feeders (they feed also on worms and other invertebrates) such as the Blackbird and Song Thrush. The Robin and Grey Headed Blackbird, which have retreated with the rainforest, are also mainly ground feeding "insectivores".

The regeneration forest, even when not fully regenerated into a condition similar to that of the original rainforest, seems to be able to provide an adequate habitat for most of the indigenous forest birds.

The most depauperate habitats so far as indigenous birds are concerned are the pasture habitats, whether these include scattered trees or not; the reclaimed pine-pasture, too, was inhabited only by Sparrows, which, in any case, probably came from the nearby houses at Kingston.

The pasture-with-thicket habitat is fairly rich in birds, and the fauna is made up about equally of native and introduced species; the former are represented by their more adaptable members. The areas where the Tamey occurs in this habitat are adjacent to forest remnants or gardens with fairly dense shrubbery.

The *Eucalyptus* plantations carried virtually no bird fauna. Local naturalists reported having seen a Robin in a plantation immediately adjacent to an area of rainforest-type vegetation.

TABLE 1

Summary of birds seen in various habitats on Norfolk Island between 16.11.1968-1.12.68	Rainforest-Pine 1	Fern-Palm 2	Sandy beach 3	Rocky shore 4	Cliffs 5	Open streamside 6	Eroded gullies 7	Open, wet flats 8	Marsh 9	Dunes 10	Reclaimed pine pasture 11	Pine or Lagunaria pasture 12	Open Pasture 13	Coastal Pasture 14	Eroded areas 15	Pasture with thicket 16	Regenerating forest 17	Eucalyptus plantation 18	Urban habitat 19
White Faced Heron							SMALL AREAS, NOT SPECIFICALLY INVESTIGATED	x		NO BIRDS SEEN, AREA SMALL					NO BIRDS SEEN, AREA SMALL				
Black Duck						x		x	x										
California Quail								x								x	x		
Swamphen						x			x										
Golden Plover			x			x		x					x	x					
Curlew			x					x											
Whimbrel			x																
Bar-tailed Godwit			x					x											
Tattler				x															
Turnstone			x					x											
Red-necked Stint								x											
White Tern	x																x		
Domestic Pigeon					x	x													x
Green Winged Pigeon	x															x	x		
Crimson Rosella	x							x					x			x	x		x
Green Parrot	x																		
Shining Bronze Cuckoo																x			
Kingfisher				x	x	x		x											x
Grey Headed Blackbird	x																		
Blackbird	x							x					x	x		x	x		x
Song Thrush	x												x	x		x		x	x
Warbler	x											x				x	x		x
Robin	x					x													
Fantail	x											x				x	x		x
Tamey, Whistler	x															x	x		x
Silvereye, *lateralis*	x															x	x		x
Silvereye, *tenuirostris*	x	x														x	x		
Silvereye, *albogularis*	x																		
Greenfinch						x													
Goldfinch													x			x			
Sparrow								x			x	x	x	x					x
Starling	x				x			x				x	x	x		x	x		x

Final Comments

The observations made on the indigenous birds of Norfolk Island in relation to their habitats have provided a preliminary picture of the present distribution of the species in relation to habitat, habitat changes and introduced species. The period of observation was short and our data on distribution on the island can relate only to the period of observation. It is to be hoped that opportunity for similar studies at other seasons will occur and comparison with our findings would be interesting.

Our observations have shown beyond doubt the vital necessity of providing protection for *adequate areas* of the original habitat if the continued existence of some of the indigenous species on the island is to be assured. They are not surviving and cannot survive other than in their original habitat; some may be restricted for breeding and be more widespread at other times, in such cases the preservation of the breeding habitat is vitally important.

Also, it seems that some of the indigenous species are surviving in new habitats because of lack of competition. There should be no further introductions if the danger of introducing fatal competition is to be avoided. In the case of the Grey Headed Blackbird it may be too late; the Blackbird may now be driving it out of its last retreat in the forest after apparently having driven it out of its other habitats. It seems that the Norfolk Island Starling and the Black and White Sparrow have already disappeared.

Our observations have indicated where the most urgent needs for bird studies on the island lie. These include:

1. A detailed study of the invasion of the rainforest by introduced birds.
2. A study of the competition between introduced and indigenous species in secondary habitats.
3. Detailed studies on the biology and ecology of the indigenous species, most urgently those of the rainforest.

Acknowledgements

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NESTING, EGG-LAYING AND HATCHING OF THE SNAKE-NECKED TORTOISE AT CANBERRA, A.C.T.

by W. J. M. VESTJENS*

(Plates IV-V)

SUMMARY

Eggs of the Snake-necked Tortoise, *Chelodina longicollis* (Shaw), were laid in nest cavities dug into sloping ground during or soon after rain. The nest cavities were sealed with a plug of compacted damp soil which baked hard in the sun. Eggs hatched after 118 to 143 days. Incubation time appeared to depend on temperature as eggs laid in January and February took longer to hatch than those laid in November and December. After hatching the young tortoises are confined to the nest cavity until rain softens the plug and they can emerge.

I. INTRODUCTION

Harrington (1933) and Goode (1965) have given detailed descriptions of the nesting behaviour of some captive Australian tortoises including the Snake-necked Tortoise, *Chelodina longicollis* (Shaw), but they give no information on what happens in the wild.

This paper reports the nesting behaviour of *Chelodina longicollis* (Shaw), near Canberra, in the Australian Capital Territory, where it was studied from 1958 to 1960 and from 1962 to 1967.

II. STUDY AREA

The study area (Plate IV) included a pond with an area of about 750 sq. yds. at Gungahlin near Canberra. The northern quarter of the area surrounding the pond was a slope and the remainder of the surroundings was flat ground. The pasture around the pond comprised a mixture of Spear grass, *Stipa falcata,* and *S. aristiglumis,* Rush, *Juncus* sp., Blue Devil, *Eryngium rostratum,* Dock, *Rumex brownii,* Plantain, *Plantago lanceolata,* and Spear Thistle, *Cirsium vulgare.*

The slope leading down to the pond included an area of about 900 sq. yds. growing mainly Yellow Buttons, *Helichrysum apiculatum,* interspersed with mosses. Also present were Spear Thistle, *C. vulgare,* Blue Devil, *E. rostratum,* Spear grass, *S. falcata, Danthonia* spp. and a *Poa* species. The vegetation on the *Helichrysum* patch was less dense than elsewhere around the pond. No trees or shrubs were present on the slope or nearby.

The soil profile in the area dominated by *Helichrysum apiculatum* was as follows: 0-4 in.—brownish-grey to brown medium clay containing a considerable amount of gravel with pieces up to ½ in.; 4-6 in.—heavy clay with large pieces of decomposing shale; below this was a heavy clay with much larger pieces of shale impenetrable to a soil auger.

In the area surrounding the *Helichrysum* patch the soil was less heavy in texture and the profile was as follows: 0-4 in.—brownish-grey loamy-clay with a small amount of gravel with pieces up to 1/16 in.; 4-7 in.—brownish-grey medium clay; below this was a heavy clay with large pieces of decomposing shale.

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III. METHODS

Nests of *C. longicollis* were found by regularly and systematically searching the study area and by following trails left by animals from the water. Nests were marked with a serial number on a wooden stake hammered into the ground approximately 6 in. to the east side of each nest. To enable the contents of the nest to be checked from time to time, the plug with which the female had sealed the nest cavity was cut round with a knife and it was then lifted out gently. After each inspection the plug was replaced and pressed down. Some plant debris was used to camouflage the nest after each check.

Eggs and young tortoises were taken out of the cavities with a pair of long blunt-nosed forceps. Ovulation was observed by dissection and measurement of the ovary. Measurements of eggs and the carapace of the embryo and of young were made with calipers.

IV. RESULTS

(*a*) *Copulation*

Copulation was observed only twice—on September 22, 1958, and on October 4, 1965—and did not appear to differ from the description by Worrell (1962). Ovulation followed one or two months later; there was no evidence that it was initiated by copulation.

Barney (1922) and Hildebrand (1929) recorded that spermatozoa would survive for four years in impregnated Diamond-back Terrapins, *Malaclemys centrata*. Ewing (1943) found that Box Turtles, *Terrapene caroline,* continued to produce eggs into the fourth year after mating. In *C. longicollis* a female kept in solitary captivity for nine months still produced fertile eggs. Another animal, collected during November, laid fertile eggs after 12½ months.

(*b*) *Nesting and Nesting Place*

A description by Harrington (1933) of nest digging by *C. longicollis,* stated that this took place on moonlit nights. In 21 observations of nest building around Canberra only two of these were on moonlit nights. Daily checks in the morning on the study area indicated that *C. longicollis* would dig a nest at night *during or after rain.* Only one animal was found digging a nest during the afternoon, and this was on an overcast and dull day. Three recordings of eggs being laid during the day were obtained from eight animals kept in captivity.

Harrington (1933) indicates that the nesting place is 3 ft. from the edge of water. Of the 20 nests observed in the Canberra study area the minimum distance from the water's edge was 6 ft., while the maximum was 310 ft. Most nests were approximately 30 ft. from the water.

One nest was found 2 ft. above the highest waterline; all the other 19 were between 7 and 9 ft. above it.

Nests were never found outside the *Helichrysum* patch. One reason for this may simply have been that in this area the vegetation was lower and less dense. The soil in this patch was probably harder to dig in, as indicated by the profile. As this area had better drainage there was less chance of the eggs being flooded.

Harrington (1933) recorded the time for preparing the cavity as approximately half an hour. His observations were in an enclosure with sandy soil. At Canberra digging times for four nest cavities were 45, 65, 70, and 80 minutes. An indication that longer times could occur was that an animal in captivity took 185 minutes to complete the cavity after a previous attempt to dig in a very shallow layer of soil above a rock. This animal rested several times for periods up to seven minutes and was seemingly greatly handicapped by sticky clay.

These observations agree with Harrington's statement that the time needed to dig a cavity depends on the physical characteristics of the soil.

Most authors mention the use of cloacal fluid to moisten soil for digging. The present observations were made during rain and the excretion of cloacal fluid has not been noticed.

(*c*) The *Nest Cavity* (Fig. 1)

The entrance to the pit in which the eggs are laid has an average diameter of 2¼ in. for a distance of 1¼ to 2 in., then the burrow widens to a round or elongated chamber. Of 12 nests nine were elongated.

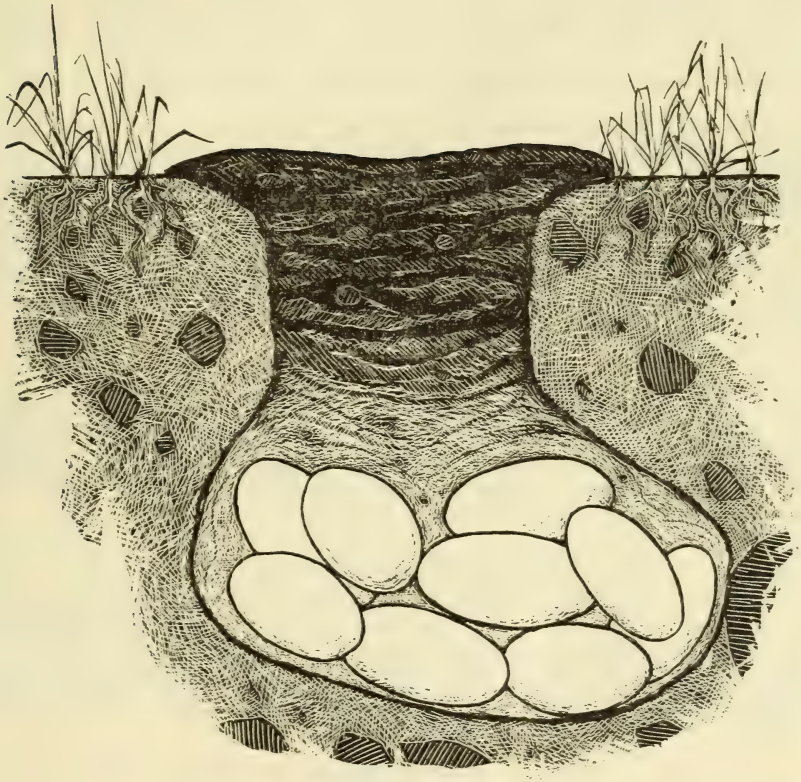

Fig. 1.—Nest cavity.

TABLE 1

RANGE OF MEASUREMENTS OF 12 NESTS OF *CHELODINA LONGICOLLIS*

	Maximum (mm)	Minimum (mm)	Mean (mm)
Depth of nest from surface	127	82	113
Length of chamber	127	89	115
Height of chamber	57	32	51
Width of chamber	63	51	57

The range of measurements of 12 nests is given in Table 1.

Eggs are laid after the nest has been dug. The actual process of egg-laying of *C. longicollis* is the same as described by Goode (1965) for *Emydura macquarii*. If no soil is available eggs may be laid in water (pond at Canberra Community Hospital, March 6, 1967), or on a concrete floor (Narrabundah, A.C.T., June 27, 1967).

During 1963, 1964, and 1966, a number of nest holes were dug and were left open. No explanation can be given for this behaviour, which has also been observed by the author in the Green Turtle, *Chelonia mydas*, in 1948 in east Java, Indonesia.

(*d*) *Date of Egg-laying*

Waite (1929) cites November and December as egg-laying time for South Australia, while Goode (1965) stated that in Victoria the period was midsummer. In Canberra the earliest date recorded was November 8, while the last eggs were laid on January 3. With animals kept in captivity later dates were recorded, up to June 27.

(*e*) *Clutch- and Egg-Sizes*

Only one clutch of eggs is laid in the season. In 15 nests, the largest clutch was 24 eggs, the smallest 13, and the mode was 19 eggs. The time needed for animals to lay clutches was observed on four occasions as 9, 13, 18, and 21 minutes for 19, 18, 24, and 18 eggs respectively. There were only four females, of the same size, whose clutch-sizes were known. There was no evidence of any relationship between the size of the animal and of its egg clutch.

The ranges of length and width of 142 eggs are given in Table 2. Goode (1967) says that egg size depends on the size of the female and may vary by as much as 10 mm in length.

TABLE 2

RANGE OF MEASUREMENTS OF 142 EGGS OF *CHELODINA LONGICOLLIS*

	Maximum (mm)	Minimum (mm)	Mean (mm)
Length	33.8	21.0	30.3
Width	21.3	12.5	19.6

(*f*) *Closing the Nest*

After the eggs are laid the tortoise scoops the soil back into the nest entrance. The surplus soil is scooped on top of the already closed entrance, the tortoise then lifts its body as high as possible by stretching the four legs, and drops it heavily on top of the loose soil. This movement is repeated until all the soil is tamped down on top of the entrance. The packed soil in the entrance varied between 45 mm and 63 mm thick. When the entrance had been closed the animals returned to the water.

The time involved in closing the nest entrance depends on the moisture content of the soil. When the soil was damp three animals took an average of 30 min. to close the nest holes. In a muddy soil each of two animals took about 125 min., and they had difficulty in separating the muddy earth from feet and plastron, and several long rests were taken during the labour of closing the entrance. Goode (1965) has given similar descriptions of tamping of the soil by *Emydura macquarii*. Harrington (1933) apparently overlooked this aspect in *C. longicollis*.

The nest entrance could be easily found in the first few days after digging, except in plant-free areas where no traces could be observed after two days. The evidence of digging was eventually obliterated by rain and after the soil had been sunbaked for weeks the top layer of the plug dried out so much that it was rock-hard. Nearby plants which had been flattened during the digging, soon recovered. No plants grew on top of the entrance for the rest of the year in which the digging occurred.

(*g*) *Egg Losses*

Harrington (1933) stated that rats ate the eggs of *C. longicollis;* no evidence of this was found in the present study. The tortoise uses the hindfoot to arrange the eggs in the burrow and during this procedure the sharp claws may puncture the eggs. Punctured eggs were found in 12 nests out of 20 and egg losses from this cause varied from 8% to 25% per clutch. Punctured eggs have been found infested with fly maggots.

Arthropods, including wood-slaters (Isopoda), spiders (Arachnida), centipedes (Chilopoda), and insects (Insecta) were commonly found in nest cavities. Insects included spring-tails (Collembola), ground-beetles (Coleoptera, fam. Carabidae), rove-beetles (fam. Staphilinidae), and histerid beetles (fam. Histeridae). No indications were found that any of these arthropods cause damage to the eggs.

In five clutches all eggs were infertile; the other 23 clutches had between 5% and 50% infertile eggs. The number of infertile eggs seems to increase in clutches that are laid in the second half of the breeding season, as is shown in Table 3.

TABLE 3

INFERTILE EGGS IN CLUTCHES DURING THE 1966/67 SEASON

Laying Dates	Number of Eggs in Clutch	Number of Infertile Eggs
28.xi. 1966	18	1
28.xi. 1966	21	0
28.xi. 1966	17	1
13.xii.1966	20	6
13.xii.1966	17	9
29.xii.1966	19	15
3. i. 1967	18	16

Two nests which were found during the 1966-67 season and which were not properly closed by the animal contained desiccated eggs only. Dented eggs were common, probably because there are usually two layers of eggs in the nest cavity. Eggs with dents hatched successfully.

(*h*) *Development*

Development of the embryo was not obvious during the first 15 days after egg-laying.

Three clutches, all of the same age, were sampled at intervals by taking one egg from each clutch: the size of the embryo at various ages was determined by measuring the carapace. Measurements are given in Table 4.

TABLE 4

MEASUREMENTS OF CARAPACE OF EMBRYOS

Age of Eggs[1] (days)	Embryos[2] Measured	Nest A Length (mm)	Nest A Width (mm)	Nest B Length (mm)	Nest B Width (mm)	Nest C Length (mm)	Nest C Width (mm)
32	3	No carapace developed					
40	3	First sign of development of carapace					
62	3	9.8	7.8	10.5	8.0	10.3	8.0
80	3	15.9	13.9	16.0	14.5	16.0	14.2
122[3]	3	22.0	19.5	21.5	19.2	22.7	19.8

[1] Laying date 2.xii.1966.
[2] One egg from each nest.
[3] The hatching age for some eggs in the same nest.

The incubation period for these eggs was 122 days. Shorter and longer periods have been recorded. During the 1966/67 season, eggs laid in November hatched after 118 to 125 days, while eggs laid in December took 131 to 143 days to develop. In the study area only one nest was recorded with eggs laid as late as January 3. Hatching of these eggs occurred after 148 to 150 days.

The incubation period seems to depend on temperature. Eggs laid between early November and the second half of December receive more heat than at any other time of the year. After February the soil temperature drops (Fig. 2), but the tortoises are still able to hatch as late as early June.

A longer incubation period was observed in eggs laid by an animal in Ainslie, A.C.T., on January 13, 1960.

Measurements were made of the carapace in the embryos from this nest. Only one embryo could be measured on each date. Data are given in Table 5.

TABLE 5

MEASUREMENTS OF CARAPACE OF EMBRYOS FROM EGGS IN ONE NEST (AINSLIE, A.C.T.)

Age of Eggs[1] (day)	Number of Embryos	Length (mm)	Width (mm)
60	1	5.0	2.5
84	1	9.0	7.2
132	1	11.0	9.1
191	1	12.1	10.5

[1] Laying date 13.i.1960.

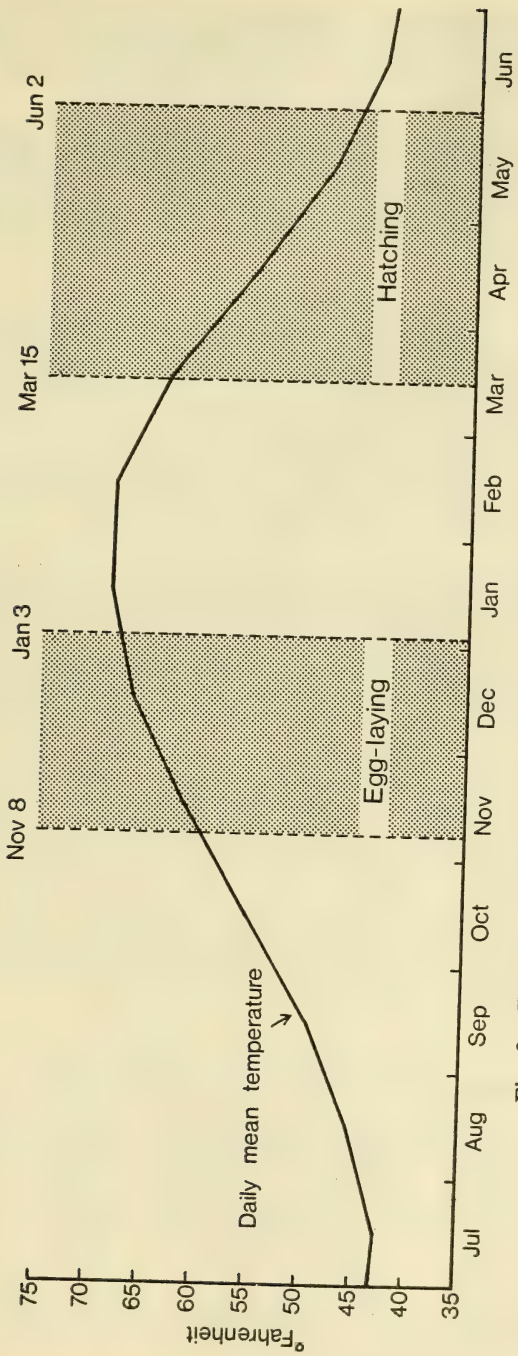

Fig. 2.—Egg laying and hatching periods of *Chelodina longicollis* at Canberra, A.C.T. in relation to monthly average daily mean temperature. (Temperature data from Commonwealth Bureau of Meteorology 1956—"Climatic Averages Australia.")

Insufficient eggs were available for development to be followed to hatching.

Data in Tables 4 and 5 show the slower developments in a late clutch. The average carapace length in clutches laid in early December was 10.2 mm after 62 days of incubation, while in a clutch laid in January the carapace length was still only 11.0 mm., after 132 days of incubation.

Gadow (1900) pointed out that in *Emys orbicularis* the hatching of the eggs is deferred until the next spring, the embryo's development being arrested during the winter. In *C. longicollis* the development of the embryos slowed down during the winter, but due to the unavailability of eggs no evidence could be obtained that the hatching would have been delayed until the next spring.

(*i*) *Hatching*

When the embryo is completely developed it cuts its egg shell with its caruncle. This "hatching tooth" is 0.4 mm long, has its point curved upwards, and is situated approximately 1 mm under the nostrils on the premaxilla. Tortoises which feed soon after hatching and are active, lose their caruncle after three or four weeks. Some remained inactive after hatching and retained the caruncle for more than three months, losing it during the winter.

The newly-hatched tortoise is unable to retract its head under the carapace. The yolk sac is still connected at the plastron centre between the hyoplastron and hypoplastron plates; the remains drop from the animal after two to three days.

Evidence was obtained that young are unable to leave the nest until it rains. Regular inspection of nests indicated that young were found in the cavity some days and weeks after hatching, but they left the cavity after the first rain. In an observation in January 1965, eggs of the same nest were divided up into three batches and were buried in three nest-holes, identical in size and depth to the original nest. One batch was given an artificial rain shower every two weeks; the second was subjected to natural rainfall; and the third batch did not receive any water but was able to obtain normal sunlight. An intact nest of the same age was checked regularly for normal development. The eggs in the nest which received artificial showers decayed; those in the nest which received normal rainfall hatched and the young were able to leave the nest 10 days after hatching. The third batch was kept dry for 30 days after hatching, then the entrance was soaked with water, and 20 minutes later the young left the burrow for the nearest water (Plate V).

(*j*) *Size of the Young Tortoises*

The carapaces of newly hatched tortoises were measured and the animals were returned to the nest cavity. Measurements were obtained again after 10 and 30 days.

TABLE 6

CARAPACE SIZE OF YOUNG TORTOISES

Age of Young (days)	Place	Number of Animals	Length of Carapace Maximum (mm)	Length of Carapace Minimum (mm)	Width of Carapace Maximum (mm)	Width of Carapace Minimum (mm)
0-1	in nest cavity	14	23.0	21.5	20.0	19.0
10	in nest cavity	33	29.0	27.0	25.5	22.5
30	in nest cavity	7	29.5	27.0	25.7	22.7

As shown in Table 6 animals grow rapidly and by the 10th day reach a limit due to the absence of food in the nest cavity. Animals which stayed in the nest cavity for 30 days after hatching were not different in size from 10-day old animals.

V. DISCUSSION

In the literature about reptiles there is little evidence of a correlation between breeding and rainfall. Cott (1960) stated that in North Lake Victoria, East Africa, the incubation of the eggs of the Nile crocodile, *Crocodilus niloticus,* occurs when the level of the lake is low. The eggs are laid as the waterlevel is falling and have to be hatched before the level rises again. Cott noted that eggs were destroyed if the nests were flooded. In *Chelodina longicollis* a correlation between breeding and rainfall appears to apply; this tortoise needs rain in order to dig the nest-hole for egg laying, while the young need rain to leave their cavity. Eggs are destroyed if they are flooded.

Legner (1960) found for the Ornate Box Turtle, *Terrapene ornata ornata,* that the incubation period in cool and damp conditions was prolonged. He noted that the period of incubation ranged from 56 to 64 days at an average temperature of 91°F while at 75°F the incubation period was from 124 to 127 days. Kendeigh (1963) found that in the house wren, *Troglodytes aedon,* the incubation period of the eggs depends on the temperature above a threshold value. Below this threshold temperature there was no growth but the eggs were not necessarily killed. It is not known whether there is such a threshold value in the long-necked tortoise, but the growth rate of the embryo does not appear to be a function of temperature.

VI. CONCLUSION

Nest-site selection and successful reproduction in *C. longicollis* appear to be influenced by environmental factors which include depth of soil, exposure to solar radiation, security from flooding, and access to permanent water.

VII. ACKNOWLEGMENTS

The author wishes to thank B. V. Fennessy, R. Barwick, and G. F. and P. van Tets, who read the manuscript and helped in the preparation of this paper. R. Barker identified the plants, and F. D. R. Knight prepared Figures 1 and 2.

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MARINE TURTLES IN NORTHERN AUSTRALIA

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(Plates VI-VII; text-fig. 1.)

INTRODUCTION

The work reported here began as part of a systematic survey of the reptiles and amphibians of the Coburg Peninsula Wildlife Sanctuary being carried out by the authors for C.S.I.R.O. Division of Wildlife Research. Preliminary data indicated not only the presence of previously unrecorded species of marine turtles but also that the species breeding in the area possessed diagnostic differences in habits and breeding biology. Subsequently one of us (D.A.L.) made casual observations and collections extending over a period of 2 years, while stationed at Port Essington as Ranger of Coburg Peninsula Wildlife Sanctuary (Fig. 1). During this time aboriginal informants confirmed many of these observations and assisted in the collection of specimens. Some additional data and specimens were collected by the other author on the Sir Edward Pellew Islands in the Gulf of Carpentaria, where survey work was also undertaken under the auspices of C.S.I.R.O. Division of Wildlife Research.

Studies of Australian marine turtles are few. Moorhouse's (1933) study of the green turtle (*Chelonia mydas*) at Heron Island, on the southern end of the Great Barrier Reef, has provided the only significant information on the biology of a marine turtle in Australian waters. Bustard (1966) has published brief notes on his current long-term studies of *Chelonia mydas* and the loggerhead (*Caretta caretta*) at Heron Island.

The value of Fry's work (1913) on the flatback turtle (*Chelonia depressa*) is only now being recognised. The status of this species has recently been re-examined by Williams *et. al.* (1967) who have supported Fry's conclusions. Studies of the marine turtles of Ceylon by Deraniyagala (1953; for numerous earlier publications on marine turtles see references in 1953 paper) have helped to clarify the taxonomic status of Indo-Pacific turtles, while the work of Carr and his colleagues on New World turtles has resulted in a wealth of information on the ecology, biology and conservation of several species. Harrison (1961, 1962; see former paper for references to his numerous prior publications on turtles) has made valuable observations on a number of species of marine turtles occurring in the waters off Sarawak.

In the present paper five species of marine turtles are recorded from Northern Territory waters, including the first record of a breeding population of the olive-backed turtle (*Lepidochelys olivacea*) in Australian waters.

Only three of these five species are known to breed in the area. They are *Chelonia mydas, Chelonia depressa* and *Lepidochelys olivacea. Caretta caretta* and the hawksbill (*Eretmochelys imbricata*), though plentiful in the coastal waters of the Northern Territory, have yet to have nesting records in the area confirmed.

The leathery turtle (*Dermochelys coriacea*), though not seen during the course of our observations, has been included in the key for the sake of completeness. It is widely distributed throughout Australian waters, but there are no nesting records for Australia.

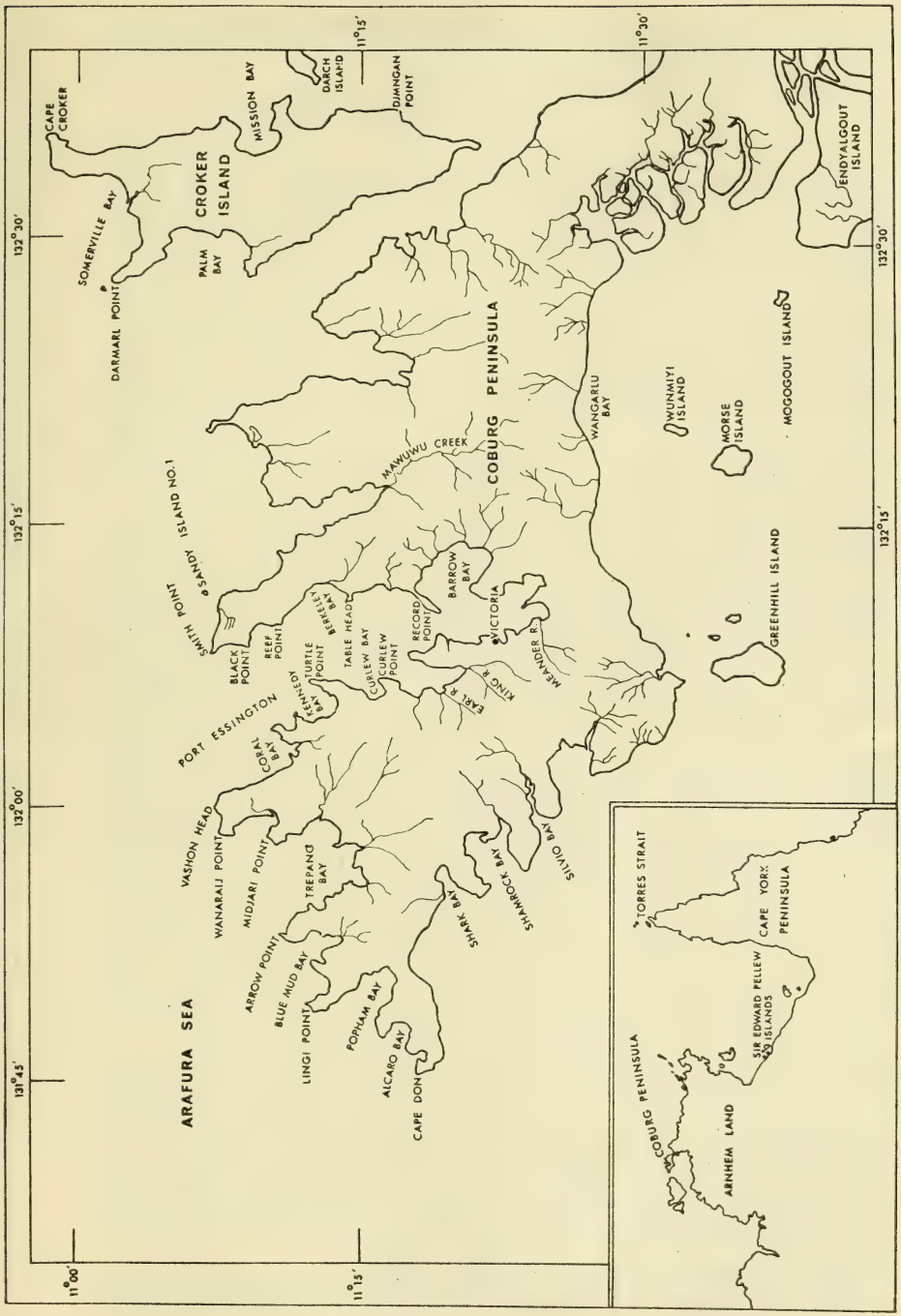

Fig. 1. Map of Coburg Peninsula, Northern Territory, showing localities mentioned in text. Inset shows location of Coburg Peninsula and Sir Edward Pellew Islands.

KEY TO THE GENERA AND SPECIES OF AUSTRALIAN MARINE TURTLES

1. Carapace with a series of enlarged shields; one or two claws on each forelimb 2
   Carapace without regular shields, covered by a leathery skin with five longitudinal ridges; forelimbs without claws ..... *Dermochelys coriacea*
2. Four costal shields on each side 3
   Five or more costal shields on each side 5
3. One pair of prefrontals; shields of carapace never imbricate; tip of upper jaw not extending outwards and downwards to form a narrow projecting beak 4
   Two pairs of prefrontals; shields of carapace (at least in adults) frequently imbricate; tip of upper jaw extending outwards and downwards to form a narrow projecting beak ..... *Eretmochelys imbricata*
4. Usually four or more postoculars; a series of enlarged scales on the upper eyelid, the larger of which are at least half the width of the adjoining prefrontal; distal half of forelimb almost entirely covered by enlarged scales, without distinct areas of smaller irregular scales between the phalanges ..... *Chelonia mydas*
   Three postoculars; upper eyelid composed of numerous small, irregular, subequal scales, the larger of which are much less than one quarter the width of the adjoining prefrontal; distal half of forelimb with single rows of enlarged scales extending along phalanges separated by areas of smaller irregular scales or wrinkled skin ..... *Chelonia depressa*
5. Four enlarged inframarginals on the bridge, with or without pores; usually six or more costals on either side; adults olive-grey, dorsally, hatchlings almost black ..... *Lepidochelys olivacea*
   Usually three enlarged inframarginals on the bridge, without pores; rarely more than five costals on either side; adults and young distinctly reddish-brown dorsally ..... *Caretta caretta*

HAWKSBILL TURTLE, *Eretmochelys imbricata* (Linne)

This species occurs commonly in the waters of northern Australia. Most sightings at Coburg Peninsula were of sub-adult specimens (averaging between 12 and 20 inches in carapace length) which were frequently sighted around coral and rocky reefs. Only four records of adult specimens were made; one of these was a sighting of a large specimen, approaching three feet in length, off Vashon Head. The remaining three records are based on an examination of turtle shell held by natives at Cape Don.

Aboriginal informants at Cape Don were confident that this species occasionally nested in the area, but as no hatchlings or small juveniles were seen in the course of our observations the nesting of *Eretmochelys imbricata* on Coburg Peninsula remains an open question. Similarly, in the Sir Edward Pellew Islands, no nesting was recorded, but local informants left little doubt that the species does nest in the area. It seems certain, however, that nesting at Coburg Peninsula is too sparse to be considered responsible for the relative abundance of sub-adult Hawksbills in that area.

A survey of the literature does little to clarify the situation. The only nesting record that we can find for Australian waters is that of Musgrave and Whitley (1926), who reported that ". . . According to Surgeon-Lieut. W. E. J. Paradice, R.A.N. the Hawksbill lays . . . on Thursday Island, and perhaps breeds southward as far as Low Island, Queensland." However, 2 hatchlings (A4905 and A4906) in the Australian Museum collection were collected 90 years ago in Torres Strait by Alex Morton. Although it was recorded that these emerged at 10 p.m. on 20th September, 1878, the immediate location of the nest is not recorded. Thus while it seems probable that some nesting occurs over a wide area of northern Australia, further surveys will be needed to determine the extent of breeding populations.

The richly-coloured carapaces of many hawksbills may be encrusted with barnacles and covered by a fine growth of algae. Such specimens have a

characteristic pallid appearance under water which is distinct from the typical, brightly-patterned and clean-shelled sub-adult *Chelonia mydas* seen often in the same areas.

The overlapping carapace shields often characteristic of larger *E. imbricata* are not developed in hatchlings and the latter, in size and reddish-coloration, may superficially resemble hatchling *Caretta caretta.*

Partly because of a decline in pearling operations in northern Australian waters and the concentration of the aboriginal population at government settlements and church missions, hawksbills have long been relatively free from interference by humans over much of their range. Recently, however, there has been a revival in the demand for tortoise shell (Carr, 1964), and shell is constantly being sought by Japanese currently working with the Port Essington pearl culture farm.

The operation of Australian-Japanese prawn trawlers out of Australian ports could result in a dramatic increase in the demand for this species. This factor, together with an expanding tourist market for whole mounted specimens, might well encourage aboriginals again to take up large scale hunting and trading of hawksbill turtles. If this occurs, conservation measures will probably be necessary.

OLIVE-BACKED TURTLE OR PACIFIC RIDLEY, *Lepidochelys olivacea* (Eschscholtz)

Lepidochelys olivacea is widely distributed throughout the Indo-Pacific region (Deraniyagala, 1953; Loveridge, 1945; Carr, 1952). However the only record from Australian waters is that of Brongersma (1961) who listed a specimen in the British Museum (Natural History) from Torres Strait.

It would appear, however, that this species occurs commonly in northern Australia and that it nests in many areas. We have recorded nests at various localities between Gove Peninsula and Coburg Peninsula, while reliable reports have been received of nesting on Bathurst and Melville Islands.

Largely because of their colour, adult *L. olivacea* in north Australia are frequently confused with *Chelonia depressa* by Europeans. This contrasts with the literature, in which *L. olivacea* has usually been confused with the more closely allied *Caretta caretta.*

Because *L. olivacea* nests extensively along the Arnhem Land coast its eggs and hatchlings, which are considerably smaller than those of *C. depressa,* have been seen by many of the Europeans living or operating small craft in that area. The operators of two small craft which visited Black Point were shown live hatchlings of this species and were rather surprised at their identity, having always regarded them as the young of *Eretmochelys imbricata.*

Many authors (Boulenger, 1889; Smith, 1931; McCann, 1966) have regarded *L. olivacea* as merely a subspecies or a synonym of *Caretta caretta.* However Deraniyagala (1933, 1953) pointed out numerous distinguishing features and showed clearly that the two species are distinct.

L. olivacea is the smallest of the Indo-Pacific cheloniid turtles, and females are known to mature at a carapace length of about 25 inches. The largest specimen recorded in the literature measures only 31.5 inches (Pritchard, 1967). In adults the snout is blunter and less beak-like than in *Caretta.* The smooth carapace is relatively deep, domed anteriorly and subcircular in outline. Our specimens agree in all respects with those described from elsewhere in the Pacific (Deraniyagala, 1953).

Unlike other cheloniid turtles *Lepidochelys* is extremely variable in the numbers of its costal shields. However only rarely do the costals number fewer than six; only one of the 42 specimens examined by us has five costals, and this count is restricted to one side only. Deraniyagala (1934) records only one instance of 5 pairs of costals in 378 specimens of *Lepidochelys* examined.

All but two of our 42 specimens have 26 marginal shields; the remaining two each have one of these divided to give a count of 27. All have 4 enlarged inframarginals on each side of the plastron, each with a pore near its

posterior margin. Adult specimens are dull olive grey above; white to pale yellow below. Other scale counts vary as follows in our series (figures in parentheses represent the number of specimens):

Postoculars: 3 + 3 (12); 3 + 4 (15): 4 + 4 (14).
Postparietals: 2 (11): 3 (3); 4 (7); 5 (13); 6 (5); 7 (1); 8 (1).
Vertebrals: 5 (3); 6 (11); 7 (27).

Hatchling *L. olivacea* range from 42 mm. to 46 mm. in carapace length; the carapace has three longitudinal ridges while the colour is black above, mottled dark brown and whitish below.

At Coburg Peninsula 9 sightings of adult specimens of *L. olivacea* were made, 7 of which were of specimens basking on the surface in depths exceeding 5 fathoms.

Although only one nesting was actually observed, the tracks, nesting sites and eggs of the species are diagnostic. More than 50 nests were noted, of which 12 were randomly selected to confirm the accuracy of the nest identifications. All of these proved to belong to *Lepidochelys* (as confirmed by identifications of embryos and hatchlings). Clutch sizes in six nests varied from 50 to 147 (mean 108), the slightly elliptical eggs measuring from 38.5 to 41.0 mm. in diameter (mean 38.8). Incubation times (from day of laying to day of hatching) for four nests ranged from 48 to 52 days (mean 50 days). All nests were recorded between January 31st and March 17th, 1967, and during March, 1968. Deraniyagala (1953) records clutches varying from 90-135.

At present many of the small islands on which *Lepidochelys olivacea* nests are rarely visited by man and are not inhabited by any of the predators (e.g. dingoes, monitor lizards) which frequently destroy mainland turtle nests. Basking adults are extremely unwary of approaching boats but the flesh is not esteemed by aboriginals and adults are rarely hunted. The main threat to the survival of the species would seem to lie in the population growth and development of the northern coast. However, any conservation program designed to protect important nesting beaches of *Chelonia depressa* would probably also ensure the survival of this more widely distributed species in Australian waters.

LOGGERHEAD TURTLE, *Caretta caretta* (Linne)

Although well known by local natives, this species would appear to be the least common turtle in the area. Six specimens were observed, while two other turtle sightings were regarded as possibly being *Caretta*. Natives informed us that the species was not infrequently encountered during hunts for *Chelonia mydas* in Bluemud Bay between Kuper Point and Sandy Island Number One and north of Midjari Point in Trepang Bay. Because of the large adult size, the fact that the flesh is relatively tough, and probably mainly because small *C. mydas* are generally easily found in these same areas, *Caretta* is rarely killed for food. No record of this species nesting in the area was made and local natives could recall no instances of its breeding on the Peninsula. The single specimen collected was taken in the prawn net of the "Pathfinder K" off Reef Point, in seven fathoms.

With the removal of *Lepidochelys olivacea* from the synonymy of *C. caretta,* the latter species is less variable in external morphology than many descriptions have implied. Deraniyagala (1953), Carr (1952) and Pritchard (1967) have found little variation in costal counts in *C. caretta,* compared with considerable variation in these characters in *L. olivacea,* while each species has a characteristic inframarginal condition (see key). The number and disposition of the shields in the carapace are subject to greater variation in *L. olivacea* than in *C. caretta.*

FLATBACK OR GREYBACK TURTLE, *Chelonia depressa* Garman

The status of *C. depressa* has frequently been disputed. Barbour (1914) has pointed out that one of Garman's cotypes (No. 2. M.C.Z. 1413, from Penang,

Malaya) is conspecific with *Chelonia mydas.* The other juvenile cotype (M.C.Z. 4473, from North Australia) Loveridge (1934) considered to be an aberrant *mydas,* as did Boulenger (1889), Siebenrock (1909), M. Smith (1931) and Mertens and Wermuth (1955).

Although Baur (1890) disputed Boulenger's action and McCulloch (1908) in describing *Natator tessellatus,* also recognised the validity of *depressa,* the first significant paper dissenting from this view was that of Fry (1913), who showed clearly that *depressa* and *mydas* were distinct species which could be readily distinguished on numerous morphological features. Fry's work was all the more remarkable considering that he was not acquainted with *depressa* in the field, nor had he seen adult material. Subsequently Williams *et. al.* (1967) have confirmed the reliability of most of the features on which Fry differentiated *depressa* from *mydas,* and have provided additional distinguishing characters. Nevertheless these authors have still only "tentatively" regarded *C. depressa* as a distinct species. It is only fair to point out that failure to recognise *depressa* as a distinct species has been almost entirely confined to workers outside Australia. Specimens received by at least two Australian museums during the past 55 years were correctly identified and catalogued under *depressa* when they were acquired. Glauert (1928) listed *C. depressa* and included it in a key to Western Australian turtles. Worrell (1963) erroneously referred *C. depressa* to *Chelonia japonica;* however he was fully acquainted with the species in the field and noted several generalised features distinguishing *depressa* from *mydas.* Although he mentioned "prominent osteological differences" between the two, he did not describe such differences.

We have little really significant information to add to Fry's (1913) description of *C. depressa* nor to the brief ecological notes given by Hugh W. Christie (and quoted by Fry).

The following variation in scale counts was noted in our series; counts for our small series of *C. mydas* are included for comparison. Similar asymmetrical counts have been lumped together, independent of the side on which the higher count occurs; numbers in parentheses indicate numbers of specimens.

	depressa	*mydas*
Costals	4 + 4 (59); 4 + 5 (4)	4 + 4 (37)
Marginals	24 (61); 25 (2)	24 (37)
Post-parietals	0 (2); 1 (36); 2 (13); 3 (11)	2 (21); 3 (6)
Postoculars	3 + 3 (63)	3 + 3 (1); 3 + 4 (2); 4 + 4 (21); 4 + 5 (12); 5 + 5 (2)

Those characters which we consider to be the most reliable diagnostic features are given in the key. Also, Fry (1913), quoting H. Christie, pointed out that the carapace of adult *C. depressa* is covered by a thin "greasy" skin which is usually free of barnacles, etc., whereas the carapace of adult *C. mydas* is covered by hard, horny plates. This distinction is extremely important and reliable, and readily distinguishes the two turtles in the field.

Williams *et. al.* (1967) list 15 characters in which significant, but not diagnostically reliable differences occur between *depressa* and *mydas.* They point out the difficulties in expressing some of these differences in unequivocal or empirical form, but some of these characters, such as the condition of the scales on the fore and hindlimbs (as figured by Fry, 1913), and the upper eyelid scales, appear to be totally diagnostic. On the other hand, we

have found some of their other features to be unreliable. In the condition of the prefrontal length relative to supraocular, 44% of 66 specimens of *depressa* examined have the *mydas* condition of prefrontal longer than supraocular; 19% have the *mydas* condition of prefrontal contacting the maxillary sheath; 39% have the *mydas* condition of first vertebral and first marginal in contact, while 19% have the *mydas* condition of paired postparietals, although asymmetry of the division is usually maintained. The description of the "subtemporals" for *mydas* and *depressa* were accidentally transposed in their list of characteristics on p. 3. The subtemporals are smaller and more numerous in *C. mydas* than in *C. depressa.*

Chelonia depressa is widely distributed along the coast from north-western Australia to eastern Queensland. Williams *et. al.* (1967) record specimens from various localities along the eastern coast of Queensland, while Bustard (1968) has recorded a breeding colony near Bundaberg, Queensland.

Although frequently considered a "rare" turtle (Bustard, 1968) *Chelonia depressa* is abundant. Its rarity in collections is almost undoubtedly due to the paucity of biological collecting in the areas in which it occurs most commonly.

In the shallow bay and coastal waters in which most of the observations were made (that is, in depths rarely exceeding 10 fathoms) *C. depressa,* in contrast with *C. mydas,* was not usually found in depths of less than three fathoms. However except in these shallow areas *C. depressa* was the most commonly observed turtle, the most frequent sightings being made in Port Essington and Port Bremer. Two specimens were collected by prawn trawlers between Black Point and Turtle Point, being netted in 7-8 fathoms. Although most sightings were of adult specimens, all growth stages were encountered down to two specimens of estimated carapace length less than 8 inches. Because of the light carapace coloration, basking specimens are often conspicuous at a considerable distance. The species appears to be unwary when on the surface and is generally easily approached within close harpooning distance. Older local natives who until 1939 had often been employed skin diving for trepang consider that *C. depressa* lives largely on trepang, having been frequently encountered where these were abundant. This view is supported by the fact that prawn trawlers frequently take *depressa* from the "clean" bottoms over which the trawlers usually work.

Chelonia depressa nests on both mainland and offshore island beaches. In 1967 nesting occurred during May and June at Smith Point and on Sandy Islands Numbers One and Two. Occasional nesting occurred at all other times, but the period of most concentrated nesting took place on Sandy Island Number Two during March-April, when daytime checks of tracks indicated laying by 3-5 females each night. From information supplied by local natives it would seem that the greatest concentration of nesting occurs on Greenhill Island (see fig. 1). At the time of our only visit to this island (May 5th, 1968) little nesting was evident. Moderate nesting activity was observed in the Sir Edward Pellew Islands during October, 1967, with abundant evidence of massive nesting activity on Pearce Islet just prior to our visit. Hatchlings of this species born on Sandy Island Number One or Two have only a narrow beach to cross before reaching the sea, since all observed nests had been made just within the edge of the flat grassy areas of the islands. The mainland nesting beaches are mostly less protected by offshore reefs than those of the two islands and most are backed by one or more dunes with only occasional beach oaks (*Casuarina* sp.) and little or no grass. The nesting procedure most commonly adopted by *C. depressa* on these beaches is to proceed up rising ground either until the top of the dune or a level surface is reached, or until a patch of fallen *Casuarina* leaves or grass is entered. In most instances one or more trial excavations (without egg chambers) are left along the route from the water's edge to the final nesting excavation. At Smith Point three nests were noted approximately 80 metres from the high water mark; on two occasions the females that had nested on the top of dunes headed

inland from their nest sites before they apparently instinctively realised their error and returned to the sea. Another specimen proceeded across a beach dune onto a grassy flat behind, and after attempting unsuccessfully to make an excavation in the hard ground reclimbed the dune and successfully nested slightly on the seaward side of the dune's crest. In 14 nests where the eggs were counted the clutch sizes ranged from 41 to 74 (mean 53). The diameters of eggs varied from 49 mm. to 54 mm. (mean 52.1). Incubation times (as defined under *Lepidochelys olivacea*) for six nests varied from 45 to 56 days (mean 50.2).

GREEN TURTLE, *Chelonia mydas* (Linne)

Although, because of its economic importance, *C. mydas* has attracted more attention than other marine turtles, its presence and relative abundance in the waters of northern Australia have been in question.

Williams *et. al.* (1967) were unable to locate any specimens of *C. mydas* from areas west of Torres Strait. They also pointed out the difficulty in referring literature records of "green turtles" from this area to either *C. mydas* or *C. depressa.*

Chelonia mydas is, indeed, abundant in Northern Territory waters, where it is a staple item in the diet of coastal aboriginals. It is much preferred to *Chelonia depressa.*

In the calm sultry weather experienced in March and April of both 1967 and 1968, numbers of subadult *C. mydas* congregated around the headlands on the north coast of the Peninsula apparently attracted by beds of algae.

On the 4th April, 1967, one boat-run close inshore, from Black Point to Sandy Island Number One, yielded sightings of twelve specimens of *C. mydas* as well as three subadult specimens of *Eretmochelys imbricata.* At other times not infrequent, but less concentrated, sightings of adult and smaller specimens were made in the same areas, usually of specimens disturbed feeding on the bottom in clear shallow water. The species appeared more wary when on the surface than other species except *Eretmochelys.* Copulating pairs of *C. mydas* were noted at Lingy Point on the 5th Sept., 1968 and at Black Point during October. The nesting of this species appears to be sparse on the Peninsula and only three nests were recorded in the course of the present work. Reliable reports indicate that large nesting aggregations occur on islands off the coast of north-western Australia and on some islands in the Gulf of Carpentaria. This species was not seen on the Sir Edward Pellew Islands in October, but local informants affirm that nesting of this species occurs commonly.

Chelonia mydas is offered statutory protection throughout most parts of northern Australia, but large numbers are still taken under license from Western Australia, and smaller numbers from the waters of Cape York Peninsula, to supply southern canneries. Little information is available on the numbers taken but the serious depletion of populations of this species throughout most parts of the world (Parsons, 1962) fully justifies the enlightened protective measures taken by the Commonwealth and various State Governments.

SUMMARY

Five species of marine turtles have been recorded from northern Australia. These are *Chelonia depressa, Chelonia mydas, Eretmochelys imbricata, Caretta caretta* and *Lepidochelys olivacea.*

Of these, *Lepidochelys* has been found to be a common species along the Arnhem Land coast, with widespread nesting in the region. In contrast, *Caretta caretta,* though apparently plentiful, is not known to nest in this area.

Both *Chelonia mydas* and *C. depressa* are common and widely distributed, and both species nest extensively in northern Australia. It is difficult to determine

which, if any, is more abundant, but nesting of *C. depressa* far exceeds that of *C. mydas* on the Coburg Peninsula.

An examination of a large series of *C. depressa* has confirmed the views of Fry (1913). We would go further than the "tentative" recognition of *depressa* by Williams *et. al.* (1967), for differences in morphology and ecology leave no doubt that *depressa* is a distinct and distinctive species. Indeed, we suggest that these differences are so great as to warrant, within the context of current cheloniid taxonomy, a re-examination of the status of the genus *Natator* McCulloch.

Although *Eretmochelys imbricata* is common throughout the area under discussion, adults are only occasionally seen; reports of nesting are frequent, but none of these has been confirmed.

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EXPLANATION OF PLATES

Plate VI *Lepidochelys olivacea* nesting at Black Point, Port Essington. (Photo: D. Lindner).

Plate VII Upper Left.—*Chelonia depressa* covering nest site, North Island; Sir Edward Pellew Group, Northern Territory.
Upper Right.—*Chelonia mydas* basking on reef flat of Heron Island, Capricorn Group, Queensland.
Lower Left.—*Caretta caretta* nesting on Heron Island.
Lower Right.—Subadult *Eretmochelys imbricata,* Heron Island.

(Photos: H. G. Cogger).

OBSERVATIONS ON SOME TASMANIAN FISHES: PART XVI

By E. O. G. Scott

(Figures 1-2).

ABSTRACT

CENTROLOPHIDAE.—*Centrolophus maoricus* Ogilby, 1893: additional local record, observations on a specimen from River Tamar, key to Tasmanian species. NEOODACIDAE.—*Odax beddomei* Johnston, 1885: a fish with ventral fins is referred to this species, long thought to lack ventrals, and hence transferred in the Check-List to SIPHONOGNATHIDAE; if present attribution is correct, species is now *Neoodax beddomei* (Johnston, 1885): specimen described and figured. CREEDIIDAE.—*Creedia haswelli* (Ramsay, 1881): first record from Tasmanian waters; description of 2 examples (ventral in this material i, 4, not i, 5); fleshy rostral appendages figured. CLINIDAE.—*Petraites phillipi* (Lucas, 1891): recent material; variation in coloration; distinction from *Clinus perspicillatus* Cuvier & Valenciennes, 1836. TRIPTERYGIIDAE.—*Brachynectes fasciatus* Scott, 1957: specimen from south-eastern Tasmania; values for some body ratios transgress reported extremes.

INTRODUCTION

This paper follows the general plan of others in the series; Parts I-XV of which have appeared in the *Papers and Proceedings of the Royal Society of Tasmania,* 1934-1967. The following conventions, among others, continue to be observed: unless otherwise stated, lengths are given in millimetres, the name of the unit normally being omitted; *Ls, Lt* denote standard length, total length, respectively; *TLs, TLt* denote thousandths of standard, of total length.

Family CENTROLOPHIDAE

Centrolophus maoricus Ogilby, 1893, the subject of the observations below, is the only member of the Centrolophidae noticed in the Check-List (McCulloch, 1929:122), where it is recorded from New South Wales and New Zealand. Munro (1958:118) lists 6 Australian species: (*i*) *Centrolophus maoricus* Ogilby, 1893; (*ii*) *Mupus tasmanica* (Whitley, 1943); (*iii*) *Mupus imperialis* Cocco, 1883; (*iv*) *Schedophilus maculatus* Günther, 1860; (*v*) *Psenopsis humerosus* Munro, 1958; (*vi*) *Hyperoglyphe porosa* (Richardson, 1845); of which (*i*), (*ii*), (*iii*), (*vi*) are recorded from Tasmania, the notice of (*iii*), from stomach of *Rexea solandri* (Cuvier & Valenciennes, 1832) off the mouth of the Tamar River and south of Cape Carnot, South Australia, providing the first record for Australia. Munro treats *Hoplocoryphis physaliarum* Whitley as a synonym of *Schedaphilus maculatus* Günther; and recognizes only a single species of *Hyperoglyphe* Günther, 1859 (Richardson's *Diagramma porosa*), the Check-List admitting a second species, *H. johnstonii* (Morton, 1888), referred by its describer to his own genus *Eurumetopos.* Species (*i*), (*iv*), (*vi*) were placed by McCulloch (1927:42) in the Stromateidae, (*i*) later going in the Check-List to Centrolophidae, and (*iv*) and (*vi*) to Nomeidae, the last (the only species he notes from South Australia) being retained by Scott (1962:143) in that family.

The inclusion of *Centrolophus maoricus* in the Tasmanian list is based on a record by Whitley (1951:63) of an example 38 inches long from Triabunna, Pembroke, presented to the Australian Museum by the C.S.I.R.O. Division of Fisheries. A further occurrence of the species in our waters is noticed below.

KEY TO CENTROLOPHIDAE RECORDED FROM TASMANIIA

	Lateral line >150 (≧160). Dorsal and anal not apparently differentiated into spines and rays. More slender, depth ≐ 4 (3.8-4.5) in standard length	*Centrolophus maoricus*
	Lateral line <150 (≐80-144). Dorsal and anal both with spines and rays. Deeper, depth <4 (≐2.0-3.1) in standard length	2
2	Scales on opercle. Anal originating behind middle of total length. Dorsal rays <25 (≐21). Anal rays <18 (15-16). Profiles of spinous and soft portions of dorsal forming 2 very distinct arcs, separated by a notch. Larger, length to more than 4 feet	*Hyperoglyphe porosa*
	No scales on head. Anal originating in advance of middle of total length. Dorsal rays >25 (27-45). Anal rays >18 (20-23). Profiles of spinous and soft portions of dorsal forming a more or less continuous curve, not divided by a notch. Smaller, length to about 2 feet	3
3	Lateral line <130 (≐80-100). Total dorsal and anal spines and rays <70 (≦65). D. vi-viii, 27-31. A. iii, 20-23. Larger, length to about 20 inches	*Mupus imperialis*
	Lateral line >130 (≐144). Total dorsal and anal spines and rays >70 (≧80). D. iv, 45, A. ii, 31-33. Smaller, length to about 4 inches	*Mupus tasmanica*

Genus CENTROLOPHUS Lacépède, 1802

Centrolophus maoricus Ogilby, 1893

Centrolophus maoricus Ogilby, 1893, *Rec. Aust. Mus.* II, 5:64. Type locality: New Zealand.

Centrolophus maoricus Ogilby. Regan, 1902, *Ann. Mag. Nat. Hist.* (7), X:195. Regan, 1914, Brit. Ant. Exped. Zool., I, 1:19; and 1916, I, 4:144, pl. X, fig. 7 (postlarva). McCulloch, 1919, *Rec. Aust. Mus.*, XII, 8:176, pl. 26, fig. 2. Whitley, 1951, *Proc. Roy. Zool. Soc. N.S.W.* (1949-1950):63. Munro, 1958, *Handbk. Aust. Fish.*: 118, fig. 778 (in *Fisheries Newsletter*—now *Aust. Fisheries*—XVII, 11, Nov. 1958).

Additional record.—The initial record of the Triabunna specimen by Whitley, noted earlier, appears to have remained till now the sole notice of this interesting fish from our waters. On 1st September 1966, Mr. N. P. Scott brought to the Queen Victoria Museum, Launceston, one of a number of examples observed near a stranded sunfish (presumably *Mola ramsayi* Giglioli, 1883) at Garden Island, River Tamar.

Behaviour.—Mr. Scott reported the small fish were actively milling around the large one, and spoke of their attacking it. Whether or no the *Centrolophus* were actually attempting to prey on the *Mola* cannot now be definitely ascertained: usually the relation between the species is one of peaceful commensalism, and it would be interesting to learn if, in the event of the sunfish becoming incapacitated, its character changes. Of this curious association Munro (1958:118) has noted 'Juveniles accompany the giant sunfish *Mola* in the same fashion as pilot fish accompany sharks'. Members of the genus *Centrolophus* are pelagic, and McCulloch (1927:43) speaks of *C. maoricus* as 'a rare oceanic species': Munro notes it occurs (as might be expected in view of its association with the sunfish) in deep water.

Counts, proportions.—D.39. A.22. P.21 (both fins). V.i, 5. C.18. L.lat. *ca* 170. *Ls* 307, *Lt* 380, length to end of middle caudal rays 354. Some other measurements, given in mm, and as *TLs* in parentheses, follow. Length to dorsal origin 101.5 (331), to dorsal termination 254 (827), to anal origin 167 (544), to anal termination 255 (830), to ventral origin 78 (254), to vent 162 (528). Head 81 (264), snout 23 (75), eye 17 (55), interorbital 29.5

(96). Maximum depth, occurring shortly in advance of level of vent, beneath highest point of dorsal, 81 (264), depth at vent 79 (257), depth of caudal peduncle 20 (65). Length of pectoral (whole fin) 57 (186), of longest (4th, 5th) pectoral ray 46.5 (151); length of ventral (whole fin) 35.5 (116), of longest (2nd) ventral ray 30.5 (99), of spine 15.5 (51); length of longest dorsal ray 40 (130).

Comparative data.—Ogilby's (1893) tolerably comprehensive account of the holotype was supplemented by a figure and a more detailed description by McCulloch (1919) of a specimen, 740 mm long from snout to end of middle caudal rays, washed up on a beach at the entry to Crookhaven, New South Wales, the first individual recognized from Australian waters. McCulloch observed of his example 'It differs from Ogilby's description in several characters, but a comparison of it with the holotype of the species, which is stuffed in the Australian Museum collection, shows it to be similar in all details'.

Comparison of the present specimen with Ogilby's and McCulloch's accounts of theirs (with reference, at some points, to McCulloch's figure) yields the following results (our example noted last). D. 38, 39, 39. A.25, 25, 22. P. 21, 20, 21. C. 19, 17, 18. Scales below lateral line between operculum and base of tail: not noted, 'one hundred and sixty or more', *ca* 170. Maximum depth five in total length, 4.08 in *Ls* or from figure about 4.7 in *Lt*, 3.79 in *Ls* or 4.69 in *Lt*. Head five and a half in total length, 4.5 in *Ls* or from figure about 5.4 in *Lt*, 3.79 in *Ls* or 4.69 in *Lt*. Some ratios with length of head as numerator: eye four and one-tenth, 4.2, 4.8; snout 3.6 (by calculation), 4, 3.5; longest dorsal ray (to which, in all specimens, longest anal ray is subequal) 3.3 (by calculation), 2.5, 2.0; pectoral two and one-seventh, 1.7, 1.4; ventral 3.6 (by calculation), 3, 2.3. Interorbital, relative to snout, equal, a little greater, 1.28. Dorsal base in *Lt* two and one-fifth, from figure about 2.2, 2.5. Anal base in dorsal base exactly twice, from figure about 1.7, 1.7. Interval between anal and caudal origins in length to caudal origin one and one-fourth, from figure about 1.1, 1.2.

The obtuse upper jaw projects slightly beyond, from figure perhaps falls short of, falls slightly short of, tip of lower jaw. Nostrils (which are placed close together, far forward, in anterior one-third of snout): 'the anterior is oval and vertical, the posterior much larger and subarcuate', 'the anterior rounded and slightly larger than the posterior, which is oval', the posterior is oval, set transversely, its major axis equal to, or slightly greater than, the diameter of the rounded anterior, which has a low rim, the actual aperture of the posterior, however, greatly exceeding that of the anterior (a feature that may well vary with circumstances of preservation). Maxilla to below anterior one-fourth, anterior border, anterior border, of orbit. 'A single series of cardiform teeth in the jaws, so irregularly placed as to form in many cases an apparently double series', 'teeth cardiform, in a single row in each jaw, but irregular and almost biserial in the anterior portion of the premaxillaries', cardiform, in single row, no marked tendency to become biserial in the premaxillary. Palate and tongue, as McCulloch notes, toothless. There appears to exist some confusion concerning the margins of the plates of the operculum. Ogilby says of the preoperculum 'its angle and lower limb finely denticulated', and adds 'the margins of the sub- and inter-opercles rather more strongly so', while McCulloch writes 'margins of the preoperculum, suboperculum and interoperculum membranaceous and finely lobate.' In our specimen the interoperculum presents a gently and evenly convex border, far from being rigid, along which are set, in the space of 10 mm, a dozen fine, very acute spines of approximately equal size; beyond this border there extends a soft membranous frill, about 1 mm across, its free external border minutely crenulate or lobate; soft fringing folds occur also on the operculum and preoperculum, the margins internal to these being largely entire, in part obscurely denticulate. In our specimen scales on the dorsal surface of the head extend forward for half its length, to slightly behind level of eye. Of the numerous pores on the head (which is naked except for the opercle) those on the dorsum are the smallest, while a group between the eye and the origin of the lateral line includes the largest.

Family NEOODACIDAE

The four species accredited to Tasmania in the Check-List, where the family appears (McCulloch, 1919:323) as Odacidae—(*i*) *Olisthops cyanomelas* Richardson, 1850, of which *Olistherops brownii* Johnston, 1884, from Table Cape [Wellington], Tasmania, is listed as a synonym; (*ii*) *Haletta semifasciata* (Cuvier & Valenciennes, 1840), placed in *Neoodax* Castelnau, 1875 [*Haletta* Whitley, 1947]; (*iii*) *Neoodax balteatus* (Cuvier & Valenciennes, 1840), the unspecified type locality of which is determined by McCulloch as Tasmania (Péron's material); (*iv*) the endemic *Neoodax attenuatus* (Ogilby, 1897), which seems not to have been satisfactorily recognized since its description—together with (*v*) *Neoodax radiatus* (Quoy & Gaimard, 1835), first recorded for Tasmania in Part XII of a series contributed by the writer to the Royal Society of Tasmania, have been keyed in that paper (1964:96): while (*vi*) *Neoodax frenatus* (Günther, 1862) was added to the State list in Part XIV (1966:100). [In 1.8 of p. 100 of the 1966 contribution the date of (*v*) appears as 1853, but is correctly given elsewhere on the same page as 1835].

After a lapse of some fourscore years R. M. Johnston's *Odax beddomei*, which appears in the Check-List in the Siphonognathidae, has now, it is believed, again been collected, and the status of this species (the curious history of which is traced below) as a Tasmanian member of the Neoodacidae appears to have been satisfactorily established.

Genus NEOODAX Castelnau, 1875

Neoodax beddomei (Johnston, 1885)

(Figure 1)

Odax beddomei Johnston, 1885, *Pap. Proc. Roy. Soc. Tasm.* (1884):231. Type locality: Derwent River [Monmouth/Buckingham], Tasmania.

Neoodax beddomei (Johnston). Lord & Scott, 1924, Synopsis Vert. Anim. Tasm.: 12, 76.

Siphonognathus beddomei (Johnston). McCulloch, 1929, *Mem. Aust. Mus.* V, 11:325. *Id.* Whitley, 1929, *Pap. Proc. Roy. Soc. Tasm.* (1928): 59, pl. IV, fig. 6.

?Siphonognathus argyrophanes Richardson. Whitley, 1929, *Pap. Proc. Roy. Soc. Tasm.* (1928):59.

History.—This species, hitherto known apparently only from the type specimen (now lost), has had a chequered history, in the course of which it has appeared in two families.

Johnston noted the fish was 'caught in the waters of the Derwent', and presented to him by Captain Beddome. His description (with some typographical rearrangement) is as follows. 'D. 20, 12. A. 3, 9. P. 12-14. L.lat. 40. L.tr. 3/8-9. Body elongate. Praeoperculum entire. Snout much produced and finely pointed. Eye rather large. Height of body one-tenth of the total length, and length of head contained in the latter three and one-third times. Upper posterior margin of operculum produced into a flaccid membrane having a rayed appearance. Colour of body and fins reddish, becoming lighter below lateral line. There is a singular well marked black elongate streak, margined with a scarcely perceptible yellow border extending over five of the upper rays of caudal fin, which latter is somewhat rounded terminally'. The dimensions, presented in tabular form, are: total length 4¾ inches; body 4 in.; head 1⅓ in.; snout 8/12 in.; eye 6 mil.; greatest depth of body ½ ¼ (*sic*) in.; least depth of body ¼ in.

Lord & Scott (1924)—in whose synopsis of Tasmanian vertebrates I may here set on record, from information given to me many years ago by my father, the fishes were handled by Clive E. Lord—remark (p. 76), 'We have been unable to trace Johnston's type, which was apparently not preserved, nor have we been able to secure further specimens'. In a paper on R. M. Johnston's memoranda, Whitley reproduced (1929, pl. IV, fig. 6) a sketch by Johnston of his type. Noting that 'After examining the sketch and manuscripts

of Johnston, the late A. R. McCulloch recognized the resemblance of *Odax beddomei* to *Siphonognathus*', he deals with the fish under the name of *Siphonognathus beddomei* (with *S. argyrophanes* Richardson, 1858 as a queried entry in the synonymy): the same attribution occurs in the Check-List (McCulloch, 1929:325).

The two obvious reasons that doubtless led McCulloch to refer *Odax beddomei* to the genus *Siphonognathus* Richardson, 1858 are, first, the much produced snout, secondly, the absence in the sketch of any indication of the presence of ventral fins and the lack in the account of any mention of them (the Siphonognathidae being trenchantly distinguished from the Neoodacidae by the complete absence of ventrals). A fish from waters round the Furneaux Islands (lying off the north-eastern corner of Tasmania, and politically part of this State), of which a full account is subjoined, is here referred with considerable confidence to Johnston's species, with the account and figure of which it agrees closely, except in one critical point, its possession of (rather small, inconspicuous) ventral fins. If this attribution is correct, it would therefore appear that (apart from the logical possibility but biological improbability that the possession by the present specimen of ventral fins is an abnormality) either Johnston's type was an imperfect or abnormal individual, lacking ventrals, or else Johnston simply overlooked them.

Material and locality.—A small collection of fish presented by Mr. R. Slater to the Queen Victoria Museum, Launceston includes the specimen here discussed; also the 2 examples of *Creedia haswelli* (Ramsay, 1881) on which some observations are made below. Mr. Slater (*in litt.*, 2nd May 1967) has kindly supplied the following particulars. The fish were obtained in August 1966, during the course of an expedition round the Furneaux Islands for the purpose of collecting bottom sediment samples. A small dredge was used; 'most of, if not all, the fish were found usually in weedy sand flats at depths from 2 to 8 metres', those given to the Museum coming from 'around Franklin Sound between Flinders [Island] and Cape Barren [Island] or just west of Cape Barren and Flinders Island around the smaller islands of Badger, Mt. Chappell, etc.'

Dimensions.—The more important dimensions are here given expressed as *TLs* (with absolute values in millimetres in parentheses). Standard length (65.0), total length 1205 (78.3). Length to origin, termination (base of last spine) of first dorsal 354 (23.0), 645 (41.9); of second dorsal (from base of 1st ray) 657 (42.0), 811 (52.7); of anal 700 (45.5), 806 (52.4): total base of dorsal (1st spine-last ray) 457 (29.7). Pectoral: length to origin 323 (21.0); length of longest (6th-7th) ray 123 (8.0), of whole fin 140 (9.1). Ventral: length to origin 389 (25.3); length of spine 78 (5.05), of 1st-4th rays 100 (6.5), 103 (6.7), 100 (6.5), 97 (6.3), of whole fin 109 (7.05). Lengths of 1st, 2nd, 9th, 19th dorsal spines 46 (3.0), 62 (4.05), 58 (3.8), 58 3.75); of 1st, 3rd, 12th, 13th dorsal rays 54 (3.5), 62 (4.0), 80 (5.2), 45 (2.95). Lengths of 1st, 2nd anal spines 20 (1.3), 38 (2.5); of 1st, 2nd, 5th, 6th rays 63 (4.1), 75 (4.9), 77 (5.0), 62 (4.0). Head 340 (22.1), snout 154 (10.0), eye 69 (4.5), interorbital 55 (3.6). Length to vent 683 (44.4). Depth at front of eye 74 (4.8), at back of eye 95 (6.15), at opercular border 78 (5.05); maximum depth of trunk 92 (6.0); caudal peduncle 58 (3.8).

General description.—D. xix, 13. A. iii, 9. V. i, 4. P. left/right 12/12. C. 20 (13 reaching, or virtually reaching, hind border). L.lat. 40 (including 1 on caudal base). Sc. tr. 3/1/7.

Head 2.94, trunk 2.91, tail (without caudal) 3.16 in *Ls.*

Elongate; as preserved, head deeper than body; maximum depth of head (at back of eyes) 10.6, depth at operculum 10.7, maximum depth of trunk 10.8, depth at vent 12.7, minimum depth of caudal peduncle 17.1 in *Ls;* body well rounded, widths at pectoral, ventral, anal origins 0.95, 1.3, 1.3 in depths there; caudal peduncle long, 3.8 its least depth, subequal to caudal fin.

Trunk and tail wholly covered with cycloid scales, which extend also on to caudal base, and cover almost the whole pectoral base. On dorsum of head scales cease as a compact mass at the transverse neuromast canal (which exhibits a number of irregular short vermiform projections running forward or backward) that curves over the head (a little behind level of posterior border of preoperculum) to link the two lateral lines, but half a dozen scales, of which 4 are collinear, mesial, extend forward on to occiput, reaching level of posterior border of orbit: 3 or 4 scales, the hindmost the largest, extend horizontally across upper one-fifth of operculum, the rest of which is naked: 8-10 scales occur on vertical limb of preoperculum, not quite extending back to its posterior border, and ceasing below anteroinferior angle of orbit. The lateral line curves down (most rapidly in hinder part of this segment) to reach, just behind tip of pectoral, a point about twice as far from ventral profile as from dorsal; behind this it extends, in a virtually straight (slightly upwardly convex) oblique line, to about level of termination of vertical fins, where it is about equidistant from dorsal and ventral profiles, and from which it runs back horizontally, with last (40th) tubule on caudal base.

Head large, subequal to trunk: in front of level of back of eyes quadrangular, behind this somewhat more rounded. Snout long, 1.3 postorbital head, about half tail (without caudal); tumid upper lip upcurved to stand almost vertical, leaving, so postured, the lower lip projecting the merest trifle beyond it. Length of mouth cleft equal to diameter of eye, the rictus nearer to tip of snout than to anterior border of orbit. Teeth in upper jaw fused to form a cutting edge, continuous save for a mesial notch, its free margin smooth, or, posteriorly, minutely serrate; the form of many of the subconical stout teeth being recognizable between the thinner, flatter lamellae joining them: in lower jaw fused throughout, but presenting in posterior half, or more, of the system on each side distinct, moderately elevated, rounded free crowns. Palate apparently edentulous. The fairly extensive subvertical lunule visible at tip of upper jaw between inner border of lip and tooth-line strongly plicate, the plications (here mainly longitudinal) continuing backward for some distance on either side of jaw as this labial-dental interspace progressively narrows to virtual extinction. Eye large, 4.9 in the large head, more than half longest pectoral ray; just cutting dorsal profile. Interorbital flat; 1.25 in eye, 0.7 distance between posterior end of gape and orbit. Anterior nostril tubular, its height exceeding its diameter, its apical extremity surmounted by a subtriangular flap about two-thirds as long as the cylinder; nearly twice as far from rictus as from orbit, its distance from latter about half an eye-diameter, subequal to its distance from its fellow. Posterior nostril a simple opening with slightly elevated rim; directly behind anterior nostril, its distance from which is subequal to its distance from orbit measured along the line joining the nostrils, twice its least distance from orbit. Branchiostegals 6. Branchiostegal membrane continuous, with free border across isthmus. Operculum produced at upper angle into a broadly rounded membranous lobe, the subrectangular mesial part of the lobe, about twice as long as wide, thicker than the rest, and projecting a trifle beyond it; almost the whole lobe marked with minute ridges, running horizontally in the mesial elevated strip, diverging above and below it. Margin of preoperculum entire.

Numerous small pores on various parts of head, largely, probably wholly, representing the openings of neuromast tubules, which tubules often form well defined lines, sometimes simple, sometimes with short branches, usually of one tubule only. The conspicuous series are: (*i*) on each side, a direct forward continuation from lateral line proper to eye, at 2 o'clock (left side viewed), bearing half a dozen upward and two or three downward offsets; (*ii*) a symmetrically sinuous, grossly forwardly convex line, with well defined branches, originating on each side in the posterior part of (*i*), and crossing dorsum of head to link the systems of the two sides; (*iii*) a segment, curved forward mesially for a distance little less than its transverse extent, linking the anterior terminations of (*i*), passing across head in hind half of interorbital area; (*iv*) a paired segment, arising from about the anterior one-third of (*iii*), and running forward along top of head, internad of nostrils, to end about two-

thirds as far from end of snout as from level of front of eye, the two elements subparallel throughout their length, which is a little less than length of snout; (*v*) on each side, a continuation from the junction of (*i*) and (*iii*), consisting of some 25 tubules, extending first downward, then forward right round orbital rim to 7 o'clock, thence running on, without interruption, in a slightly upwardly concave line, to cease about half an eye-diameter in advance of eye, at a little above level of lower border of pupil; (*vi*) on each side, a line running down the slightly oblique ridge of the preoperculum, and thence extending forward, nearly straight, passing just below orbit, to end on ventral surface near tip of lower jaw, the posterior part giving off several broad-based offshoots, which rebranch. When the specimen is freshly taken from the alcohol, large sections of these canals are at times seen to be filled with air.

Dorsal with 19 spines, 13 simple rays, the former scarcely less flexible than the latter, but somewhat more slender basally; originating very shortly behind tip of opercular lobe, about level with base of lowest pectoral ray; length to origin 2.83 in *Ls;* terminating in advance of caudal base by slightly less than length of caudal fin; base of spinous portion, measured between bases of spines, less than distance of its origin from tip of snout, 1.07 in interval between ventral and anal origins; base of rayed portion, measured between bases of rays, 1.89 in base of spinous portion, equal to snout; whole fin continuous, its total length, including membrane between last spine and 1st ray, 2.19 in *Ls*: many spines and rays imperfect distally, making outline of fin somewhat conjectural; spinous portion, after rising sharply from 1st to 2nd spine, probably decreasing slightly and evenly to last spine; rayed portion, after beginning a trifle lower than last spine, rising noticeably to penultimate ray; longest measured spine (2nd) 5.5, longest measured ray (12th) 4.25, in head; 1st and 2nd spines, and 12th and 13th rays, inserted very close together. Anal with 3 spines, 9 simple rays, the first 2 spines contiguous basally, originating below 4th dorsal ray, terminating below interspace between last 2 dorsal rays; length to origin 1.43 in *Ls;* base 9.42 in *Ls,* a little less than one-fourth total dorsal base, about one-third of ventral-anal interval; fin probably increasing in height regularly to 4th ray, which is 4.4 in head, and thereafter decreasing. Ventral with 1 spine, 4 subequal simple rays, the 2nd (longest) 3.3 in head, 1.3 in the spine; fin rather small, 3.0 in head, 9.2 in *Ls;* originating about below first one-third of pectoral, slightly nearer top of snout than end of anal; length to origin 2.58 in *Ls;* extending 0.37 of distance towards vent. Pectoral with 12 rays (both fins), simple, or bifurcated very briefly, the uppermost unbranched, stouter than the rest; largish, 2.4 in head, 7.1 in *Ls,* bluntly rounded; longest (6th-7th) ray 2.6 in length to origin of fin, subequal to postorbital head; adpressed, reaches to below interval between 8th and 9th dorsal spines. Caudal with 20 rays, 10 branched, 13 reaching to, or almost to, hind border, the upper 3 and the lower 2 very slender; rather large, 1.7 in head, 4.9 in *Ls,* about twice anal base; probably somewhat pointed; bearing in middle one-third of upper portion a conspicuous ovoid black spot (see below).

General color yellowish flesh. Lateral surface of trunk and tail liberally sprinkled with minute darker punctulations, those on trunk being almost continuous from dorsal profile down to a little below midlateral line, below which they continue, more sparsely, as 4 indistinct bars, the upward extension of which is vaguely indicated by some small irregular areas left unpigmented, or pigmented less densely than most of upper half of flank; those on the tail extending down to ventral profile, varying somewhat in intensity, with a suggestion (particularly on left side) of the presence of 3 obscure bars; the whole pattern between head and caudal base faint. Ventral surface of trunk immaculate; that of tail lightly dusted with small dark chromatophores, except narrowly along most of (left side), or hinder half of (right side), anal base. A yellow, virtually immaculate streak, beginning just behind middle of snout, running back horizontally to orbit, its upper border level with middle of height of trunk, its lower failing to reach ventral profile by something less than its own width; continuing unbroken below orbit, and spreading over preoperculum up to level of middle of eye [from its anterior origin to below

middle of pupil this area of color coincides with the genal facet met with in other members of the family (Scott, 1966:100, 102)]: except for its squamous upper one-fifth, operculum immaculate: rest of lateral surface, and whole dorsal surface, of head minutely peppered: whole lower surface without markings. Portions of head lacking discrete chromatophores in general yellowish, punctulated portions darker; behind eye mostly light brownish (some reddish immediately behind middle of orbit), immediately in front of eye a triangular reddish patch, tapering forward to about middle of snout, the rest of snout light brownish; on dorsum, a little less than first half of snout light brown, the rest reddish, this color extending mesially to level of middle of orbit, there being succeeded by darkish brown; interorbital portions of both the reddish and the darkish brown bordered by conspicuous supraorbital arcs of darker, almost black.

Dorsal spines and rays whitish; membrane, part only of which is intact, whitish with a few small areas of black chromatophores distributed thus: on basal half of membrane between spines I and II (a few punctulations also on bases of spines), on basal one-eighth (all that is preserved) of II-III, and III-IV, a single line along base of IV-V (all membrane here intact), a short subvertical line in middle of lower two-fifths of VIII-IX; the whole of the membrane of rays 2-3, and 3-4, with some on basal one-third of ray 1 (membrane 1-2 missing). Anal spines and ray 1 whitish; all membrane of 2-5 heavily punctulated with black, the pigmentation encroaching, in several small patches, on the rays; behind ray 5 all that is preserved of fin whitish (rays) or colorless (membrane). Pectorals and ventrals wholly hyaline. Caudal greyish (the punctulation equally dense on membrane and rays), a trifle lighter, more yellowish, basally, where scales extend on to fin: a very conspicuous sharply defined ovoid black spot (quite the most noticeable marking on the fish), touching 1st (most dorsal), and extending over 2nd, 3rd, 4th, branched rays; the major axis longitudinal, a little shorter than distance of front of marking behind base of rays, or about two-thirds the extension of the fin beyond it, or 0.8 eye-diameter; faint indications, in parts, of a yellowish border.

Discussion.—A comparison of the characters of our specimen (noted here in parentheses) with those of Johnston's, as reported in his account, or as derived from his sketch, yields very good overall agreement.

Dorsal, anal, pectoral counts—20/12 (xix, 13); 3/9 (iii, 9), 12-14 (left/right 12/12)—show divergence only in the dorsal, in which, however, the total number of elements is in both cases 32; in the present specimen the 3rd anal element is broken off within a millimetre of the base, but is judged, on basal diameter, probably to be a spine (iii is the normal count in Neoodacidae). As already observed, Johnston makes no mention of, and does not figure, ventrals (i, 4). Lateral line counts are identical at 40. Johnston's l. tr. is recorded as '3/8-9' (3/1/7). In considering the short table of dimensions given for the type, 'total length', 'length of body' are taken to signify length from tip of snout to tip of caudal (*Lt*), length from tip of snout to base of caudal (virtually *Ls*), respectively: the entry '½ ¼ inches' for greatest depth of body is presumably to be read as ½ in. ('¼ inches' appearing again, immediately below, for least depth of body). Proportions calculated from these measurements, with values of our specimen in parentheses: *Lt* 1.19 (1.20) *Ls;* head 3.01 (2.94) in *Ls,* 3.57 (3.54) in *Lt;* snout 2.00 (2.21) in head; eye 2.82 (2.22) in snout, 5.57 (5.02) in head; greatest depth of body 8.00 (10.8) in *Ls,* 9.50 (13.1) in *Lt;* least depth of body 16.0 (17.1) in *Ls,* 19.0 (20.6) in *Lt.* Some approximate values derived from the sketch of the type published by Whitley (1929) expressed as *TLs* (our values in parentheses): length to dorsal origin 320 (354); dorsal base 500 (457); length to anal origin 700 (806); anal base 100 (106); hence dorsal base about 5 (4.2) anal base. The figure shows the anal originating about under 8th ray of dorsal counting forward from last ray (12th), and ending below interval between last and penultimate dorsal rays (ditto): interval between anal termination and caudal origin about twice (1.8) anal base, subequal to (0.87 of) combined eye and snout; length of caudal peduncle about three times (3.2) its minimum depth.

The three other morphological items noticed in the account of the type—the entire preoperculum, the much produced, finely pointed snout, the opercular lobe with 'a rayed appearance'—are matched in our fish. 'Colour of body and fins reddish' is not applicable to the present specimen, which has body in general yellowish flesh, and fins hyaline or greyish, some with dark areas: touches of reddish apparent in several places may indicate, however, a more general former presence of that color. The most notable marking on the fish, the black spot on the caudal, is similarly located in the figure and in our specimen, but is in the latter less extensive anteroposteriorly, while remaining equally sharply delimited and no less conspicuous.

The matter of the ventrals calls for some further examination. That Johnston neither described nor figured them is certain; and all else is speculation: and, while speculation in circumstances such as these is always hazardous, notice should be taken of two considerations that would seem to carry, in a balancing of probabilities, a certain amount of weight—namely, first, he makes no mention of their absence, though a lack of ventrals is quite unusual (among Australian Labriformes occurring only in the Siphonognathidae); secondly, he placed his fish, without question, in the genus *Odax* Cuvier & Valenciennes, 1840 [date given as 1839 in Sherborn, p. 4543, with reference to p. 298 of vol. xiv of *Hist. Nat. Poiss.*, and in the Check-List: however, Whitley (1947:146), giving page reference as 299, notes '"1839" = January, 1840'] (a genus replaced in the Check-List, for Australian species, by *Neoodax* Castelnau, 1875), which is characterized by the possession of ventrals. On the other hand, if his fish had ventrals, why does not his sketch show them? If the writer were to venture a guess (to be recognized as such), it would envisage the following situation: (*a*) ventrals were present in Johnston's specimen; (*b*) omission of mention of them from his account was due (in possible order of likelihood) to an assumption the matter was already covered by the generic ascription, to oversight, to some other reason; (*c*) their omission from the sketch either represents a pure visual error made at the time (the fins in our specimen are small, and are carried so close to the body that, unless sought, they can easily remain unseen), or is to be ascribed to the rather informal character of the sketch (when our fish is viewed in strict profile, the left ventral, lying close against the trunk, does not break the general line of the body, below which the right, somewhat more erected, dips slightly).

There remains, finally, the question of the generic status of the present specimen. The presence of ventrals (together with the absence of the vermiform appendage on the tip of the upper jaw) clearly rules out *Siphonognathus* Richardson, 1858 (Siphonognathidae), under which it appears in the Check-List (McCulloch, 1929:325). With the little-known species, such as *Neoodax attenuatus* (Ogilby, 1897) from Tasmania—which does not seem to have been recognized since its institution—and perhaps one or two of Castelnau's imperfectly characterized species held in suspense, the remaining well-known

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Fig. 1.—*Neoodax beddomei* (Johnston, 1885). 1*a*.—A specimen, 65.0 mm in standard length, from the Furneaux Islands, Tasmania; some details of vertical fins conjectural: x2. 1*b*.—Ventral aspect of anterior portion of upper jaw, showing labial plicae: x15. 1*c*.—Ventral aspect of left ventral fin, with azygous basal scales: x6.

Fig. 2.—*Creedia haswelli* (Ramsay, 1881). Some details from two specimens, 60.1 mm, 34.8 mm in standard length, from the Furneaux Islands, Tasmania. 2*a*1.—Frontal aspect of head (smaller specimen), to show tips of jaws (pupil with anteroinferior displacement): x25. 2*a*2.—Lateral aspect of anterior portion of head (smaller specimen), to show tips of jaws: x20. 2*a*3.—Ventral aspect of anterior portion of upper jaw (smaller specimen), to show scoop-like distal process: x40. 2*b*.—Internal aspect of left ventral fin (larger specimen): x10.

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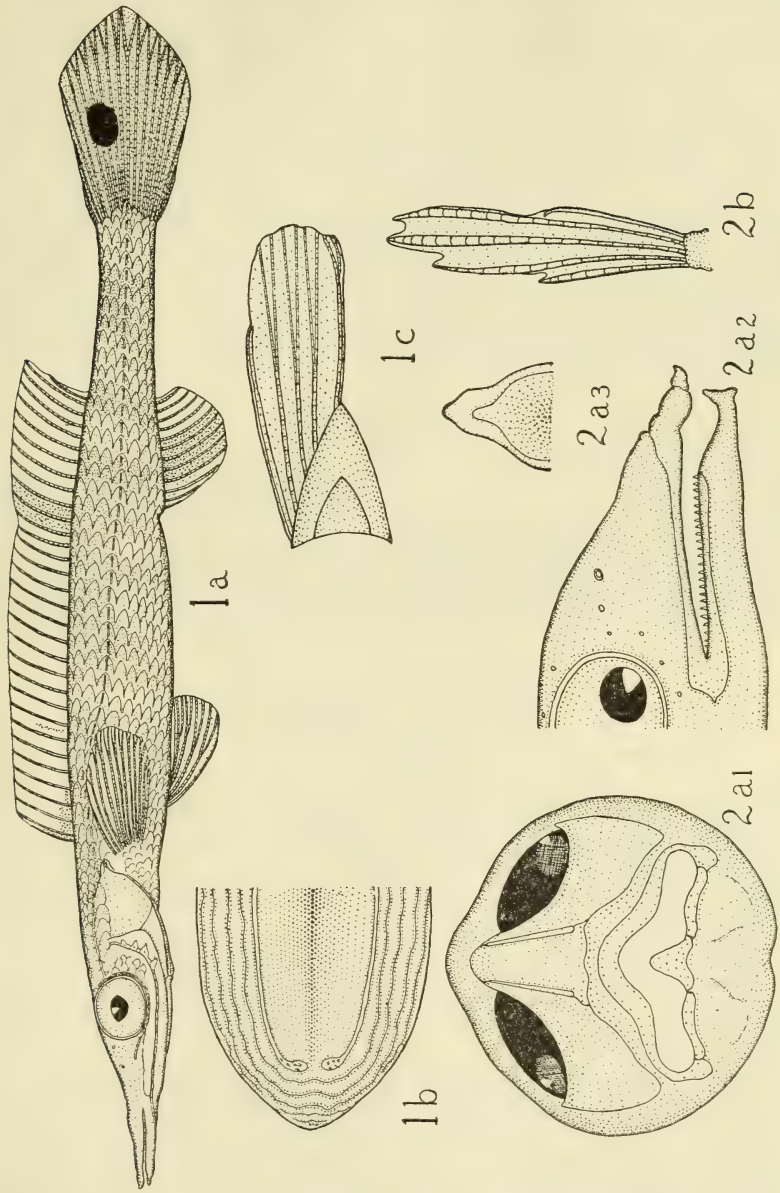
1a
1b
1c
2a1
2a2
2a3
2b

species listed under *Neoodax* in the Check-List (McCulloch, 1929:323-324) constitute a group well characterized by the standard family features and satisfactorily homogeneous in respect of general structure. Though *Odax semifasciatus* Cuvier & Valenciennes, 1839 [1840] has been generically separated from other species of *Neoodax* as *Haletta* (Whitley, 1947:146) on the ground that it 'differs from other members of the family in having more than 50 (usually about 55 to 63) transverse rows of scales, instead of from about 30 to 45, as in *Neoodax* spp.', while in the same paper there is instituted *Sheardichthys,* a subgenus of *Neoodax,* with as orthotype *Malacanthus radiatus* Quoy & Gaimard, 1835, 'distinguished from typical *Neoodax* by its acutely pointed middle caudal rays, the rest of the fin rhombic rather than rounded, whilst the preoperculum has an entire edge', the 2 species thus separated off are, except in respect of the differentiae noted, well assimilated as regards general form with the remaining well-established species. With this compact group, more or less coextensive with *Neoodax* as understood in the Check-List, our specimen would certainly seem naturally to be associated. A notable point of similarity, over and above agreement in general form, is the presence in those fish and in the present specimen of large tumid lips, internally strongly plicate. The specimen here discussed is accordingly identified as the long-missing *Neoodax beddomei* (Johnston, 1885).

Family CREEDIIDAE

Only two representatives of the family appear in the Check-List: (*i*) *Creedia haswelli* (Ramsay, 1881), of which *C. clathrisquamis* Ogilby, 1898 is treated as a synonym; (*ii*) *Squamicreedia obtusa* Rendhal, 1921. Neither is listed from southern Australian waters, McCulloch recording the first from New South Wales (both Ramsay's and Ogilby's types) and Victoria, the second only from north-western Australia. *Creedia haswelli* is here reported from Tasmanian waters: opportunity is taken to extend the accounts of Ramsay, Ogilby, and Waite (1899), and attention is called to some differences found in our material.

Genus CREEDIA Ogilby, 1898

Creedia haswelli (Ramsay, 1881)

(Figure 2)

Hemerocoetes haswelli Ramsay, 1881, *Proc. Linn. Soc. N.S.W.*, vi, 3:575. Type locality: N. Head, Port Jackson; 16 fathoms.

Creedia clathrisquamis Ogilby, 1898, *Proc. Linn. Soc. N.S.W.*, xxiii, 3:299. Type locality: Maroubra Beach, near Sydney.

Creedia clathrisquamis Ogilby. Waite, 1899, *Mem. Aust. Mus.*, IV, 1:63, figs 6, 6A, 6B.

Creedia haswelli (Ramsay). McCulloch, 1929, *Mem. Aust. Mus.*, V, III:333.

Tasmanian record.—Two specimens—(*a*) *Ls* 34.8, *Lt* 40.5; (*b*) *Ls* 60.1, *Lt* 69.5—were collected by Mr. R. Slater in August 1966 in the Furneaux Islands (for notes on locality record and circumstances of capture see account of *Neoodax beddomei,* above).

Dimensions as TLs.—Length to dorsal origin 626, 632, termination 876, 886; anal origin 484, 471, termination 950, 960; pectoral origin 175, 184; ventral origin 182, 186. Length of pectoral 122, 146, of longest (5th, 4th) ray 86, 108; of ventral 57, 77, of longest (3rd, 3rd) ray 53, 68. Head 207, 223; eye 32, 36; snout 56, 55; interorbital 4, 5. Length to vent 460, 463. Depth (in parentheses width) at back of eye 52, 57 (56, 63); at operculum 78, 93 (66, 67); maximum 86, 97 (66, 82); at vent 59, 84 (43, 75); at caudal peduncle 30, 51 (17, 21). Specimen (*b*): 1st, 3rd (longest), last dorsal ray 82, 90, 32; 1st, 2nd, 3rd, 12th (longest), last anal ray 20, 33, 37, 67, 23; 1st-4th ventral rays, counting from spine, 67, 68, 57, 33. ventral spine 38.

General description.—Where two values are given in the following account, the first relates to the smaller individual (*a*); single statements are applicable, except where expressly stated otherwise, to both examples.

D. 15(?), 15. A. 27(?), 27. P. left/right 15/14, 15/14. V. i, 4. C. 16 (10 branched, reaching hinder border). L.lat. 43. Sc. tr. 3½/1/1½. Br. 6.

Head 4.83, 4.49, trunk 3.95, 4.17, tail (without caudal) 1.85, 1.86 in *Ls.*

Elongate; maximum depth 11.6, 10.4, depth at vent 17.0, 11.9, caudal peduncle 33.1, 19.7 in *Ls;* body well rounded, widths at pectoral, ventral, anal origins 1.2, 1.4; 1.2, 1.4; 1.4, 1.1 in depths there.

Trunk and tail wholly covered with large scales in 6-7 rows; except for the specialized lateral line scales, cycloid; several on caudal, none on pectoral, base; on dorsum of head extending forward only to occiput, about to level of preopercular border; on lateral surface of head a band 4-5 long on cheek, anteriorly with 3 rows posteriorly with 2, upper border of series about level with bottom of pupil, lower border below level of angle of gape; head otherwise naked: 27, 25 scales on dorsum in front of 1st dorsal ray. Scales of lateral line to level of adpressed pectoral (about 8) similar to adjacent scales; thereafter, to level of vent, with posterior border becoming progressively more produced and more pointed, both borders of this tongue, from second scale in advance of vent caudad, exhibiting some serration; beyond vent, projections at first few (2.3), large, confined to basal region of lobe, becoming in later scales progressively more numerous (up to 8), smaller and finally obsolescent, disposed along nearly the whole of each border.

Lateral line with 43 tubules, the first 8-9 running back from upper angle of operculum in a nearly straight, slightly downwardly oblique line to midlateral flank at level of end of adpressed pectoral; next 4-5 descending at an angle of about 45° to reach (at about posterior two-thirds of ventral-anal interval) to within 2 scales of midventral line, at 4-5 times as far from dorsal as from ventral profile; thence continuing caudad subparallel to ventral profile.

Head rather small; subconical, superior profile more oblique than lower. Snout moderate; 1.6, 1.5 in postorbital head; subequal to (0.95 of), less than (0.72) length of ventral. Eye moderate; 6.5, 6.2 in head, 1.8, 1.5 in snout; set high, cutting dorsal profile. Interorbital convex, moderately anteriorly, strongly posteriorly; very narrow, 7.3, 7.0 in eye.

In the smaller individual, in which the snout is intact, the upper jaw projects beyond the lower in a scoop-like extension; in plan, nearly two-thirds of an ellipse, bounded by the lips (much thickened anteriorly); excavate ventrally, with the lips constituting a pronounced inwardly-projecting rim; in lateral aspect, with the ventral profile curved upwards, more rapidly anteriorly, the dorsal profile made up of two segments, the hinder exhibiting the greater convexity; dorsal surface strongly convex transversely: lower jaw with a terminal knob, directed vertically upward (based broadly across the front, rather narrowly anteroposteriorly), its subconical distal part received, with jaws closed, into the relatively deep general concavity of the roof of the mouth immediately posterior to the scoop of the upper jaw. In the larger individual the tip of the upper jaw has been crushed into an irregular mass, but this jaw still projects somewhat beyond the other, and the general arrangement of the parts is similar to that in the smaller fish, except that the base of the mandibular symphysial knob extends noticeably further caudad along its anteroposterior axis. See Fig. 2a; also discussion, below.

Mouth extends: cleft to below 0.2, 0.1, maxilla to below 0.4, 0.6, of eye. Teeth in lower jaw biserial: outer row, visible externally, about 24, beginning some distance behind tip of jaw, large, stout, subconical, straight or slightly recurved, regularly spaced, their interspaces at base about half basal diameter, increasing in size backwards to about the 20th, behind which they decrease somewhat; inner row set well within jaw, shorter than outer row, the teeth

more pointed, relatively more slender, much smaller than (about half the size of) those of outer row, set somewhat irregularly, their interspaces varying by at least a factor of 2. Teeth in upper jaw confined to little more than the hinder half of the jaw, chiefly in a single row of 35-40, very much smaller than (less than half the size of) the outer mandibular teeth, the anterior ones minute. Palate apparently edentulous. Tongue long, slender, subtriangular in section; the borders of the upper surface papillate; translucent except for a brownish slightly expanded terminal lobe.

Anterior nostril transversely elliptical, with a low rim; superior, on an anteroposterior axis passing through a point about midway between upper border of pupil and upper border of orbit; about twice as far from eye as from free border of lip. What is probably the posterior nostril is a low-rimmed opening of similar size, set shortly behind the anterior nostril, their interspace subequal to shortest distance from anterior nostril to free border of lip. Other pores, little smaller than the presumed nostrils, occurring on the head include: a series of about 7, appearing as openings at the junctions of the elements of a segmented neuromast tube starting behind and slightly below presumed posterior nostril (to which it is somewhat closer than that opening is to anterior nostril), running round eye to about 3 o'clock (left side viewed), where it becomes confluent with a subhorizontal forward extension, consisting of 5-6 tubules, of the lateral line proper, and with a loop, with 5 symmetrically disposed pores, passing over occiput to join the system on other side of fish; two pairs, smaller than those just noted, on dorsum behind nostrils. Branchiostegals 6. Branchiostegal membranes free, not joined across the isthmus; wholly covered by the flexible, transparent, strongly radially striated operculum and suboperculum, whose inferior borders extend well behind and below the branchiostegals. Free border of preoperculum in (*a*) rounded, the upper portion minutely crenulate; in (*b*) more sharply angled, the upper segment crenulate, the lower in part minutely denticulate. Upper portion of opercular border sigmoid; with, in (*b*), numerous small denticulations; hind and lower portions a single, broad, more or less even curve, bearing, in both specimens, some obscure well-separated crenulations.

Dorsal with 15(?), 15 rays, most simple, but several (not consecutive) in middle part of fin with some indication of brief distal bifurcation; originating above 9th (?), 9th anal ray; length to its origin 1.60, 1.61 in *Ls*, or 1.36, 1.29 times anal base; terminating above 24th (?), 24th anal ray, in advance of caudal base by 0.54, 0.45 its own base, which is 4.22, 3.94 in *Ls*, or a little less than ventral-anal interval, or a trifle more than half (0.51, 0.52) anal base: in (*b*)—tips of most rays missing in (*a*)—fin increasing in height from 1st ray to 3rd (these 3 rays 6.9, 2.7, 2.5 in head), thereafter decreasing evenly to last, which is 6.9 in head. Anal with 27(?), 27 rays, all simple; length to its origin 2.07, 2.12 in *Ls*, or slightly more than, slightly less than, base of fin, the latter 2.15, 2.04 in *Ls*: (the following notes on anal rays are based on (*b*) only), 1st, 2nd, 3rd rays 11.3, 6.7, 6.1 in head; fin increasing regularly to its maximum height about at 12th ray, which is 3.3 in head, thereafter decreasing in height very slightly to within 3 or 4 rays of the end; last ray 9.6 in head, intermediate in length between 2nd and 3rd rays. Ventral with 1 spine and 4 simple rays (see Fig. 2b); moderate, pointed; length 3.6, 2.9 in head, 17.4, 13.0 in *Ls;* inserted a trifle behind front of pectoral base, and a little behind level of middle of operculum; length to origin 5.5, 5.4 in *Ls;* extending 0.21, 0.28 of distance towards vent; in (*b*) spine and rays in succession from spine 5.8, 3.4, 3.3, 3.9, 6.7 in head. Pectoral with 15 rays (left), 14 (right) in both fish; largish, 1.7, 1.5 in head, 8.4, 6.9 in *Ls;* pointed, the upper 3 or 4 rays not much shorter than longest ray (5th, 4th), which is 2.4, 1.7 in head, the lowest 3 or 4 rays very short; all rays simple; adpressed, fails to reach level of vent by a distance subequal to length of postorbital head. Caudal moderate, 1.3, 1.2 in head, 6.1, 6.4 in *Ls;* truncate; with 16 rays, of which 10 (branched for about one-third of their length) contribute to posterior border of fin.

Smaller individual with head and trunk uniform pale pearly yellowish, except for a patch of small brownish chromatophores on occiput; tail with, particularly along dorsal profile, some sparse minute punctulations visible only with a lens: fins grossly concolorous with head and body, the membranes somewhat lighter. Larger fish with similar ground color; a subcircular patch of small brown spots on occiput (which is tinged with reddish brown); brownish punctulations, varying from a group of two or three to a more or less clearly developed subvertical band of a couple of score, situated on, or behind, middle of exposed part of scale occurring as follows—on whole dorsum of tail and on most of dorsum of trunk; in the anterior portion of the lateral surface of trunk on the 2 upper rows of scales, in the posterior portion and continuing on tail to caudal base on the 3 upper rows of scales; on all, except the first couple, of scales bordering the anal fin, and on the same row on the caudal peduncle: all fins immaculate except caudal, which bears a few obscure small dark scattered spots.

Discussion.—Comparison of our material with the accounts, each based on a single individual, of Ramsay (1881:575) (*Hemerocoetes haswelli;* length 2.4 in.), Ogilby (1898:299) (*Creedia clathrisquamis;* 37 mm), and Waite (1899:63) (*Creedia clathrisquamis;* 52 mm)—the last with an outline figure of the fish, twice natural size, and figures of an ordinary scale and a scale of the lateral line—reveals a good general agreement, accompanied by some interesting variations. Waite records no fin counts or dimensions (other than length of specimen), and data for his example are derived from his illustration: with these our fish is here directly compared (Waite's data in parentheses) [specifications from Ramsay and Ogilby, where available, in square brackets; if 2 values given, Ramsay's first].

Dorsal: rays more numerous, 15 (12) [14, 12]; beginning above 9th anal ray (8th-9th) [Ramsay 'nearly opposite seventh']; base in (*a*), 0.237 *Ls,* subequal, in (*b*), 0.254, longer (0.242); fin lower, longest ray (*b*) 2.5 in head, 11.1 in *Ls* (1.9, 9.0); profile behind 3rd ray virtually straight (convex), last ray much shorter, 0.4 (0.7) 1st ray; rays in general slender, and, except for several with some indication of distal division, cylindrical (regularly expanding distad); interval between dorsal origin and caudal origin, relative to length to dorsal origin, noticeably less, 0.60, 0.58 (0.69) [Ogilby '⅔']. Anal: ray count, 27, in good agreement (26) [27-28; 26]; base a little shorter, 0.52, 0.49 *Ls* (0.54); fin lower, longest ray (*b*) 3.3 in head, 14.8 in *Ls* (2.4, 11.4); anterior margin of fin rising gradually, with 1st-3rd rays, as *TLs,* 20, 28, 37 (1st ray subequal to 2nd and next few rays); length to origin, as fraction of interval from origin to caudal origin, noticeably greater, 0.94, 0.89 (0.80) [Ogilby '4/5']. Pectoral: count of 14-15 is perhaps higher than Waite's [Ramsay 13-14]; length a trifle less than postorbital head (the same) [Ogilby '½ of the head']; lower rays decidedly shorter. Ventral (Fig. 2b): i, 4, with ray second from spine barely longer than ray next to spine (Waite's figure perhaps depicts 4 elements in all, the second extending well beyond the rest) [Ramsay '1/5', Ogilby 'second ventral ray the longest, about 1/3 of the head']. Caudal: 16, with 10 reaching hind border, branched (the same) [Ramsay the same].

Lateral line 43 (about the same) [44, 40]. Scales between head above and 1st dorsal ray about the same, 27, 25 (about 27) [Ramsay 26-28]. Head a little larger, 4.7, 4.5 in *Ls* (5.1) [Ramsay 5 in *Ls,* Ogilby '4⅔ in the total length']. Eye about the same, 6.5, 6.2 in head (about 6.3) [Ramsay 6, Ogilby 6.1], and 1.8, 1.5 in snout (about 1 6) [Ogilby '4/7 of the length of the snout']. Height about the same, 2.4, 2.3 in head, 11.6, 10.3 in *Ls* (2.3, 13.3) [Ramsay 'twice in the head and nearly ten times in the total length, without caudal fin'; Ogilby '12 in the total length']. Maxillary extending to below 0.4, 0.6 of eye, the value for (*b*) the greatest recorded (about 0.4) [Ramsay mouth 'opens to opposite the anterior margins of the eye', Ogilby 'maxillary reaching slightly beyond the anterior border of the eye']. The dentition (see account of our material above) is noticed only by Ramsay: 'minute teeth on both jaws, no canines'; 'There are no teeth visible on the vomer'.

Waite observes of his example, 'It is longer than the type [*i.e.*, of Ogilby's *C. clathrisquamis*) and measures 52 mm. in length, but differs otherwise only by having the lower jaw the longer, possibly a sexual difference, and being of more pronounced colour'. If Waite's conjecture regarding a sexual significance of the longer lower jaw is entertained, the presence in both our examples of the curious fleshy appendages here described and figured—of which there is no sign in his illustration—raises a question as to whether the development of these structures may be seasonal. Ramsay's specimen (dredged in 16 fathoms, sandy bottom) was obtained in April, Ogilby's ('Maroubra Beach, near Sydney') in June, Waite's (taken on the sandy stretches of the Newcastle Bight in 24-27 fathoms) during the trawling expedition of H.M.C.S. Thetis in February and March 1898; our specimens (probably from a weedy sandy flat at 2-8 metres) in August—the samples thus being collected in autumn, winter, summer, spring, respectively.

The coloration of our fish, described above, may be summarily diagnosed as pale pearly yellowish, with brown markings on some scales, and, in (*b*), dark patch on occiput (Waite 'brown, with a circular mass of spots on the occiput and a row of spots near the margin of each scale') [Ramsay 'Colour light brown, semitransparent when alive'; Ogilby 'Colourless; a few minute black spots along the base of the anal fin; irides black'].

In spite of the existence of some differences between them—the most striking being the presence of terminal rostral structures, of only 4 ventral rays (*cf.* Ramsay's 5), and the more posterior anal origin in our material—there is probably no good reason to regard all 5 specimens here noted as other than conspecific.

Family CLINIDAE
Genus PETRAITES Ogilby, 1885
Petraites phillipi (Lucas, 1891)

Cristiceps phillipi Lucas, 1891, *Proc. Roy. Soc. Vict.* (n.s.), iii: 11, pl. iii, fig. 2. Type locality: Port Phillip, Victoria.

Petraites phillipi (Lucas). McCulloch, 1908, *Rec. Aust. Mus.*, vii, 1:43, pl. X, fig. 3. *Id.* McCulloch, 1929, *Mem. Aust. Mus.*, V, III:349.

Remarks.—Three examples from Green's Beach, Devon reported in these Observations (1966:109) provided the first record for this State: in Part XV (1967) three samples of 2, 2, 16 specimens are noted. Despite the fact that it was not till nearly three-quarters of a century after its establishment on Victorian material that this species was recognized in Tasmania, it turns out to be tolerably abundant here, numerous examples having recently been taken on our northern coast: it is at present known only from these two States.

Coloration.—A series included among intertidal material collected by Mr. R. H. Green at Kelso, Devon on 5th-6th February 1967 presents a remarkable variation in coloration. Virtually constant features include: a sharp (often very sharp) demarcation in ground color of upper and lower parts of head and body; a blackish pupil; a conspicuous glowing reddish amber or ruby iris (sometimes with indistinct darker or lighter spokes), which is quite characteristic, and makes possible the immediate separation of this species from the generally not dissimilar *Clinus perspicillatus* Cuvier & Valenciennes, 1836; a difference in color between the tubular segment of the lateral line, extending above the pectoral, and the body there (most usual colors of lateral line red or black, or an approximation to one of these).

Half a dozen combinations of flank colors, together with the color of the anterosuperior segment of the lateral line, are here noted (in each case the specification preceding the first semicolon relates to the upper portion of the flank, which is anteriorly somewhat less than, posteriorly equal to or somewhat greater than, half the vertical extension; that following the second semicolon to lower portion of flank; with the third entry referring to the lateral line): (*i*) purple, somewhat pinkish, with darker purple blotches; silvery, with some lilac; blackish: (*ii*) reddish, with some large darker vermiculations and 2 or

3 pairs of opposed dark linear markings; yellowish olivaceous; a little darker than adjacent base color: (*iii*) reddish green, with dark greenish brown mottlings; yellow, faintly greenish, with indistinct darker mottlings; barely darker than ground color: (*iv*) warm reddish brown, with greenish brown lines and other darkish markings; flesh pink, becoming somewhat greenish ventrally (demarcation between upper and lower halves of flank very pronounced); blackish: (*v*) deep reddish brown, distinctly darker in a narrow strip at junction with lower half, markings very few and faint; biscuit, virtually immaculate; blackish: (*vi*) reddish olivaceous, with a few faint dark brownish markings; lilac with some purplish longitudinal, somewhat sinuous markings, tending to form briefly interrupted lines, and with numerous small whitish spots; rather darker than base.

If color pattern were of taxonomic significance here, the specimens in which the white markings occur, in regular association with characteristic ground colors of reddish olivaceous and lilac, would certainly be differentiated from all others. In some individuals of this type the numerous small whitish spots noted for (*vi*) are replaced by a small number of larger well-rounded white spots, disposed in a more or less linear series along about middle of flank, and tending to decrease (though not always in strict sequence) caudad.

Distinction from Clinus perspicillatus.—Though this species is accorded generic distinction from what is probably our most common rock-pool fish, *Clinus perspicillatus* Cuvier & Valenciennes, 1836, on the location of the termination of the membrane of the first dorsal [in *Clinus* Cuvier, 1816 this membrane is connected to middle (or slightly below middle) or to upper half of 1st spine of the compound second dorsal (with numerous anterior spines and several posterior rays); in *Petraites* Ogilby, 1885 it ends free of second dorsal or is connected only to base of its first spine—the latter genus being established, following a suggestion by Macleay (1882:20), to accommodate species which 'oscillate between the two genera' *Clinus* and *Cristiceps* Cuvier & Valenciennes, 1836], the two forms are not very dissimilar. From *Clinus perspicillatus* the present species may be distinguished, apart from the small difference in first dorsal membrane attachment, most notably by its possession of: (*i*) higher first dorsal, relative to second, with greater disparity between the lengths of the 3 spines (2nd longest); (*ii*) longer somewhat more filamentous ventral rays; (*iii*) more pointed head [well depicted in the original, somewhat sketchy figure (Lucas, 1891, pl. iii, fig. 2), but largely missed in McCulloch's more meticulous illustration (1908, pl. X, fig. 3)]; (*iv*) less complex ocular tentacle, figured in Part XIV (1966; compare Fig. 1a and Fig. 1d); (*v*) reddish amber or ruby eye; (*vi*) probably smaller size.

Family TRIPTERYGIIDAE

The four species reported from Tasmania—two of which have been added since the publication of the Check-List (McCulloch, 1929)—have been keyed in Part XV (1967:216).

Genus BRACHYNECTES Scott, 1957

Brachynectes fasciatus Scott, 1957

Brachynectes fasciatus Scott, 1957, *Trans. Roy. Soc. S. Aust.*, 80:180, fig. 1. Type locality: Pelican Lagoon, Kangaroo Island, South Australia.

Verconectes fasciatus (Scott). Scott, 1962, Marine and Fresh Water Fishes of South Aust.: 255; unnumbered fig. on p. 256.

Generic status.—Though T. D. Scott in his catalogue of South Australian fishes abandoned his *Brachynectes,* transferring its genotype, the present species, to *Verconectes* Whitley, 1931 (proposed as a substitute for *Trianectes* McCulloch & Waite, 1918, regarded as preoccupied by *Trinectes* Rafinesque, 1832)—the type of which, *Trianectes bucephalus* McCulloch & Waite, 1918, was described from Spencer Gulf and has not been recorded outside South Australia—*Brachynectes* is retained in Whitley's recent list (1964), and some considerations

favouring this course were noted by the present writer in an account of Tasmanian examples of this species (1967:216).

The generic diagnosis specifies dorsal fins 'close together', and the species description states 'Dorsal fins close together, but not connected at their bases'. In the specimen noted below, in which the fin membranes are particularly well preserved, that of the first dorsal extends right to the base of the first spine of the second dorsal, while the membrane from the latter fin is attached to the basal one-tenth of the first ray. Examination of Tasmanian material noticed earlier shows that some connexion of the dorsals by membrane, notably the junction of the second with the third, is not unusual: it may well be in life the normal condition. [It should be noted that 'interdorsal' measurements set out in Table VIII of the 1967 paper are measured between the bases of the 2 spines and between the bases of the spine and the ray].

New locality.—A jar of fishes submitted for examination by Mr. B. C. Mollison contains—together with 2 *Clinus perspicillatus* Cuvier & Valenciennes, 1836—an example of the present species: the label notes Mr. A. H. Hewer 'collected these on the coast, S.E. Tasmania, *ca* 1954, but cannot recall a precise locality'. Prior to the taking of examples at Green's Beach, Devon in September and December 1965, this species had not been reported outside South Australia (for distribution in that State, see Part XV:216); its occurrence in S.E. Tasmania is hence of considerable interest. A number of southern Australian species added to the Tasmanian list in recent years have hitherto been reported only from the northern coast: this situation is certainly accounted for partly, though just in what measure remains at present uncertain, by more intensive collecting in this region, carried out chiefly by Mr. R. H. Green, Zoologist, Queen Victoria Museum, Launceston. In view of current interest in suspected recent and continuing environmental changes, notably alteration in mean sea temperature, around our coasts, further light on the matter would be welcome.

Counts, proportions as TLs.—D. iii, x, 11. A. ii, 17. P. 12/12. C. 13 main rays. L.lat., left 12+19: on right, there are 11 tubules, but incisions have been detected only in the last 8 scales. Principal dimensions as *TLs*: total length 1236; head 304; snout 60*; eye 79; interorbital 68; length (measured to base of spine or ray) to origin, termination of first dorsal 192*, 223*, of second dorsal 313*, 605, of third dorsal 639, 890*, of anal 426, 935; depth, at vent (which equals maximum) 234, at caudal peduncle 114. Entries marked with an asterisk are lower than the minimum recorded earlier (1967, Table VIII); interdorsal width (68) lies just above the earlier range (48-66).

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NOTES ON THE DISTRIBUTION OF AUSTRALIAN HESPERIOIDEA AND PAPILIONOIDEA (LEPIDOPTERA)

by J. V. Peters

These notes are the result of a study of the butterfly collection of the Australian Museum.

Following each species name is given the distribution of the species as recorded by Waterhouse (1932) (indicated by (W.)) and Common (1964), indicated by (C.)). Following these are unpublished records from the collections of the Australian Museum and the author; the latter are indicated by (J.V.P.). These records are either extensions of the previously recorded distribution of the species or records of uncommon species which substantiate the recorded limits of their known range.

HESPERIOIDEA

HESPERIIDAE

Coeliadinae

Allora doleschalli doleschalli (Felder). ". . . Banks Is. as far south as Kuranda". (W.). "Cape York to Cairns". (C.).—Mackay, 1♂ no date, ex. O. Lower.

Hasora discolor mastusia Fruhstorfer. ". . . Cape York to the Richmond River". (W.). "Cape York to northern N.S.W.". (C.).—Thursday Is., 2♂ no date, ex Mrs. J. Babington White.

Hasora hurama hurama (Butler). "Banks Is. and Cape York as far south as Mackay". (W.). "Cape York to Mackay". (C.).—Blyth River, N.T., 1♂ 21.ix.1968, F. Omer-Cooper.

Hasora khoda haslia Swinhoe. ". . . Port Macquarie, N.S.W. to Brisbane". (W.). "Noosa to Port Macquarie". (C.).—Killara (Sydney), 1♀ 7.ii.1938, J. T. Waterhouse.

Pyrginae

Netrocoryne repanda repanda Felder. ". . . from Sydney along the coast to Brisbane". (W.). "Bunya Mts. to N.E. Victoria". (C.).—Mackay, 4♂ Jan., 1899, Jan., Feb., 1900, Jan., 1901, R. E. Turner; Carnarvon Range, Q., 1♂ 6.i.1940 N. Geary; Gayndah, Q., 2♀ no date, ?G Masters.

Trapezitinae

Trapezites iacchus (Fabricius), "From Brisbane to Cape York along the coast, also at Kuranda". (W.). "Cape York to Brisbane." (C.).—Prince of Wales Is., 4♂ 6♀ 14.v.-23.vi.1908, H. Elgner; Horn. Is., 1♂ 1♀ 1.ii.1939, R. G. Wind; Burleigh Hds., Q., 1♀ 19.iii.1941, C. P. Ledward.

Trapezites iacchoides Waterhouse. ". . . Blue Mts. . . . Como, near Sydney . . . Pambula and Eden, . . . Barrington Tops". (W.). "Sydney to Eden, Blue Mts., Barrington Tops". (C.).—Pt. Lookout, New England National Park, N.S.W. 5,250', 1♀ 4.i.1966, J. V. Peters (J.V.P.); Narrara, N.S.W., 1♂ 17.ix.1935, G. Lyell.

Anisynta dominula (Plötz), Neither Waterhouse nor Common mention this species from the area between Barrington Tops and the Brindabella Range, A.C.T. However it is now recorded as follows:- Hampton, N.S.W., 1♀ Jan., 1918, R. J. Tillyard; Boyd River, Kanangra Walls, N.S.W. 5♂ 6♀ 5.iii.1966, J. V. Peters (J.V.P.). The northern limit of this species is recorded as Ebor, however there is 1♀ in the Australian Museum collected by A. M. Lea at Dalmerton, N.S.W.

Hesperilla donnysa samos Waterhouse. "Blue Mts., N.S.W.". (C.).—18 miles west of Coolah, N.S.W., 6♂ 5♀ 9/10.iv.1966, J. V. Peters, (J.V.P.); Mittagong, N.S.W., 1♂ 29.xi.1926, G. M. Goldfinch.

ssp. *albina* Waterhouse. "Bunbury, . . . Waroona and . . . Stirling Range". (W.). "Stirling Range to Bunbury". (C.).—Rottnest Is. W.A., 1♂ 1♀ 19/20.iii.1934, K. R. Norris.

Neohesperilla xiphiphora (Lower). ". . . found rarely in Queensland . . . common at Port Darwin". (W.). "N.T., Cooktown to Cairns". (C.).—Thursday Is.: 1♂ 19.iii.1906, 1♂ 6.xii.1910, H. Elgner; Banks Is., 1♀ 22.ii.1910, H. Elgner; Prince of Wales Is., 5♂ 3♀ 22.i.-22.ii.1939, R. G. Wind.

Neohesperilla senta (Miskin). ". . . Herberton and . . . Kuranda". (W.). "Atherton Tableland". (C.).—Brock's Creek, N.T., 1♂ 4♀ 29.i.-21.ii.1933. T. G. Campbell.

Mesodina halyzia (Hewitson), "Brisbane . . . to E. Victoria . . . Western Australia". (W.). "Brisbane to Victoria, common near Sydney. S.W. Australia". (C.).—Port Dundas, Melville Is., N.T., 1♀ 3.x.1933; Maningrida, N.T., 1♂ 25/31.vii.1968; Maningrida, N.T., 1♂ 1/8.vii.1968; Cadell R.—Blyth R., N.T., 1♂ 7.x.1968, F. Omer-Cooper.

Hesperiinae

Suniana lascivia lascivia (Rosenstock). "Very common near Sydney and Brisbane, not rare elsewhere in N.S.W.; found in Victoria and recorded from Tasmania". (W.). "Brisbane to Victoria". (C.).—Couchman (1956) states that this species does not occur in Tasmania. Mackay, 7♂ 6♀ Sept., Nov., Dec., 1901, R. E. Turner; Carnarvon Range, Q., 1♂ 5.i.1939. N. Geary; Noosa, Q., 2♂ 7.ix.1914, H. W. Simmonds.

Arrhenes marnas affinis (Waterhouse & Lyell). "Palmwoods to Cairns and Kuranda". (W.). "Cairns to Brisbane". (C.).—Burleigh Hds. Q., 3♂ 5♀ 24/25.iii.1943, C. P. Ledward.

Telicota colon argeus (Plőtz). ". . . Richmond River to Cape York; also Bank's Is., and Port Darwin. One specimen recorded from near Sydney", (W.). "Darwin, Cape York to Sydney". (C.).—Turramurra (Sydney), 1♂ 19.iii.1964 J. V. Peters, (J.V.P.).

Telicota augias anisodesma Lower. ". . . between Brisbane and the Richmond River". (W.). "Brisbane to Richmond River". (C.).—Port Macquarie, N.S.W., 1♂ 14/19.ii.1941, G. M. Goldfinch.

Telicota ohara ohara (Plőtz). "Mackay to Cape York". (W.). "Cape York to Mackay". (C.).—Thursday Is., 2♂ 18.i.1910, H. Elgner.

Telicota ancilla ancilla (Herrich-Schäffer). "Mackay to Sydney". (W.). "Mackay to eastern Victoria". (C.).—Kuranda: 1♂ Jan. 1902, 1♂ 3.iv.1902, R. E. Turner; 1♀ April 1907, F. P. Dodd; Cairns, 1♀ 16.vi.1911, G. A. Waterhouse; Gt. Palm Is., Q., 1♂ 15.ix.1923, G. A. Waterhouse.

Telicota mesoptis mesoptis Lower. ". . . Mackay to Cape York". (W.). "Cape York to Mackay". (C.).—Port Darwin, N.T. 1♂ 24.xi.1902, G. Turner.

Telicota brachydesma Lower. ". . . Cooktown. It has also been taken at Kuranda". (W.). "Cooktown to Cairns". (C.).—Mackay, 1♂ no date, ex Lower coll.; S. Johnston River, Q., 1♂ 11.xi.1903.

Parnara naso sida (Waterhouse). "Cairns to Brisbane". (C.).—Port Macquarie, 1♂ Sept. 1941, H. W. Simmonds.

Pelopidas lyelli lyelli (Rothschild). "N.W. Australia, N.T., Cape York to Brisbane". (C.).—Prince of Wales Is., 5♂ 6♀ 16.v.-18.vi.1908, H. Elgner; Darnley Is., 1♂ 12.v.1910, H. Elgner; Bank's Is., 2♂ 2.iii.1910, H. Elgner; Thursday Is., 2♀ Apr., May, 1902, R. E. Turner.

Pelopidas agna dingo Evans. "Darwin, Cairns to Brisbane". (C.).—Brock's Creek, N.T., 1♀ 22.iv.1932, T. G. Campbell; Claudie River, N.Q., 1♂ 23.iii.1914, J. A. Kershaw.

PAPILIONOIDEA

PAPILIONIDAE

Papilioninae

Pachliopta polydorus queenslandicus (Rothschild). ". . . Torres Strait Is. Rarer along the coast to Ingham". (W.). "Cape York to Ingham". (C.).—Townsville, 1♀ 16.iii.1944, P.P.D.; Wyndham, W.A., 1♂ 18.xii.1930-8.i.1931, H. J. Willings. (A second label on this specimen reads—"locality doubtful: Held for reference".).

PIERIDAE

Coliadinae

Eurema drona australis (Wallace). "N.T., Cooktown to Richmond R.". (C.). As *Terias libythea zoraide* (Felder), Waterhouse gave the distribution as ". . . Richmond R. to Cooktown and at Port Darwin. Rarely found near Sydney". The following records show that this species is more common south of the Richmond R. than has been suggested.—Urunga, N.S.W. 1♀ 8.ix.1934, G. A. Waterhouse; Port Macquarie, 1♂ 1♀ 17.iv.1922, G. A. Waterhouse; Port Macquarie, 1♀ 7.xi.1931, G. A. Waterhouse; Barrington Tops: 1♂ 16.xii.1921, A. N. Burns, 1♀ Jan. 1925, G. A. Waterhouse; Coutt's Crossing, N.S.W., 2♂ 1♀ 8.i.1966, J. V. Peters (J.V.P.); Barrington Tops, 2♀ 28/31.xii.1961, J. V. Peters (J.V.P.); Waverley (Sydney), 1♂ no date, G. A. Waterhouse; Killara (Sydney), 1♂ 15.iv.1934, G. A. Waterhouse; Clifton (Sydney), 1♂ 14.iv.1900, G. A. Waterhouse; Lindfield (Sydney), 1♂ 11.ii.1962, J. V. Peters (J.V.P.). One northern record. Moa, Banks Is., N.Q., 1♀ no date, J. W. Schomberg.

Eurema hecabe phoebus (Butler). "Throughout northern Australia. Recorded from eastern Australia as far south as Sydney". (W.). "North of Sydney". (C.).—The most southerly record appears to be.—Stanwell Park, N.S.W., 2♂ 1♀ 22.ii.1913, G. A. Waterhouse.

Eurema sana (Butler). "Cape York and the Islands of Torres Strait, also at Port Darwin". (W.). "N.T., C. York".—(C.).—Redlynch, N.Q., 1♂ 6.i.1965, J. V. Peters (J.V.P.); Kuranda, N.Q., 2♂ 7.i.1965, J. V. Peters (J.V.P.).

Eurema herla (Macleay). "Richmond River to Cape York; also rarely at Sydney". (W.). "Cape York to Sydney". (C.).—Prince of Wales Is., N.Q., 1♀ 24.v.1908, H. Elgner; Port Darwin, N.T.: 4♂ 2♀ 16.ii.-19.iii.1909, F. P. Dodd, 3♂ no date, F. P. Dodd; Groote Eylandt, N.T., 1♀ Dec. 1921, N. B. Tindale, 2♂ Feb. Mar. 1922, N. B. Tindale; Tennant's Creek, N.T., 2♂ no date, ex F. M. Angel; Maningrida, N.T., 1♂ 25.vii.-8.viii.1968, F. Omer-Cooper, Blyth R., N.T., 1♀ 22.viii.1968, F. Omer-Cooper.

Pierinae

Elodina perdita perdita Miskin. "Townsville to Cooktown . . ." (W.). "Cooktown to Townsville". (C.).—Claudie R., N.Q.: 1♂ 1♀ 19.ii.-17.iii.1914 (collector unknown), 1♂ 2.vi.1966, D. K. McAlpine; Hayman Is. Q., 1♂ May, 1933, F. A. McNeill; Holbourne Is. Q., 6♂ 1♀ 19.ix.1923, G. A. Waterhouse; Mackay: 1♂ 13.v.1934, 2♂ 1♀ 26/30.vi.1934, 2♂ 2♀ 10.ix.-19.x.1934, V. Lindsay, 1♂ 4♀ May 1935, G. A. Waterhouse.

Delias argenthona argenthona (Fabricus). ". . . Richmond R. to Cape York". (W.). "Cape York to Wollongong". (C.).—Prince of Wales Is., 3♂ 1♀ 22.v.-9.vi.1908, H. Elgner; Thursday Is.: 2♀ no date; 1♂ 1♀ no date, purchased from shop by H. Elgner. It is also interesting to note that this species has also been collected some distance from the coast.—Kensington Downs, Q., 3♂ 17/28.iii.1906, Ramsey; Mitchell, Q., 1♂ 1.iv.1933, E. O. Edwards; Mitchell, Q., 2♀ 1/2.xii.1933, G. A. Waterhouse; Goondiwindi, Q., 1♀ 12.x.1920; Gunnedah, N.S.W., 1♂ 16.x.1943, F. S. Paul; Murrurundi, N.S.W., 1♀ Dec. 1925, B. L. Middleton, 1♂ Apr. 1922, B. L. Middleton, 1♀ 15.ii.1922, B. L. Middleton.

Delias mysis onca Fruhstorfer. Not recorded by either Waterhouse or Common. The following were determined as this subspecies by M. S. Moulds.—Moa, Banks Is., N.Q., 1♂ 1♀ no date, J. W. Schomberg.

Delias ennia nigidius Miskin. ". . . Kuranda, . . . Cairns". (W.). "Cairns to Ingham". (C.).—Cooktown, N.Q., 1♂ Jul. 1922, ?Sherrin.

Delias nysa nysa (Fabricius). "From Sydney as far north as the Cairns district". (W.). "Cairns to Wollongong". (C.).—Cooktown, N.Q., 1♂ Jul. 1922, H. Sherrin; Moss Vale, N.S.W., 1♂ no date, G. M. Goldfinch; Moruya, N.S.W., 1♀ Feb. 1903, G. H. Murray.

Anaphaeis java teutonia (Fabricius). "Common throughout coastal Australia, sometimes found in the drier interior, with an occasional straggler in Tasmania". (W.). "Mainland Australia, rare visitor to Tasmania". (C.).—Moa, Banks Is., N.Q., 1♂ 1♀ no date, J. W. Schomberg.

Appias paulina ega (Boisduval). "Throughout eastern Australia and at Port Darwin . . . rare visitor to Victoria". (W.). "N. Territory, Cape York to Victoria, rare in Victoria". (C.).—Darnley Is., N.Q., 1♂ 2♀ 9.v.-1.vi.1910, H. Elgner; Banks Is., N.Q., 2♂ 1♀ 21/24.ii.1910, H. Elgner; Moa, Banks Is., 2♂ no date, J. W. Schomberg; Thursday Is., N.Q., 1♀ May 1902, R. E. Turner.

NYMPHALIDAE

Danainae

Danaus plexippus (Linnaeus). "Eastern Australia, . . . rarer in Victoria, common near Adelaide". (W.). "Cairns to Melbourne, Adelaide". (C.).—Moa, Banks Is., N.Q., 1♂ 1♀ no date, J. W. Schomberg.

Danaus chrysippus petilia (Stoll). "Widely distributed throughout Australia". (W.). "Mainland Australia". (C.).—Banks Is., N.Q., 4♂ 2♀ 2.ii.-5.iii.1910, H. Elgner; Moa, Banks Is., 2♀ no date, J. W. Schomberg; Prince of Wales Is., N.Q., 7♂ 4♀ 14.v.-26.vi.1908, H. Elgner; Murray Is., N.Q., 1♀ no date. Zeehan, Tas., 1♀ Feb. or Mar. 1907, per G. Lyell (see also Couchman, 1956).

Danaus ferruginea gelanor (Waterhouse & Lyell). ". . . Darnley Is.,". (W.). "Darnley Is.,". (C.).—North Queensland, 1♂ no date, ex Macleay Museum.

Euploea darchia darchia (Macleay). ". . . Port Darwin and Daly River, Nth. Australia". (W.). "Northern Territory". (C.).—Cape York, N.Q., 1♂ 22.iii.1906, H. Elgner.

Euploea darchia niveata (Butler). "Mackay to Cape York". (W.). "Cape York to Mackay". (C.).—Darnley Is., N.Q., 1♀ 13.iv.1910, H. Elgner; Thursday Is., N.Q., 1♀ no date.

Satyrinae

Heteronympha merope merope (Fabricius). "Eastern Australia and South Australia". (W.). "Central Qld. to S.A." (C.).—In the eastern states this species occurs westwards as follows.—Gunnedah, N.S.W., 4♂ 6/15.xi.1943, F. S. Paul; 18 miles west of Coolah, N.S.W., 1♀ 10.iv.1966, J. V. Peters (J.V.P.); Nr. Boggabri, N.S.W., 1♂ 29.x.1937, G. A. Waterhouse; Carnarvon Range, Q., 2♀ 11.i.1940, N. Geary; (note in A. M. register—Barellan, N.S.W., (Mallee Pine scrub), 1♂ 1♀ 1937, Dr. E. C. Chisholm).

Oriexenica lathoniella laranda Waterhouse & Lyell. "Mount Magnet and Zeehan . . .". (W.). "Waratah to Port Davey, Tasmania". (C.).—New Harbour, Tasmania, 1♂ 24.i.1938, C. Davis.

Geitoneura acantha acantha (Donovan). "Southern Queensland and New South Wales". (W.). "South Queensland and N.S.W.". (C.).—the northern limit of this species appears to be as follows.—Carnarvon Range, Q., 2♂ 2♀ 13.xii.1938, N. Geary: It is also recorded from the A.C.T. as follows.—Angle Bend, Canberra, 1♂ 1♀ 8.i.1938, M. F. Day; Nr. Lees Springs, 1♂ 7.i.1930, G. A. Waterhouse; This species is also recorded as far west as 18 miles west of Coolah, N.S.W., 1♀ 10.iv.1966, J. V. Peters, (J.V.P.).

Nymphalinae

Precis hedonia zelima (Fabricius). "Mackay to Cape York; . . . as far south as Brisbane". (W.). "Northern Territory, Cape York to Brisbane, rare south of Mackay". (C.).—Banks Is., N.Q., 3♂ 3/15.ii.1910, H. Elgner; Moa, Banks Is., N.Q., 1♂ no date, J. W. Schomberg; Prince of Wales Is., N.Q., 4♂ 5♀ 26.v.-9.vi.1908, H. Elgner.

Acraeinae

Acraea andromacha andromacha (Fabricius). "From Sydney to Cape York; also at Port Darwin, Wyndham and Derby". (W.). "N. Aust. to southern N.S.W.". (C.).—Prince of Wales Is., N.Q., 6♂ 3♀ 15.v.-1.vii.1908, H. Elgner; De Grey River, W.A., 3♂ no date, F. L. Whitlock; Wilson's Inlet, W.A., 1♀ no date, F. L. Whitlock.

LYCAENIDAE

Deudorix epijarbas diovis Hewitson. "Mackay to Manning River". (C.).—Tuncurry, N.S.W., 1♀ 11.v.1926, J. Parkes; Wallis Lake, N.S.W., 1♀ Feb. 1935, Dr. T. Guthrie; Ash Is., N.S.W., 1♀ no date, Scott. (note in A.M. register—1♀ caught Wyong, M. Thompson).

Jalmenus icilius icilius Hewitson. "Victoria, South Australia, and south-western Australia". (W.). "Victoria, South Australia, S.W. Australia". (C.).—Cunnamulla, Q., 1♀ Oct. 1943, N. Geary; Steam Plains, Conargo, N.S.W., 1♂ 2.xi.1938, T. G. Campbell; Broken Hill, N.S.W., 1♀ 31.x.1943, C. E. Chadwick; Gunnedah, N.S.W., 2♂ 2♀ 14/17.xii.1943, F. S. Paul; Deniliquin, N.S.W., 2♂ 2♀ 7/10.xii.1967, E. Edwards; Gulgong, N.S.W.: 1♂ 1♀ 9/10.ii.1966, 3♂ 3♀ 8/11.iv.1966, J. V. Peters (J.V.P.).

Jalmenus clementi Druce. Waterhouse and Lyell (1914) treated this species as a synonym of *J. icilius*. Peters (in press) has shown this to be a distinct species.—Roebourne, N.W.A., 5♂ 1♀ no date. Local coll. ex G. T. B. Baker coll.; N.W. Australia, 1♂ 1901, P. Lathy; Fortecue R., Hammersley Range, N.W.A., 1♂ no date, W. D. Dodd.

Narathura araxes eupolis (Miskin). "Rockhampton along the coast to Cape York". (W.). "Cape York to Yeppoon". (C.).—Moa, Banks Is., N.Q., 1♀ no date, J. W. Schomberg; Prince of Wales Is., N.Q., 3♂ 3♀ 14.v.-1.vi.1908, H. Elgner; Thursday Is., N.Q.: 2♂ 1♀ 3.xii.1909, H. Elgner, 1♀ 18.iii.1906, H. Elgner. An unusual locality appears to be Chillagoe, Q., 2♂ 22/23.iii.1905, A. B. Bell. A note in the A.M. register says of these specimens, "a surprising locality, but A. B. Bell assured me he caught them himself, G.A.W.".

Narathura micale amytis (Hewitson). ". . . Mackay to Cape York". (W.). "Cape York, Thursday Is.,". (C.).—Banks Is., N.Q., 6♂ 7♀ 3.ii.-3.iii.1910, H. Elgner; Moa, Banks Is., N.Q., 1♂ 2♀ no date, J. W. Schomberg; Prince of Wales Is., N.Q., 4♂ 4♀ 17.v.-3.vii.1908, H. Elgner.

Ogyris genoveva Hewitson. In Queensland this species is recorded from Duaringa south to the border.—Kuranda, 1♂ Mar. 1902, ?ex G. M. Goldfinch; Little Mulgrave R., N.Q., 1♂ no date, F. H. Brown.

spp. *duaringa* Bethune-Baker, "Duaringa to Millmerran". (C.).

ssp. *genoveva* Hewitson, "Brisbane to Burleigh". (C.). It is interesting to note the following specimens—Thane, Q., 1♂ 2♀ 19/28.x.1938, G. A. Waterhouse; Stanthorpe, Q., 1♂ 4.xii.1942, J. Gemell; Glen Aplin, Q., 1♀ 20.xii.1942, J. Gemell. These specimens extend the range of *duaringa* inland and southward beyond the range of the coastal subspecies *genoveva*.

Ogyris ianthis Waterhouse. ". . . Sydney". (W.). "Sydney and Millmerran". (C.). Dalby, Q., 1♀ 24.i.1934, R. Chapman; Gunnedah, N.S.W., 1♀ 27.ii.1943, F. S. Paul.

Ogyris oroetes Hewitson. ". . . Brisbane; . . . Townsville, Clermont and Millmerran in Queensland and near Scone in N.S.W. Two specimens caught near Derby, north-western Australia" (W.). "Qld., N.S.W., N.W. Aust.". (C.).—Westonia, W.A., 2♂ 2♀ Oct. Nov. 1934, R. Chapman.

Ogyris amaryllis amaryllis Hewitson. ". . . Brisbane . . . Richmond River and Tuggerah". (W.). "Brisbane to Tuggerah, N.S.W.". (C.).—Davistown, N.S.W., 4♂ 30.i.-1.ii.1964, M. Burnell (J.V.P.); Jandowae, Q., 1♂ 1♀ 24.ii.-8.iii.1920, R. Illidge; Emu Plains, N.S.W.: 17♂ 17♀ 4.ix.-2.xi.1937, G. A. Waterhouse, 8♂ 3♀ 17.iii.1938, J. T. Waterhouse, 1♂ 1♀ 17.iii.1938, G. A. Waterhouse, 1♂ 3♀ 1.xi.-8.xi.1938, G. A. Waterhouse, 1♀ 31.viii.1940, G. A. Waterhouse; Careel Bay, N.S.W.: 18♂ 7♀ 15/28.x.1938, G. A. Waterhouse, 5♀ 19.xi.1939, J. T. & G. A. Waterhouse,

2♂ Sept. Oct. 1938, Dr. T. Guthrie, 2♂ 2♀ 7.x.-10.xii.1939, Dr. T. Guthrie.

Ogyris hewitsoni parsoni Angel. "Central Australia". (C.).—Brock's Creek, N.T., 2♂ 2♀ 29.iii.1929, T. G. Campbell.

Danis cyanea arinia Oberthur. "Ingham to Cape York and the islands of Torres Strait". (W.). "Torres Strait islands, Cooktown to Ingham". (C.). Townsville, Q., 1♀ 9.iii.1903, F. P. Dodd; Mackay, Q., 1♀ no date, R. E. Turner.

Hypochrysops cyane (Waterhouse & Lyell). ". . . Millmerran, . . . near Brisbane and Mackay". (W.). "Mackay to Brisbane, Millmerran". (C.).—Cairns, N.Q., 1♂ Apr. 1913, F. P. Dodd; Toronto, N.S.W., 1♂ no date, W. Filmer.

Hypochrysops byzos byzos (Boisduval). "Near Sydney, at Como and Mosman; one specimen from Mittagong; another from Tathra". (W.). 'New South Wales". (C.).—Cunnamulla, Q., 1♀ Oct. 1944, N. Geary; Glen Aplin, Q., 4♂ 4♀ 9.xi.-14.xii.1944, J. Gemell.

Hypochrysops apelles apelles (Fabricius). "Brisbane to Cape York and the islands of Torres Strait". (W.). "Cape York to Burleigh, Qld.". (C.).—Tweed Heads, N.S.W.: 3♂ 1♀ 10.iv.1940, Dr. T. Guthrie, 4♂ 1♀ 29.x.1940, G. A. Waterhouse & C. P. Ledward, 1♂ 4.xi.1940, C. P. Ledward; Ash Is., N.S.W., 1♂ no date, Scott.

Pseudodipsas cuprea Sands. Sands (1966) recorded this species from Grafton, Boambee, Port Macquarie, Newcastle, Toronto, West Head, Lawson, Blackheath. Pambula (N.S.W.), and Launching Place (V.). It is now also recorded from Toowoomba: Q., 3♂ 24-30.xii.1965, 1♂ 8.i.1967, M. Burnell (J.V.P.).

Pseudodipsas eone iole Waterhouse and Lyell. "Herbert River district to Cape York". (W.). "Cape York to Ingham". (C.).—Prince of Wales Is., 1♂ 1♀ 29.v.-28.vi.1908, H. Elgner.

Prosotas felderi (Murray). "Sydney to Brisbane". (W.). "Brisbane to Wollongong". (C.).—Cape York, N.Q., 1♂ ?ex C. French, per G. Lyell; Gympie, Q., 1♀ no date, R. Illidge.

Prosotas nora auletes (Waterhouse and Lyell). "Cape York and the islands of Torres Strait". (W.). "Torres St. islands, C. York, Atherton Tableland". (C.).—Mackay, Q.: 1♀ Mar. 1899, R. E. Turner, 1♂ no date, R. E. Turner, 1♂ 24.v.1935, J. T. Waterhouse.

Nacaduba berenice berenice (Herrich-Schaffer). "Richmond River to Cooktown". (W.). "Cooktown to Manning R.". (C.).—Darnley Is., N.Q.: 4♂ 4♀ 13/27.xii.1909, H. Elgner, 12♂ 13♀ 3.iv.-8.vi.1910, H. Elgner, Murray Is., N.Q., 3♂ 1♀ 3/21.ix.1907, H. Elgner; Cape York, N.Q., 1♀ 17.xi.1908, H. Elgner.

Ionolyce helicon hyllus (Waterhouse & Lyell). "Cape York and Cooktown". (W.). "C. York to Cooktown". (C.).—Redlynch, nr. Cairns, N.Q., 1♂ no date, R. Hunter.

Jamides phaseli (Mathew). "Brisbane to Cape York". (W.). "N.T., Cape York to Brisbane". (C.).—Prince of Wales Is., N.Q., 2♀ 17/23.vi.1908, H. Elgner; Cooloongatta, Q., 1♂ 24.iv.1905, R. Illidge; Burleigh Heads, S.Q., 1♂ 1♀ 22.iv.-11.v.1940, C. P. Ledward.

Anthene lycaenoides godeffroyi (Semper). "Cairns to Cape York; also on Darnley Is., and at Port Darwin". (W.). "Darwin, C. York to Cairns". (C.).—Innisfail, N.Q., 1♂ 1♀ 15.v.1928, L. Franzen.

Theclinesthes scintillata (Lucas). "Brisbane to Cairns, . . . Richmond River and at Thursday Is.,". (W.). "Thursday Is., to Richmond R.". (C.).—Ebor, N.S.W., 1♂ 7.ii.1940, G. A. Waterhouse.

Lampides boeticus (Linnaeus). "Throughout coastal Australia, but not yet recorded from Tasmania". (W.). "Mainland Australia". (C.).—Darnley Is., N.Q., 1♂ 1.vi.1910, H. Elgner; Murray Is., N.Q., 1♂ 1♀ 30.vii.-5.ix.1907, H. Elgner; Prince of Wales Is., N.Q.: 1♂ 1♀ May, July, 1908, H. Elgner, 1♀ 22.iii.1910, H. Elgner; Thursday Is., N.Q., 2♀ 21.iii.1910, H. Elgner; Launceston, Tas., 1♂ 1♀ no date, D. E. MacIntyre.

Catochrysops amasea Waterhouse & Lyell. ". . . Islands of Torres Strait". (W.). "Torres Strait islands". (C.).—Cape York (type locality), N.Q., 1♂ 1♀ 6/7.iv.1908, H. Elgner.

Euchrysops cnejus cnidus Waterhouse & Lyell. "Brisbane to Cape York and the islands of Torres Strait; also at Port Darwin". (W.). "Nth. Australia south to Southport". (C.).—Burleigh Heads, S.Q., 1♂ 24.x.1940, G. A. Waterhouse; Ballina, N.S.W., 1♀ 9.x.1902, G. A. Waterhouse.

Zizeeria hylax attenuata (Lucas). ". . . Brisbane to Cape York. One specimen near Wingham and three near Sydney", (W.). "Northern Territory, Cape York to Sydney". (C.).—Prince of Wales Is., N.Q., 1♂ 24.vi.1908, H. Elgner.

Holochila margarita Semper. "Mackay to Cape York. It has been taken at Brisbane". (W.). "Cape York to Port Macquarie". (C.).—Prince of Wales Is., N.Q., 16♂ 7♀ 13.v.-30.vi.1908, H. Elgner; Thursday Is., N.Q., 1♂ 1♀ May 1902, R. E. Turner.

Erina hyacinthina eugenia (Waterhouse & Lyell). "Rockhampton to Cairns and Kuranda". (W.). "Port Stewart to Yeppoon". (C.). (as *Candalides simplexa eugenia*).—Cape York, N.Q.: 1♂ 16.iii.1906, H. Elgner, 1♀ 3.xi.1910, H. Elgner.

Erina hyacinthina simplexa (Tepper). "North-western Victoria, South Australia, and Geraldton, Western Australia". (W.). "N.W. Vic., S.A.". (C.). (as *Candalides s. simplexa*).—Round Hill, N.S.W., 2♂ 29.i.1969, J. V. Peters.

Erina erina erina (Fabricius). ". . . Port Macquarie to Cape York and the islands of Torres Strait; also at Port Darwin". (W.). "Darwin, Cape York to Port Macquarie". (C.).—Wallis Lake, N.S.W., 1♀ Feb. 1933, Dr. T. Guthrie; Groote Eylandt, N.T., 1♂ Jan. 1922, N. B. Tindale; Hector's Camp, Mary River, N.T., 1♂ 24.vi.1933, T. G. Campbell; Maningrida, N.T., 1♀ 25/31.vii.1968, F. Omer-Cooper. Cadell R., N.T., 1♂ 25.viii.1968, F. Omer-Cooper; Blyth R.,—Gadji Ck. Area, N.T., 1♂ 20.ix.1968, F. Omer-Cooper.

Adaluma urumelia Tindale. ". . . Roper River, North Australia. . . . Groote Eylandt". (W.). "Roper R., Groote Eylandt". (C.).—Maningrida, N.T., 2♀ 25.vii.-8.viii.1968, F. Omer-Cooper; 5 miles east Blyth R., N.T., 3♂ 4.x.1968, F. Omer-Copoer.

Philiris innotatus innotatus (Miskin). "Brisbane to Richmond R.". (C.).—Orara River, 20 miles south of Grafton, N.S.W., 3♂ 8.i.1966, J. V. Peters (J.V.P.); Port Macquarie, N.S.W., 2♂ 19/20.i.1935, T. R. Raine & M. F. Day.

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THE BUTTERFLIES OF NORFOLK, PHILIP AND NEPEAN ISLANDS

by C. N. Smithers and J. V. Peters
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During the period 18th to 30th November, 1968 a small collection of butterflies was made on Norfolk, Philip and Nepean Islands and the material is recorded here. Opportunity is taken also of mentioning all previous records from Norfolk Island; there are no previous records from Philip or Nepean Islands. Unless otherwise indicated all the localities mentioned are on Norfolk Island. Rainbow (1907) mentions *Papilio aegeus aegeus* Donovan as occurring on Norfolk Island but this appears to be an error.

The recently collected material is in the Australian Museum as are the few other specimens of unpublished material mentioned. Some of this latter material bears limited data and is labelled as being part of the Waterhouse Collection.

Ten species are now recorded for Norfolk Island and two species from each of Nepean and Philip Islands. These are all listed below, new records being indicated by an asterisk (*).

SPECIES KNOWN FROM NORFOLK ISLAND

Family PAPILIONIDAE
- *Graphium macleayanus* (Leach)
- *Papilio ilioneus ilioneus* Donovan

Family PIERIDAE
- *Anaphaeis java peristhene* (Boisduval)
- *Cepora perimale perimale* (Donovan)

Family NYMPHALIDAE
- *Danaus plexippus* (Linnaeus)
- *Hypolimnas bolina* (Linnaeus)
- * *Vanessa kershawi* (McCoy)
- *Vanessa itea* (Fabricius)
- * *Precis villida calybe* (Godart)

Family LYCAENIDAE
- *Zizeeria otis labradus* (Godart)

SPECIES KNOWN FROM PHILIP ISLAND

- * *Danaus plexippus* (Linnaeus)
- * *Vanessa itea* (Fabricius)

SPECIES KNOWN FROM NEPEAN ISLAND

- * *Danaus plexippus* (Linnaeus)
- * *Zizeeria otis labradus* (Godart)

PAPILIONIDAE

Graphium macleayanus (Leach)

Previous records: Scott (1893) (as *Papilio macleayanus*), includes Norfolk Island in his distribution list of this species. We know of no extant specimens from this locality.

Papilio ilioneus ilioneus Donovan

Unpublished material: 1 ♀, Jan., 1887 (collector unknown); Burnt Pine, 1 ♂, 23.xi.1968; Point Ross, 1 ♂, 24.xi.1968, 5 ♂, 27.xi.1968 (C.N.S.).

Previous records: Donovan (1805). Olliff (1888) (as *P. amphiaraus* Feld.). Hawkins (1943) (as *P. amphiaraus ilioneus* Don.).

PIERIDAE

Anaphaeis java peristhene (Boisduval)

Previous records: Olliff (1888) (as *Pieris java* Sparr.). Hawkins (1943). *A. j. peristhene* is the subspecies commonly found in New Caledonia.

Cepora perimale perimale (Donovan)

Unpublished material: 1 ♂, 1 ♀, Jan. 1887 (collector unknown); 3 ♂, 3 ♀, 1906, 7 ♂, 3 ♀, Jan., 1907 (A.H.W.); 1 ♂ Feb., 1929 (collector unknown); 1 ♂, Norfolk Island (no other data); Mt. Pitt: 3 ♂, 19.xi.1968, 3 ♂, 20.xi.1968 (C.N.S.), 1 ♂, 29.xi.1968 (H. J. de S. Disney). Red Road, 5 ♂, 19.xi.1968; Palm Glen: 1 ♂, 22.xi.1968, 2 ♂, 24.xi.1968; Captain Cook Memorial: 1 ♂, 19.xi.1968, 3 ♂, 22.xi.1968; Point Ross: 2 ♂, 24.xi.1968, 6 ♂, 27.xi.1968 (C.N.S.). Point Ross: 1 ♂, 27.xi.1968 (G. F. Smithers).

Previous records: Donovan (1805) (as *Papilio perimale* Don.). Olliff (1889) (as *Belenois perimale* Don.). Waterhouse and Lyell (1914) (as *Huphina perimale* Don.). Hawkins (1943) (as *Cepora perimale perimale* Don.) described the male for the first time.

It is interesting to note that Hawkins (loc. cit.) had only seven male specimens available, collected in February and March, and that the recent material listed above, collected in November, consisted of twenty eight specimens, all males. It seems that the males may emerge earlier than the females in each brood.

NYMPHALIDAE

Danaus plexippus (Linnaeus)

Unpublished material: 2 ♂, 1 ♀, 1906, 2 ♂, 1 ♀, Jan., 1907 (A.H.W.); 1 ♂, Feb., 1929 (collector unknown). Burnt Pine, 1 ♀, 21.xi.1968; Philip Island, 6 ♂, 1 ♀, 26.xi.1968 (C.N.S.)

Previous records: Olliff (1888) (as *Danais plexippus* Linn.). Hawkins (1943) (as *Danaus menippe* Hubner). This species has not previously been recorded from Philip Island nor Nepean Island. One specimen was seen but not captured on Nepean Island on 30.xi.1968.

Hypolimnas bolina (Linnaeus)

Unpublished material: We have not seen specimens from Norfolk Island but have received a photograph of a female from Mr. P. Gostling taken at Bullock's Hut Road.

Previous records: Olliff (1888) (as *Diadema bolina* Linn.). Hawkins (1943).

Vanessa kershawi (McCoy)

Unpublished material: Red Road, 1 ♂, 19.xi.1968; Mt. Pitt: 2 ♂, 20.xi.1968, 1 ♂, 21.xi.1968; Palm Glen, 2 ♂, 22.xi.1968 (C.N.S.).

This species has not previously been recorded from Norfolk Island.

Vanessa itea (Fabricius)

Unpublished material: 2 ♀, 1906 (A.H.W.). Mt. Pitt, 3 ♀, 20.xi.1968; Point Ross, 1 ♀, 24.xi.1968 (C.N.S.). One specimen was seen but not captured on Philip Island on 26.xi.1968. It has not previously been recorded from Philip Island.

Previous records: Olliff (1888) (as *Pyrameis itea* Fabricius). Hawkins (1943) (as *Pyrameis itea* Fabricius).

Precis villida calybe (Godart)

Unpublished material: 2 ♂, 1906 (A.H.W.). One specimen was seen but not captured at Bumbora on 18.xi.1968.

This species has not previously been recorded from Norfolk Island.

LYCAENIDAE

Zizeeria otis labradus (Godart)

Unpublished material: 1 ♂, 1906 (A.H.W.). Bumbora, 2 ♂, 18.xi.1968; Emily Bay, 25 ♂, 15 ♀, 19.xi.1968; Burnt Pine, 6 ♂, 4 ♀, 21.xi.1968; Anson Bay, 3 ♂, 3 ♀, 23.xi.1968; Palm Glen, 1 ♀, 24.xi.1968 (C.N.S.). Point Ross, 1 ♂, 27.xi.1968 (G. F. Smithers). Nepean Island, 3 ♂, 1 ♀, 30.xi.1968 (C.N.S.).

Previous records: Hawkins (1943) (as *Zizera labradus* Godart, ? subsp. nov.).

This species has not previously been recorded from Nepean Island.

ACKNOWLEDGEMENTS

Thanks are due to the members of the Norfolk Island Fauna and Flora Society for their kind assistance to the Australian Museum party of which one of us (C.N.S.) was a member.

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A NOTE ON MIGRATIONS OF VANESSA KERSHAWI (McCOY) (LEPIDOPTERA: NYMPHALIDAE) IN AUSTRALIA, 1963-1968

By C. N. Smithers
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(Figure 1.)

Smithers and Peters (1966) reported a migration of *Vanessa kershawi* (McCoy) (Painted Lady Butterfly) which took place in south-eastern Australia in 1963 and summarised the earlier literature on migrations of this species in Australia. The data presented were obtained through the efforts of co-operators, in many parts of Australia, who are participating in an insect migration study scheme organised from The Australian Museum. Additional data, collected from 1964 to 1968, are now available for consideration and comparison with the previous data and are presented in this paper. Tables I, II and III give data for 1966, 1967 and 1968. All Australian localities mentioned are in the State of New South Wales unless otherwise stipulated (e.g. Q = Queensland and ACT = Australian Commonwealth Territory).

Perusal of the tables leads to certain obvious conclusions.

The size of the migrating populations varies greatly from year to year. In 1963 migrations were obvious and reached a frequency of passing individuals of about four per minute in a front of fifty yards. There were no reports of movements during 1964 and 1965 although observations were being made. In 1966 the migration was quite spectacular, reaching frequencies of over one hundred per minute over fifty yards at the peak of activity. In 1967 only a very small migration was noticed. In 1968 the movement was again quite spectacular and numbers up to over fifty per minute over fifty yards were reported. In all probability there is some movement each year although none was reported in 1964 or 1965, but in years of low populations movements may be overlooked. 1967, which was also a year of low populations generally for this species, produced only two observations of movement from two areas; in one area it is doubtful whether movement was really unidirectional.

The direction of movement nearly always includes a southerly component. The movement is usually reported as WSW, SW or S; a few westerly movements have been reported and there has been one report of a movement to the SE and one to the NW (at a time of exceptionally strong southerly winds).

The length of time over which migration takes place is quite long. In 1963 it covered a period of about eight weeks and in 1966 and 1968 about 7 weeks; in 1967 it was only observed over a week. It seems that a seven to eight weeks migration period can be expected in years of obvious movement. The short period in 1967 could be due either to lack of observations on a small population or the period could really have been short. It is not possible to decide which was the case on the data available.

The time of year at which the movements take place, despite the apparent constancy of period length, has varied considerably. In 1963 the first movement was seen on 13th August, with a peak of activity for Sydney from about 13th to 16th September; the last movement was reported on 9th October. In 1966 the migration took place much later; the first movement was reported on 11th October with a peak of activity over the period 30th October to 9th November. The last southerly movement was reported for the 28th November but there was a single, very late, report of movement to the west on 20th December. This migration did not, apparently, start until the time of year by which the 1963 movement had ended. The 1967 movement was too small to be of much significance so far as time of year is concerned; what little of it was reported took place in the last week of September and this, presumably, represented the "peak" of whatever migrations there were. In 1968 the first reports were on 13th September with strong activity lasting, in Sydney, over the long period 28th September to 23rd October. Records from

areas other than Sydney suggest that the major flights also took place at about the same time elsewhere, that is, in late September and the first three weeks of October. By the 4th November movement had ceased through Sydney.

The "peak" periods for the three years of large movements were, in Sydney, mid-September (1963), early November (1966) and late September to the third week of October (1968).

The areas through which movements have been reported form, essentially, a broad strip down the eastern part of the continent from Brisbane southwards. From year to year, however, the areas involved appear to have varied. This may, to some extent, be due to non-reporting by co-operators or by co-operators increasing or decreasing in number in different parts of the country. In 1963 reports of movements and/or sudden increases in numbers came from Glen Innes to Tasmania and from the coast to localities well west of the mountains. In 1966 reports were from Wyong Creek to Canberra and as far west as Dubbo. 1967 produced reports from only Sydney and Wanganella. In 1968 reports have come from Brisbane to Nowra and from the coast to as far inland as Wagga Wagga. The 1963 movement covered a front stretching at least from the coast to Finley, a little less than three hundred miles; in 1966 the front was from the coast inland at least to Dubbo, just under two hundred miles; in 1967 actual movement was reported only for the coast and in 1968 the furthest inland report was from Wagga Wagga, indicating a front of at least a little over one hundred and fifty miles.

Although it has long been known that *V. kershawi* was a strong migrant like its near relative *V. cardui* (Linnaeus) in Europe, little detail has been published of the duration, extent and variation in its movements. This basic information, necessary for planned study, is now slowly becoming known and ability to predict the time and extent of movement would be a help in planning future work.

On the data at present available it can be said that in years of reasonably high populations a generally south westerly migration can be expected to start at any time between mid-August and early October and that the movements will continue for seven to eight weeks, varying in intensity, but showing some degree of increase in numbers to a peak of activity with subsequent falling off. The migrations may be noticeable from southern Queensland to Tasmania and be on a front of three hundred miles inland from the coast.

The suggestion was made (Smithers and Peters, 1966) that years of heavy rainfall may coincide with big migrations as this is said to be the case with *V. cardui* (e.g. Sanders, 1948, p. 157). Without precise knowledge, however, of the distribution of breeding areas, the time of breeding and other biological and ecological information, it is not possible to say whether rainfall was directly or indirectly related to the migrations of *V. kershawi* reported here.

An interesting phenomenon, apparently associated with large-scale migration in eastern Australia, is the appearance of Australian species in New Zealand (Ramsay, 1966; Gibbs, 1961). Wind assistance is generally believed to be involved in carrying specimens from Australia to New Zealand. When more details are available on the precise arrival dates in relation to weather and migrations in Australia closer investigation will be possible.

V. kershawi has recently been recorded for the first time on Norfolk Island; it was present in large numbers in the second half of November, 1968 (Smithers and Peters, 1969). The date of the first appearance on the island is not known but it must have been during the first half of November at the latest. This is the period during which the 1968 migration was declining in eastern Australia. Conditions at low altitudes were not particularly favourable for rapid movement across the sea. There were, however, storm conditions along the coast of northern New South Wales in which strong updraughts of air were involved. Also, the air conditions in many parts of eastern Australia

were such that strong updraughts from extensive bushfires were common. Over wide areas, therefore, conditions were favourable for the rapid lifting of specimens in flight to heights of 15,000 feet and more. At these heights the winds were easily capable of transporting specimens to Norfolk Island in a matter of hours. The temperatures at such altitudes were below freezing and the passive movement of torpid butterflies could have been quite rapid; certainly a short enough period of time would be involved to permit the butterflies to descend unharmed. At the time of the records of *V. kershawi* on Norfolk Island the atmosphere over the island was clouded due to the smoke from Australian bushfires.

A population of passively drifting butterflies at high altitude presumably loses individuals by descent as it moves along with the high altitude air movement. Turbulence over land or convergence phenomena could cause the descent of a larger number of individuals in greater concentration; hence the appearance of numbers of specimens in the vicinity of one another (relatively speaking) over land.

If the movement to areas such as Norfolk Island is entirely passive the phenomenon should be regular because the species is regularly present in its "home" area and species other than migrants should be involved. Most species reported arriving in New Zealand, however, are migrants or suspected migrants from Australia.

This apparent species "selection" is probably explainable by considering the flight habits of butterflies in relation to wind and population density. A dense population is more likely to have individuals lifted from it and transported in detectable numbers than is a sparse population. Although migrants migrate every year their populations are not always high enough to permit detection of the movement in its usual habitat. This would account in some degree for irregularity by wind transport. Also, of course, meteorological conditions may not be such as to provide the necessary updraught and suitable high altitude wind when a species is present in numbers. At least one or other species is abundant, however, whenever conditions are suitable, even if they are not migrants, and these should be lifted and carried. That this is not often the case seems due to the flight habits of butterflies in relation to wind speeds. For a butterfly to be lifted and carried it must be flying in the air which is lifted. Most butterflies settle down when speeds near the ground increase; this would prevent their being lifted. It is characteristic of a migrating population that its members tend to be far more persistent than those of a non migratory population in their flight activity when wind speeds rise. Migrating specimens (e.g. of *V. kershawi*) can be seen being carried along by a following wind, being blown at an angle to their line of flight by a cross wind or striving against a head wind which is actually blowing them backwards. They continue to fly persistently in strong winds which would have caused non-migrating populations to settle or seek shelter.

Non-migrating populations tend to settle or seek shelter in just those conditions of increasing wind velocity which increases likelihood of their being lifted and transported; they seldom, therefore, reach the areas mentioned although their populations may well be greater than those of migrant species in the area of origin of the winds.

Migrating populations display this persistence in flight and migrant species thus form a high proportion of those which are carried rapidly over long distances by air and appear in numbers in areas such as New Zealand and Norfolk Island at a time when migrations are in progress in Australia.

ACKNOWLEDGEMENTS

I would like to thank the many co-operators who have so kindly recorded and submitted the data on which this paper is based and officers of the Bureau of Meteorology, Sydney, for providing information on weather.

SUMMARY

Data on migrations of *Vanessa kershawi* (McCoy) in eastern Australia for 1964-1968 are given and discussed with previously published data for 1963. Reasons for sudden appearances of Australian migrant species in areas such as New Zealand and Norfolk Island are discussed.

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Figure 1.—Map of eastern Australia, New Zealand and Norfolk Island, showing localities mentioned in text and tables.

TABLE I

MIGRATION RECORDS FOR *VANESSA KERSHAWI* (McCOY)—1966

Locality	*Dates*	*Direction*	*Numbers*	*Observer*
Wyong Creek	1.xi.66	SW	"41/min/44 ft."	E. A. Hurst
Wyong Creek	20.xii.66	W	"Strong migration"	E. A. Hurst
Dubbo	23-27.x.66	SW	"Many hundreds"	R. Gilroy
Bandon Grove	23-25.x.66	WSW	"Many"	W. Dowling
Katoomba	18.x.66	SW	"Many dozens"	R. Gilroy
Katoomba	2.xi.66	SW	"Many dozens"	R. Gilroy
Lucas Heights	2.xi.66	SW	"30-40/1 min./20 yds"	M. Copland
Heathcote	2.xi.66	SW	"30-40/1 min./20 yds"	M. Copland
Sydney area	11.x.66-22.x.66	—	First appearance followed by increase in numbers	C. N. Smithers.
	30.x.66	S	1/5-10 min./50 ft.	Based on many observations of: S. Ross, C. N. Smithers, A. S. Smithers, D. Sault, J. V. Peters, B. Brown, W. Wright, G. Holloway.
	31.x.66	S	Large numbers	
	1.xi.66	S, SW, W	Peak of movement with up to 24 in 3 min./60 ft.	
	11.xi.66-28.xi.66	S, W	Numbers falling off	
Cataract Dam	2.xi.66	SW	"60/5 mins/50 yds."	B. Jessop
Wollongong	2.xi.66	—	"Many"	N. Robinson
Canberra to Mittagong	29.x.66	S	"Few"	C. N. Smithers
Canberra	23.x.66	S	"Many"	M. Upton
Canberra	24.x.66	S	"6-27/5 min./40 yds."	M. Upton
Canberra	25.x.66	S	—	M. Upton

TABLE II

MIGRATION RECORDS FOR *VANESSA KERSHAWI* (McCOY)—1967

Locality	*Date*	*Direction*	*Numbers*	*Observer*
Sydney	23-24.ix.67	S	"Few"	C. N. Smithers
	30.ix.67	S	"Few"	C. N. Smithers
Wanganella	3.ix.67	—	"Large numbers"	E. Edwards

TABLE III

MIGRATION RECORDS FOR *VANESSA KERSHAWI* (McCOY)—1968

Locality	*Dates*	*Direction*	*Numbers*	*Observer*
Brisbane	3.xi.66	NW	5	A. Bird
Wyong Creek	1.x.68-6.x.68	SW	"Quite a large migration"	E. A. Hurst
South Springwood	20.x.68	SW	"10-15/30 mins."	M. Gregg
Sydney area	21.ix.68	SSW	"Few"	J. V. Peters
	28.ix.68-23.x.68	SW, SSW and W	The main movement, varying in strength but never weak. Up to 111/5min./60 feet and probably more in some cases	Based on many observations of: C. N. Smithers, J. V. Peters, R. Moore, B. Brown, R. Jeffery, A. Rose, M. Gray.
	29.x.68	SW	Falling off	
	2.xi.68		No clear movement in area after this date although specimens common	
National Park	20.ix.68	WSW	"Many"	J. V. Peters
National Park	29.ix.68	SW	"Large numbers"	C. N. Smithers
Madden Plains	29.ix.68	SW	"Thousands"	P. Hendricks
Figtree	6.x.68	SW	"Quite a large migration"	P. Hendricks
Wagga Wagga	14.ix.68	—	"Abundant"	M. Upton
Canberra to Wagga	13.ix.68	S	"Continuously all day"	M. Upton
C'berra to Clyde Mts.	14.ix.68	S	"Movement"	I. Common
Braidwood to Clyde Mt.	6.x.68	S	"Abundant"	I. Common
Canberra	20.x.68	S	"99/5 mins./23 yds."	I. Common
Canberra	End Oct. early Nov.	S	"Large numbers"	I. Common
Sydney to Nowra	22.x.68	W	"Vast numbers"	B. Brown

STUDIES ON THE MORPHOLOGY OF MALPIGHIAN TUBULES OF **AULACOPHORA FOVEICOLLIS** LUCAS (COLEOPTERA: CHRYSOMELIDAE)

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(Plate VIII, figures 1-3).

SYNOPSIS

The morphology of the malpighian tubules of *Aulacophora foveicollis* and their reassociation with the hind gut has been described in detail.

INTRODUCTION

Morphology of the malpighian tubules in the family Chrysomelidae has been studied by a number of workers since long ago (Ramdhor, 1811; Dufour, 1834; Mobusz, 1897). During the present century workers like Woods (1916), Heymons and Luhmann (1933), and Lison (1938) have given some account of the morphology of the malpighian tubules with special reference to its reassociation with the hind gut. An account of the cryptonephridial system in the family under reference has been given recently by Saini (1964). All these workers have confined their studies mostly to the origin and reassociation of the tubules with the wall of the hind gut. Saini (1954), while describing the anatomy of the genus *Aulacophora,* has mentioned about the origin and number of the malpighian tubules but a detailed account of the tubules in relation to the complete alimentary canal has not been given by any worker. In the present paper an attempt has been made to describe the detailed morphology of the malpighian tubules of *Aulacophora foveicollis* which is a serious pest of cucurbitaceous plants.

MATERIAL AND METHOD

A large number of adult *Aulacophora foveicollis* individuals were collected from the fields and kept in fine meshing cages in the laboratory. These insects were provided with leaves of the cucurbitaceous plants for eating. However, it was observed that they had a great liking for the leaves of pumpkin, *Laginaria siceraria* Standl. and Kohmra, *Cucurbita maxima* Duch. only. Sometimes they also feed on the leaves of Nenua, *Luffa cylindrica* (Linn.) M. Roem, but with great distaste. Petri dishes containing water were also put in the cage to maintain proper humidity so that the leaves might remain green for some days.

Insects were dissected in insect Ringer solution under high power binocular microscope for the study of the gross morphology. Diameter of the tubules was measured by ocular stage micrometer, the length by a millimetre scale.

OBSERVATIONS

There are six malpighian tubules which are long, flexuous and thread-like structures bathed by the body fluid. Each malpighian tubule is closely applied to the alimentary canal with the help of the trachea and tracheoles. The fat bodies are also entangled with the tubules.

The malpighian tubules originate in two separate groups. The first (or anterior) group of two malpighian tubules originates from the junction of the mid and hind gut whereas the remaining four of the second (or posterior) group of malpighian tubules originate from an ampulla or excretory vesicle, a little behind the origin of the first (anterior) group (fig. 1). Mostly the malpighian tubules arise from either side of the gut or in one bundle from one side only, but in this case both the bundles of malpighian tubules arise from one side, i.e. the right side of the alimentary canal.

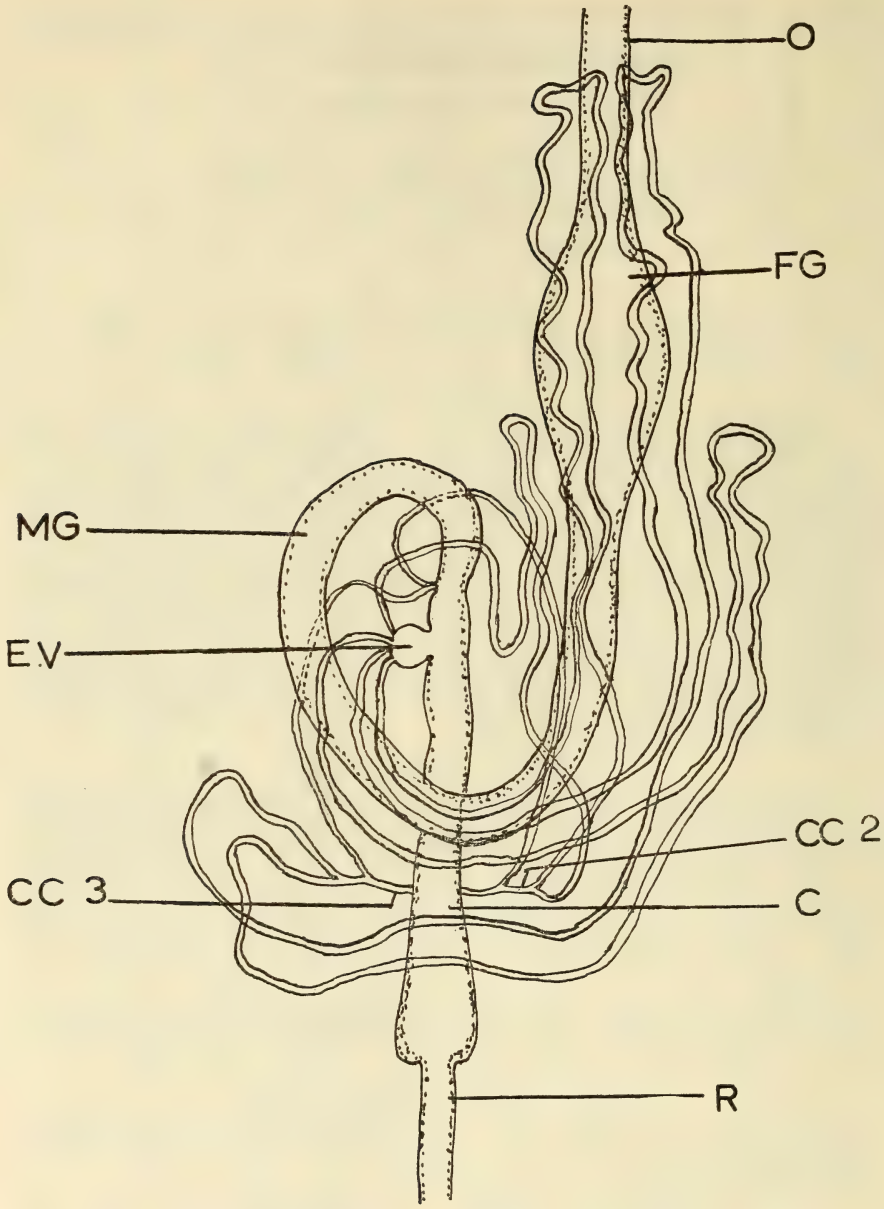

Fig. 3. The distribution of malpighian tubules in respect to the alimentary canal (Diagrammatic). C, Colon; CC2, Union of the two of the second group of the malpighian tubules to form a single tube; CC3, Common stem of malpighian tubules formed by the union of CC2 with one of the malpighian tubules of the first group; EV, Excretory vesicle; FG, Fore gut; MG, Mid gut; O, Oesophagus, R, Rectum.

The malpighian tubules are whitish in colour and they are embedded in the fat body very intimately. There is no external division of the malpighian tubules into granular and non-granular region. On the other hand they are completely granular in nature and are of the type as typically found in other coleoptera (Patton, 1963).

All the malpighian tubules are beaded in appearance and both of the first (or anterior) group are thin whereas those of the second (or posterior) group are thicker in diameter than the first two. There is difference in the lengths of both the groups of malpighian tubules. The malpighian tubules of the first group are shorter than the four malpighian tubules of the second group. The malpighian tubules of the second group also vary in length. Two of the four malpighian tubules are longer than the remaining two. The malpighian tubules of the anterior group measure approximately 13 mm. in length and 30-40 mu in diameter. In the second group two malpighian tubules are about 20 mm. in length whereas the other two largest are approximately 25 mm. in length. The diameter of both these two sub-groups is about 50-60 mu.

REASSOCIATION OF MALPIGHIAN TUBULES

All the malpighian tubules ultimately proceed posteriorly and reassociate with the anterior part of the colon. One of the tubules of the first group soon after its origin proceeds a little anteriorwards and then takes a posterior turn whereas the second tubule proceeds directly posteriorwards. These tubules ultimately proceed posteriorly one from each side of the alimentary canal (Shukla and Singh, 1968). In the posterior group of four tubules two continue anteriorly up to the beginning of the mid gut whereas the other two extend as far as the anteriormost part of the crop with which they are closely in contact. All these four tubules turn posteriorwards two from each side of the gut (fig. 2). All the three malpighian tubules of each side (one from the anterior group and two from the posterior group) unite to form a common stem. However workers like Woods (1916) and Saini (1954) have described that the common stem formed by the union of three malpighian tubules on each side reassociates with the hind gut. These tubules do not meet on a single point to form the common stem, but the two thicker tubules of the second group unite first of all and the thicker stem so formed unites with the other thinner tubules of the first group after a short distance and ultimately form the common stem (fig. 3). The common stems so formed of both the sides are ultimately enclosed within the peritoneum of the anterior colon and they immediately split into three terminal branches on each side which run intimately attached to the inner wall of the peritoneal chamber and thus reassociate in this manner. This has been confirmed by cutting sections of this region. Our observations are in agreement with those of Saini (1964) regarding the presence of weak peritoneum, covering the reassociated malpighian tubules.

This insect when touched, instantaneously performs the phenomenon known as reflex bleeding. The liquid discharged is yellowish in colour having a pH range 4.6-4.9 approximately. As already reported (Pradhan, 1942) it may be a defensive mechanism in which a lot of water is lost. The reassociation of the tubules may be one of the factors responsible for making good the loss of water.

SUMMARY

1. There are six malpighian tubules.
2. malpighian tubules are whitish in colour.
3. The six malpighian tubules originate in two bundles, one of two and the other of four and both these originate from the same side i.e. the right side of the gut.
4. The length and diameter of the two groups of malpighian tubules are different.
5. A set of three malpighian tubules on each side ultimately form the common stem which reassociates with the anterior part of the colon.
6. A weak peritoneal covering is present around the reassociated malpighian tubules.

7. The common stem on both sides of the gut split into three branches in the peritoneal chamber.
8. The phenomenon of reflex-bleeding has also been observed.

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EXPLANATION OF PLATE VIII

Fig. 1. The origin and number of malpighian tubules. EV, Excretory vesicle; HG, Hind gut; JMH, Junction of mid and hind gut; I GRMT, First group of malpighian tubules; II GRMT, Second group of malpighian tubules; MG, Mid gut.

Fig. 2. The mode of reassociation of malpighian tubules. AC, Anterior colon; CC2, Union of the two of the second group of Malpighian tubules; CC3, Common stem of Malpighian tubules; PC, Posterior colon.

BIRD ECTOPARASITES FROM NORFOLK ISLAND

By Bernard C. Nelson
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The Trustees of the Australian Museum sponsored an expedition to Norfolk Island, which lies approximately 1,000 miles northeast of Sydney, Australia, from 16 November to 1 December 1968 to study its avian and insectan fauna. Ectoparasites were collected from eight species of birds and in addition from two species of birds, the Grey Noddy and Sooty Tern, from Philip Island, which lies approximately five miles south of Norfolk Island.

The following birds and their ectoparasites are reported herein:

Pterodroma cookii nigripennis (Rothschild, 1893). Black-winged Petrel.
- Mallophaga (Menoponidae): *Longimenopon* sp. 1 ♂, 2 ♀.
- Mallophaga (Philopteridae): *Halipeurus accentor* Edwards, 1961. 2 ♂, 1 ♀, 5N.
- *Trabeculus hexacon* (Waterston, 1914). 1 ♀.
- Acarina (Pterolichidae): *Zachvatkinia puffini* (Buchholz, 1869). 1 ♂.

Sula dactylatra personata Gould, 1846. Masked Gannet.
- Acarina (Argasidae): *Ornithodoros capensis* Neumann, 1901. 5 larvae.

Sterna fuscata Linnaeus, 1766. Sooty Tern.
- Mallophaga (Philopteridae): *Quadraceps birostris* (Giebel, 1874). 3 ♂, 2 ♀, 1N.

Procelsterna cerulea albivitta Bonaparte, 1856. Grey Noddy.
- Mallophaga (Menoponidae): *Actornithophilus ceruleus* (Timmermann, 1954). 2 ♂, 3 ♀, 1N.
- Mallophaga (Philopteridae): *Quadraceps hopkinsi* Timmermann, 1952. 3 ♂, 3 ♀.

Gygis alba royana Mathews, 1912. White Tern.
- Mallophaga (Philopteridae): *Saemundssonia* sp. 2 ♀.

Halcyon sancta norfolkiensis Tristam, 1885. Sacred Kingfisher.
- Mallophaga (Philopteridae): *Alcedoecus* sp. 10 ♂, 8 ♀.

Pachycephala pectoralis xanthoproctor Gould, 1838. Norfolk Island Whistler.
- Acarina (Analgesidae): *Hemialges rennellianus* Gaud, 1962. 1 ♂, 4 ♀, 1N.

Turdus philomelos Brehm, 1831. Song Thrush.
- Mallophaga (Philopteridae): *Philopterus turdi* (Denny, 1842). 1N.

Sturnus vulgaris Linnaeus, 1758. Starling.
- Mallophaga (Philopteridae): *Sturnidoecus sturni* (Schrank, 1776). 9N.
- Acarina (Pterolichidae): *Pteronyssoides truncatus* (Trouessart, 1885). 1 ♀.

Discussion.—Three of the above Mallophaga are not identified to species. The two females of *Saemundssonia* from *Gygis alba* cannot be identified further without males. The two populations referred to respectively as *Alcedoecus* sp. from *Halcyon sancta* and *Longimenopon* sp. from *Pterodroma cookii nigripennis* are most certainly new species, but descriptions will not be given until these specimens have been compared with species already described in each of the respective genera. Specimens of *Longimenopon* are of interest as Clay (1962) has stated that they are rare in collections and has suggested that members of this genus probably live inside quill feathers.

Trabeculus hexacon from *P. cookii nigripennis* and *Quadraceps hopkinsi* from *Procelsterna cerulea* each constitutes a new host record for these lice, *T. hexacon* has been recorded previously from several hosts (Timmermann, 1959). Specimens of *Quadraceps* from *P. cerulea* were compared with those from *Anous minutus*, the type host of *Q. hopkinsi*, and found to be similar.

Timmermann (1954) described *Actornithophilus ceruleus* from five specimens removed from two skins of *Procelsterna cerulea*. Clay (1962) compared the

type series of *A. ceruleus* with specimens taken from two skins of *Anous minutus*, and found that the two series appeared to be inseparable. She concluded that either *A. ceruleus* occurs on both *Procelsterna* and *Anous* or the host record of the type material is incorrect. I have compared specimens from *Procelsterna cerulea* from Norfolk Island with those from *Anous minutus* from Heron Island, Capricorn Group, Queensland. The two populations can be distinguished by differences in the setal pattern on the abdominal tergites, a character regarded as of specific rank by Clay. Neither Timmermann (1954) nor Clay (1962) described or figured the setal pattern of the abdominal tergites for *A. ceruleus*. It is impossible therefore to determine whether the population from *Anous* or *Procelsterna* should be referred to *A. ceruleus* without examination of the type series, and consequently the identification herein is provisional.

The specimens of *Ornithodoros capensis* comprise the first record of this tick from Norfolk Island. Amerson (1968) has recorded *O. capensis* from several hosts, including *Sula dactylatra*, from 32 islands throughout the world.

Summary.—Eleven species of Mallophaga, three species of feather mites and one species of tick were taken from birds on Norfolk Island. Four new host records of Mallophaga are reported of which two are probably undescribed species, and the confused status of the type host of *Actornithophilus ceruleus* is discussed. *Ornithodoros capensis* is recorded from Norfolk Island for the first time.

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ON A DISTINCTIVE NEW SUBEQUATORIAL AUSTRALIAN QUADRANNULATE LAND-LEECH, AND RELATED MATTERS

by Laurence R. Richardson[1,2]

(Figures 1, 2)

Abstract:

The elaboration of organs on the anterior end of the paired male ducts within the median longitudinal chamber, the absence of a vagina and the presence of an oviducal glandular sac, are shown as a typical haemadipsoid reproductive system. *Nesophilaemon* is shown to differ markedly from the haemadipsoids. Blanchard's *minutus* and *grandidieri* are removed from *Philaemon*. *Neoterrabdella australis*, n.g., n.sp. has 2 jaws; viii to xxiii complete ($a_1/a_2/b_5/b_6$—total 16); xxiv, 3-annulate; 6 or 7 annuli margining the auricles; lambertian organs absent.

Because of the inadequacies in the systematics of the land-leeches, before a description of a new leech from the vicinity of Darwin can be undertaken, it is first necessary to demonstrate the distinctive nature of the regional morphology of the anterior portion of the paired male ducts in the land-leeches; as also of the morphogenesis and organization of the median region of the female system and to provide a distinctive terminology for this; to consider the nature of the g.*Philaemon* and its content, as also matters concerning other 4-annulate genera.

The 4-annuulate land-leeches have been known as a small group with a peculiar distribution. Although Lambert (1898) provided a fully detailed account of the 2-jawed 4-annulate *Philaemon pungens*, the type of the genus, Blanchard did not utilize this information in his monograph of the Haemadipsinae (1917) where he concerns himself only with external metamerism and places all 4-annulates in the g.*Philaemon*. The inadequacy of this simple systematics was demonstrated in the discovery by Moore (1938) of *Tritetrabdella*, a 3-jawed 4-annulate land-leech in Malaya. Blanchard handled material from eastern Australia and Java, all of which he considered to be *P. pungens*, and described *P. minutus* from the Samoan Islands and *P. grandidieri* from Madagascar. Johansson (1924) described a 2-jawed 4-annulate from Juan Fernandez, placing this in the g.*Philaemon*. Ringuelet (1955) gives a detailed account of this species and provided a new genus, *Nesophilaemon*, for it. In his invaluable key to the genera and catalogue of the species of the haemadipsid leeches, Soos (1967) recognised 9 genera and 24 species. He gives a brief diagnosis of the g.*Philaemon* giving the annulation of complete somites as $b_1/b_2/a_2/a_3$, a_1 being subdivided as is the condition found by Ringuelet in *Nesophilaemon*. This does not agree with Lambert nor with the annulation I have so far seen in the Australian 4-annulates. Soos recognises in *Philaemon* the three species in Blanchard, and *P. grandis* Ingram 1957 which is closely and fully described.

The haemadipsoid reproductive system (Figs. 1B, F.)

Details of the reproductive system in land-leeches were first given by Whitman (1886) in his account of *Haemadipsa japonica*. Others have been described since then; but the complete contrast between the reproductive systems in the aquatic arhynchobdellids and the land-leeches has never been demonstrated as distinctively haemadipsoid and without parallel in the hirudinoids.

Lambert (1898) gave an intimately detailed account of the male and female systems in *Philaeman pungens*, and (1899) describes the systems in

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two species of *Chtonobdella* as being similar to *pungens;* Harding (1913), in *Idiobdella;* Moore (1927), in several Asian species of the g.*Haemadipsa,* in 1938 in a Malayan species of *Tritetrabdella* and a species of *Phytobdella,* and 1944 in two further species of *Phytobdella* from New Guinea; Ingram (1957) in close detail for *Philaeman grandis;* and Ringuelet (1955) in *Nesophilaemon.* There are some other accounts but not fully assessable with confidence. In addition to *Chtonobdella,* I have knowledge from the dissection of three other species of 5-annulates of a second genus, and a variety of species of Australian 4-annulates as well as the new genus described below. From the above, we have knowledge of the reproductive systems in 3-jawed 4- and 5-annulate leeches, and 2-jawed 4-, 5-, and 6-annulate leeches. With the single exception of *Nesophilaemon,* which is dealt with separately later in this paper, the systems are closely similar in all, in both morphogenesis and organization, and in regional morphology.

In the hirudinoids (Richardson, 1969) I have shown that the organs on the anterior portions of the paired male ducts elaborate within the paramedian longitudinal chambers of the body cavity, lateral to the paramedian palisade of the dorsoventral muscle system and accordingly lateral to the crop. There are five distinctive patterns. There is only the one pattern in the haemadipsoids. The vas deferens runs anteriorly in the paramedian chamber in the haemadipsoid, the same as in the hirudinoids, but a primary reflected simple loop forms on each of the male paired ducts within the median chamber, extending ventral to the crop. The epididymis elaborates on the recurrent limb, and the thin-walled sperm-duct on the procurrent limb which terminates in a minute ejaculatory bulb lacking in *Philaemon* and *Idiobdella.*

As seen in the dissection of small specimens of 4- and 5-annulates (9.0 to 13.00 mm. in length), in initial morphological and functional development, the right and left loops lie side by side and are parallel in the median chamber. In later growth and functional differentiation, the initial and terminal portions of one loop elongate so that there is a greater length of vas deferens on this loop and the epididymis and the coiling portion of the sperm-duct become located posteriorly, even extended dorsal to the female median region, and there is a length of straight sperm-duct connecting to the median region. In this way the epididymis and coiling sperm duct of the one side become located posteriorly to the organs on the other loop in which the portion of vas deferens in the median chamber remains short, and the sperm duct remains short but is much coiled even close to the bulb. The two sets of organs now lie in tandem.

The sequence of vas deferens, epididymis, and sperm duct without an ejaculatory bulb is seen in various hirudinoid genera (*Aetheobdella, Macrobdella,* some species of *'Limnatis'*) and with a bulb in *Ornithobdella.* There is here a similarity in the level of organization on the male paired ducts in hirudinoids and haemadipsoids; but the regional morphology of the organs on the male paired ducts in the haemadipsoids is seen nowhere in the hirudinoids. The central positioning of these organs in the median chamber and the tandem arrangement which extends them along more somites than in the typical amyomeric mesomorphic jawed aquatic is recognisable as functionally advantageous to a terrestrial animal which must maintain balance and move in an environment which does not give passive overall support to the body such as does the aquatic environment. The functional demands placed on the muscular body wall envelope of the land-leech are most clearly expressed in the maintenance of the erect extended posture over considerable periods.

The male median region in all consists of a small weakly muscular atrium ending in a bursa opening at the genital pore. I have seen a minute and short briefly conical penis in several, a penis similar to that in the ornithobdellids *Aetheobdella* and *Ornithobdella,* hirudinoids which are both amyomeric, micromorphic in the form of the median male region as is the condition in the haemadipsoids.

In the new leech described here and in *Idiobdella,* the ovaries are simple tubular, briefly folded; simple sac-like in all others. The oviducts are short, not markedly longer than the ovaries, thin-walled as in the hirudinoids, and in the haemadipsoids join without the formation of an obvious atrial chamber such as is characteristic in the hirudinoids.

The regional morphology of the hirudinoid and haemadipsoid female median regions is the same. Both are myomeric, with an elongate muscularised region between the junction of the oviducts and the bursa. This is mesomorphic in the haemadipsoids, the junction of the oviducts remaining in the original position; but the morphogenesis and organization of this region in the haemadipsoids is entirely distinct.

The female median region in both develops in the median longitudinal chamber as a posteriorly directed loop, formed at a locus of growth between the junction of the oviducts and the bursa. The loop is ventral to the crop and lies initially in the horizontal plane. The recurrent limb of the loop is initially thin-walled but in the haemadipsoids it becomes moderately muscular in differentiation (Ingram, 1957, reports well-developed circular muscles), and the lumen is relatively reduced. This contrasts with the recurrent limb (common oviduct) in the hirudinoids which is never invaded by muscularization and remains always thin-walled with a relatively large lumen. In the haemadipsoid, the procurrent limb extending from the elbow of the loop anteriorly to the bursa becomes strongly muscular with a greatly reduced lumen. In this way, it resembles the vaginal duct of the hirudinoid.

The two limbs are parallel, closely approximated, and invested with a common connective tissue. The posterior face of the elbow expands posteriorly in morphological differentiation to form a weakly muscled sac lined with a thick glandular epithelium which as seen in small specimens (Fig. 1, F.) is initially thicker than the supporting tissue of the wall of the sac. Through this morphogenesis, the two limbs of the primary loop open without valves and in immediate proximity to one another on the anterior face of the sac, initially centrally, later ventrally following secondary expansion of the sac on the oviducal side. The area surrounding the entry of the two limbs becomes more strongly muscular than the general wall of the sac.

The asymmetrical growth of the sac is associated with torsion of the sac on the axis of the procurrent limb, the torsion extending somewhat along the two limbs so that the recurrent limb lies more or less above the procurrent limb. I have noted in some dissections that there is a compact half-loop on the end of the recurrent limb immediately at the attachment to the sac, a development clearly related to the process of torsion for both limbs are intimately bound together along their length.

The female median region of the haemadipsoid is without parallel in the hirudinoids. In the hirudinoids with the myomeric condition, muscularization spreads along the procurrent limb but never onto the recurrent limb. The procurrent limb differentiates as the strongly muscular vagina (and vaginal duct). The recurrent limb enters this terminally in the acaecates. In the caecates. the caecum forms by growth of the muscular vagina beyond the point of connection to the recurrent limb. This caecum is lined with epithelium of the same nature as the body of the vagina.

The glandular sac of the haemadipsoid can in no way be assessed as morphologically an equivalent of the vagina or vaginal caecum in the hirudinoid. To apply to it such terms as vagina, vaginal sac, and to refer to a vaginal duct is misleading, confusing, and obscures the distinctive nature of the organization in this region of the reproductive system of the haemadipsoids.

The prostate glands so far as I have seen them in the haemadipsoids are finer in texture, less compact, more deeply subdivided and a larger mass

than in the myomeric hirudinoids; but they are similar to the glands as seen in the amyomeric hirudinoids (*Aetheobdella,* etc.).

I have seen no indications of albumen glands in the haemadipsoids, nor have I seen them reported in other accounts.

The g. *Philaemon*.

It is most exceptional in the jawed leeches to have a genus provided before 1900 based on a species intimately described externally and internally at the time the genus was established. Lambert (1898) gives a complete and precise account of *Philaemon pungens* as the type of this genus, the first such description of a land-leech and without equal until Moore (1927). To Lambert's account can be added Ingram's (1957) excellent description of *Philaemon grandis* and a briefer account of *pungens.* The two species are clearly congeneric and allow of a description of the g. *Philaemon* adequate for the present occasion.

Blanchard (1917) defines the g. *Philaemon* only as 4-annulate, gives only the external meristic morphology of *pungens,* figures a leech which he considers to be this species, and describes and figures the external meristic characters of two other species which being 4-annulate he places in *Philaemon.* Moore (1938) completely describes a 4-annulate land-leech, *Tritetrabdella,* which however has 3 jaws, so demonstrating the dangerous simplicity of Blanchard's systematics. Johansson (1924) described *Philaemon skottsbergi,* a 2-jawed 4-annulate which Ringuelet (1955) studied intimately and placed in a new genus, *Nesophilaemon.* Soos (1967) in his highly valuable key to the genera and catalogue of the species of land-leeches provides assistance to those concerned with the difficulties of the 4-annulate leeches. Against this background and with a growing personal experience of the Australian 4-annulates, it is now possible to make progress toward a further understanding of this group.

From Lambert, Ingram and my personal material, the g. *Philaemon* based on *P. pungens* can be characterised with the somital limits of Moore as: 2-jawed; monostichodont with minute teeth (50 to 70); no salivary papillae; 4-annulate; vii, 3-annulate; 2 annuli between vii a_2 and viii a_2; viii to xxiii complete (total 16), with $a_1/a_2/b_5/b_6$; xxiv, uniannulate; 6 annuli posterior to xxiii a_2; auricles bilobate margined by 3 annuli; crop compartmented, each compartment with a single pair of simple caeca, those of xix forming postcaeca; lambertian organs present, anterior, in xx and xxi, the ducts elongate, 2 or 3 times the length of the organs; genital pores xi b_5 (? b_5/b_6) and xii b_5 (? b_5/b_6); reproductive system, haemadipsoid; no ejaculatory bulbs; ovaries sac-like. Size moderate. Colour pattern, interrupted longitudinal stripes. Terrestrial. Sanguivorous. Australian Region.

A query is provided here on the position of the genital pores because among the continental Australian 4-annulates there are species with the pores close to the posterior border of b_5 even in b_5/b_6. These appear to belong to *Philaemon* as above.

Soos (1967) differentiates *Philaemon* from *Nesophilaemon* by the absence of lambertian organs in the latter which has an annulation of complete somites as $b_1 = b_2 = a_2 < a_3$. He gives the annulation of *Philaemon* as $b_1 = b_2 = a_2 = a_3$.

In all the 2-jawed 4-annulates from continental Australia which I have personally examined, the annulation of the complete somite is always a_1, a_2, b_5, b_6 as Moore (1938) gives for the 3-jawed *Tritetrabdella.* In my material the somital sense organs are obvious. Somite v is 2-annulate above; vi, 3-annulate above, with two annuli between vi a_2 and vii a_2; two annuli between vii a_2 and viii a_2; and three annuli between viii a_2 and ix a_2. To provide a 4-annulate viii having an annulation of $b_1/b_2/a_2/a_3$ with vii 3-annulate as usual, it would be necessary for there to be three annuli between vii a_2 and viii a_2.

This is not the case in the continental Australian 4-annulates I have so far studied. Since the annulation of complete somites is $a_1/a_2/b_5/b_6$ in 4-annulates where vii is clearly 3-annulate with only two annuli between vii a_2 and viii a_2, the development of a third annulus in this region can come only through subdivision of vii a_2 so converting vii to the complete condition, as in *Tritetrabdella* where Moore found vii to be complete, and also in the leech tentatively assigned to *Philaemon grandidieri* by Mann and Tyler (1963), a leech found subcutaneously in a frog in New Guinea. (I have recently had the opportunity of examining this leech. It has 3 annuli between vii a_2 and viii a_2).

The one established exception to this pattern of annulation in the 4-annulates is *Nesophilaemon,* as described by Ringuelet (1955).

The species of *Philaemon* as given by Blanchard (1917) are *pungens* of south-eastern Australia up to the Queensland border, and Java; *P. minutus,* of the Samoan Islands; and *P. grandidieri* of Madagascar. Blanchard gives external meristic data with the somital limits of Whitman. Somital sense organs are shown in all somites figured for *pungens;* on the genital and pregenital region for *grandidieri;* but not in *minutus* in which some nephropores are indicated. From this, the annulations can be converted to the limits of the somites in the manner of Moore.

Blanchard's account of *P. pungens* in the text, he states, is based on specimens from the vicinity of Melbourne, and the description in the text agrees with the *pungens* of Lambert. The specimen illustrated in his Fig. 7 as being *P. pungens,* has vii 3-annulate, only two annuli between vii a_2 and viii a_2, so complete somites will be $a_1/a_2/b_5/b_6$; viii to xxii are complete (total 15); xxiii, incomplete 4-annulate, $a_1/a_2/(b_5+b_6)$; xxiv, 2-annulate with (?) a_2a_3 forming the anterior lobe of the auricle, a condition not in *pungens.* The genital pores are at xi b_5/b_6 and xii a_2/b_5, again not as in *pungens.* There are 7 annuli behind xxiiia_2.

In my collections of 4-annulates ranging from Tasmania to the Iron Bark Range, Northern Queensland, the male pore is reasonably constant in xi b_5 or b_5/b_6. The female pore is in xii a_1; xii b_5 (b^5/b^6); xii b_6; or xiii a_1. I have not yet established the systematic value of the various positions of the genital pore. It is at least specific, and more probably generic in three groups, xii a_1; xii b_5(b^5/b^6), b_6; and xiii a_1.

From the above, it can be recognised that the leech shown in Blanchard's Fig. 7 is not *P. pungens.* The figure may possibly be based on his specimens from the Upper Richmond River, northern N.S.W., this being by far the largest specimen available to him. I have not yet seen the leech shown in Blanchard, Fig. 7.

In Fig. 9, *P. grandidieri,* as determined by the somital sense organs, there are two annuli between vi a_2 and vii a_2; three annuli between vii a_2 and viii a_2. In Fig. 8, *minutus,* the indicated position of nephropores permits recognition of annulus 14 as being viii a_2. The 5th pair of eyes in annulus 7 establishes this as vi a_2. Acordingly in both species there are 6 annuli between vi a_2 and viii a_2, as in *Nesophilaemon* and *Tritetrabdella,* not 5 as in all 4-annulates of continental Australia which I have so far examined. There is no basis in either figure to determine vii as 3- or 4-annulate. If vii is 3-annulate, then viii must be $b_1/b_2/a_2/a_3$ and also the following complete somites. The annulation of complete somites will then exclude both species from *Philaemon.* If vii is 4-annulate, the annulation will be $a_1/a_2/b_5/b_6$ as in *Philaemon,* but vii to xxiii will be complete (total 17). This too excludes both species from *Philaemon.* In *minutus* there are 6, in *grandidieri* 7 annuli behind xxiii a_2.

It can be noted in Fig. 8, *minutus,* there has been either a simple error, or there is distinctive novelty in the arrangement of the nephropores in this species. The figure shows the '2nd' nephropore on annulus 13. This places

it in viii which in haemadipsoids typically lacks a nephropore. If in fact the 2nd, the '16th' shown on xxiii is actually the 17th and there will be no auricular nephropore. It is possible that *minutus* lacks a labial nephropore.

The g. *Nesophilaemon*.

From Ringuelet's detailed account (1955) of *Nesophilaemon skottsbergi* (Johansson, 1924) of Fernandez Island, the characters are: 2-jawed; vi and vii, 3-annulate; viii to xxiii, 4-annulate, complete (total 16) with $b_1=b_2<(b_5b_6)$; the anus at xxvi/xxvii; 5 pairs of testes; genital pores at xi/xii and xii/xiii; auriculate; the auricles margined by 3 annuli; nephropores on viii to xxii, (? labial), and auricular.

It differs from all other 4-annulates in having the annulation of complete somites as a_1 divided into b_1 and b_2.

Otherwise, it differs in the nature of the reproductive system from all haemadipsoids as known. Ringuelet in his other carefully conducted studies of leeches has shown the morphological relationships of the testes and vas deferens correctly, with the testes medial to the vas deferens as in all hirudinoids known to me (Richardson, 1969) and all haemadipsoids where the testes are in the median longitudinal chamber of the body-cavity, connecting laterally through the paramedian palisade to the vas deferens which runs in the paramedian chamber.

Accordingly in his figure, the position of the testes lateral to the vas deferens (and so also in the 3-annulate S. American land-leech *Mesobdella*, Ringuelet, 1943) represents a unique morphological relationship among all jawed sanguivorous leeches so far known.

The anterior portion of the paired male ducts in *Nesophilaemon* do not extend into a posteriorly directed simple primary loop as in all known haemadipsoids, but like the Australian aquatic richardsonianid sanguivores the epididymis elaborates in xii posterior to the sperm duct in the contiguous portions of xi and xii, accordingly in a linear relationship unique among the haemadipsoids. There is no ejaculatory bulb.

The male median region appears amyomeric, micromorphic as usual in the haemadipsoids.

The ovaries are sac-like, the oviducts twice the length of the ovaries, and joining without an obvious atrium. The female median region forms on a posteriorly directed simple primary loop. The recurrent limb is shown as little wider than the paired oviduct (as in the young haemadipsoid) and terminates before the elbow of the primary loop so that it is shorter than the procurrent limb. It enters terminally (as in the acaecate hirudinoid) into a rapidly widening chamber (Ringuelet's 'vaginal sac') which in the contiguous portions of xv and xvi curves sharply to be continuous with the much larger, wider, 'vaginal duct'. There is nothing here of the organization of structures on the female median region typical of the haemadipsoids.

In the above it is clear that *Nesophilaemon* stands apart from the haemadipsoids in the morphological relationships and organization of structures on the anterior portion of the male paired ducts, as also the regional morphology of testes and vasa deferentia; in the organization of the female median region; and in the annulation of complete somites.

The differences are more than simply generic in value. Regrettably, I cannot reach an adequate appreciation of the median female region in *Mesobdella*. Both *Mesobdella* and *Nesophilaemon* appear to be haemadipsoid principally in the annulation of the ocular somites.

Neoterrabdella, n.g.

Monostichodont; duognathous; no salivary papillae; teeth, minute, acute, 25 to 30; annulation of ocular somites, haemadipsoid; vii, 3-annulate; complete somites 4-annulate ($a_1/a_2/b_5/b_6$), viii to xxiii (total 16); xxiv, 3-annulate;

somital sense organs obvious; auricles margined by 6 (or 7) annuli (xxiv a_1 to xxvii); anus at posterior margin of xxvii; salivary glands obvious, loosely arranged in clusters along a few long ducts on each side; pharynx moderately muscular, suspended by obvious radial muscles, terminates viii b_5/b_6; pharynx with a single dorsomedian and paired ventrolateral muscular ridges, the former ending on the margin of the entrance to the pharynx, the paired ridges fusing each to enter a jaw; crop with 11 compartments, each with a single pair of simple caeca, those of xix forming postcaeca; no lambertian organs; intestine with an anterior pair of long caeca each opening lengthwise into the intestine; genital pores, xi b_5 and xii b_6; reproductive system haemadipsoid; 10 pairs of testes; anterior portion of paired male ducts reflect each in a simple loop in the median chamber with the epididymis and sperm duct subparallel; small ejaculatory bulbs present; male median region amyomeric, micromorphic; penis minute, low conical; ovaries, tubular; oviducts short; female median region myomeric, mesomorphic, formed on a simple posteriorly directed loop; recurrent limb, moderately muscular, lumen reduced; procurrent limb, strongly muscular, lumen very small; glandular thin-walled oviducal sac present. Size medium. Colour pattern, longitudinally striped, essentially uninterrupted. Terrestrial. Sanguivorous. Australian Region.

Type species: *Neoterrabdella australis* n. sp.; Holotype-specimen deposited in the Australian Museum, Sydney, N.S.W. Coll. No. W 4191. The type specimen has xxv, uniannulate. Collected, 3/12/68, by J. and S. Aldrick and J. Goode, Holmes' Jungle, 10 miles south-east from Darwin, Northern Territory. On coarse bladed grass a foot and more above the ground.

(The generic name is based on: *neos,* new; *terra,* land; and *bdella,* leech. f.).

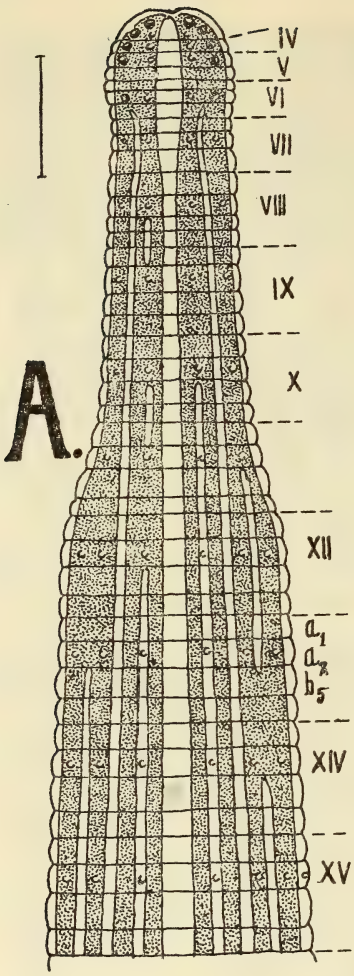
Being 4-annulate on complete somites; *Neoterrabdella* is comparable with *Nesophilaemon, Philaemon* s.s., the *'Philaemon'* of *grandidieri* and *minutus,* and *Tritetrabdella.* It resembles *Nesophilaemon* only in that both are 2-jawed and lack lambertian organs, the two differing in the pattern of annulation of complete somites, in the regional morphology of the male paired ducts, the relationships of the organs on the anterior portions of the male paired ducts, and in the organization of the female median region which is peculiar to *Nesophilaemon* and typically haemadipsoid in *Neoterrabdella. Neoterrabdella* has ejaculatory bulbs, lacking in *Philaemon* s.s., and lacks the lambertian organs which are present in *Philaemon* s.s. (as also in the 5-annulate *Chtonobdella,* a second Australian 5-annulate genus, and the 6-annulate *Phytobdella*—all of which are 2-jawed). The 3-jawed *Tritetrabdella* also lacks lambertian organs, and has 3 annuli between vii a_2 and viii a_2, vii being 4-annulate (which is probably also the actual condition in *'Philaemon' grandidiere* and *minutus,* and so differs from *Neoterrabdella* in which vii is clearly 3-annulate, and vii a_2 is followed by only 2 annuli.

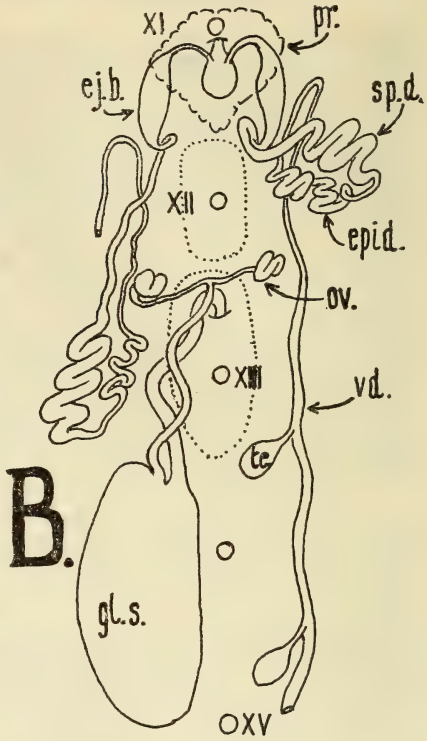
With increasing knowledge of the Australian 2-jawed land-leeches, all known until now as having lambertian organs, it seemed most probable that these represent a familial group distinct from the F. Haemadipsidae. *Neoterrabdella* does not fall fully within the concept formulating for the Australian family, and for the time being can only be referred provisionally to the F. Haemadipsidae s.l., differing from all auriculates in having the auricles margined by 6 or 7 annuli.

Neoterrabdella australis, n.sp. (Fig. 1A to E, 2G, H)

A medium sized, strongly papillate, richly coloured land-leech with seven delicate dorsal longitudinal stripes. The venter immaculate, pale pinkish red in life. The dorsum with a background colour of dark blackish brown in life with seven well-defined longitudinal narrow golden-yellow stripes which are finely black-margined in full extension. The background fades in alcohol to pale reddish brown, the stripes to pale creamish yellow or cream with very narrow nearly black margins.

The longitudinal dark bands between the stripes are of equal width in the middle half of the body where the paired stripes are of about half the width of the dark bands.


A.
IV
V
VI
VII
VIII
IX
X
XII
a_1
a_2
b_5
XIV
XV


B.
XI
pr.
ej.b.
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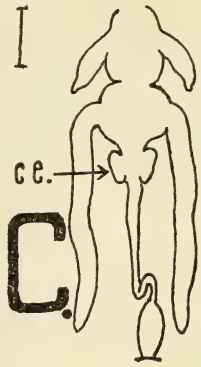
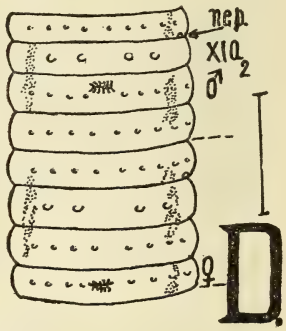
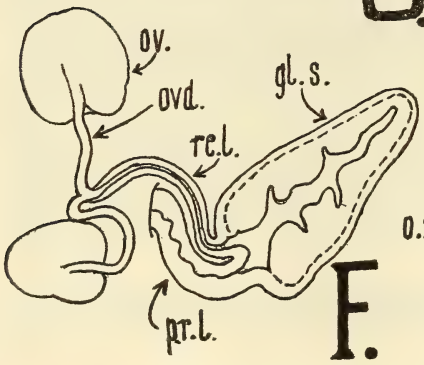
XII
epid.
ov.
XIII
vd.
te.
gl.s.
XV


C.
c.e.


D.
nep.
XI a_2
♂
♀


F.
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ovd.
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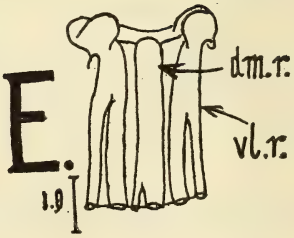
0.2


E.
d.m.r.
vl.r.
1.0

The median light stripe is under half the width of the median field and continuous from the first pair of eyes to the anus, but does not extend onto the posterior sucker which is plain, immaculate, and light in colour on the dorsum. The median stripe narrows anteriorly back to ix, widening a little to continue of this width to xvii, narrower behind this to xx and briefly wider back to xxvii. The paired light stripes are each about half the width of the median. The innermost pair are paramedian, include the sense organs, and extend continuously or only briefly interrupted from xxiv a_2 to ix a_2, or only to xii/xiii being represented anterior to this by elongate patches as between xi a_2 and x a_2, and ix a_2 to viii a_2, but never represented anterior to viii a_2, so that the paramedian stripes are always shorter than the median and the adjacent paired stripes lateral to them. This second pair of stripes are each median in the paramedian field and continuous from xxiv a_2 to vi a_2/a_3, terminating just medial to and just behind the 5th pair of eyes. The third pair of stripes are in the intermediate field, for the greater part of their length slightly wider than the paramedian stripes, and extend from xxiv a_2 to xi b_5 either continuously or with brief interruptions as from xvii a_2/b_5 to xv a_2/b_5, or xiii a_2 to xiv a_2, and do not extend anterior to xi a_2. A fourth and wider pair of light stripes are of the colour of the venter, marginal in position, and extend from the posterior border of the auricle to iii/iv being lateral anteriorly to the eyes. These stripes are partially, even incompletely separated from the venter by one or two rows of diffuse, irregular, small, dark elongate or short patches of such size and frequency as to suggest in places the presence of an interrupted line separating the marginal stripe from the venter; but not in all specimens.

A second collection (9/2/69) from the same location contains 17 specimens ranging from 10.0 to 44.0 mm. in length. A specimen 10.0 mm. long lacks pigment other than in the eyes and very small, closely spaced pale brown indistinct specks in a transverse row on all annuli and of such number as to be apparently associated with the secondary sensillae. Otherwise, it is translucent, pale flesh pink, and entirely without stripes and bands. A slightly longer specimen, 12.5 mm., is pale greyish black on the dorsum and venter, the dorsum divided into three pairs of pale dark bands by a median and two pairs of uninterrupted faint lighter stripes corresponding to the stripes of the paramedian lines and the stripes of the paramedian fields. These terminate at xxiii/xxiv, the inner extending to x a_2, the outer to vi/vii. Another of this same size is much darker in general, almost a pale black, with pale stripes and dark bands as in the adult, i.e. the stripes in the intermediate fields have been added. The adult colour appears in specimens 15.0 mm.

Figure 1. A to E, *Neoterrabdella australis,* n.g., n.sp. A. Somites 1 to xv, dorsal aspect to show colour pattern in relation to somital sense organs; B. Reproductive system, dissection from the dorsal aspect, primary loops of male paired ducts displaced laterally and the medial aspect shown, dotted lines indicate the normal position of the organs on the male primary loops; C. Posterior portion of crop and the intestine showing location and form of the intestinal caeca; D. The location of the genital apertures and the ventrolateral bands; E. Pharynx opened along midventral line to show internal muscular ridges; F. *Chtonobdella limbata.* In toto cleared preparation of the female reproductive system of a 13.0 mm. long specimen showing the relationships of the two limbs and the glandular sac, and the reduced lumen of the thick-walled recurrent limb.

Somites and somital ganglia in Roman figures. ce., intestinal caecum; dm.r., dorsomedian muscular ridge; ej.b., ejaculatory bulb; epid., epididymis, gl.s., glandular sac; nep., nephropore; ov., ovary; ovd., oviduct; pr., prostate; pr.l., procurrent limb; re.l., recurrent limb; sp.d., sperm duct; te., testis; v.d., vas deferens; vl.r., ventrolateral ridge. All scales in mm., 2.0 mm. unless otherwise indicated.

long and longer. The sequence in development of pattern and colour is apparently that described by Ingram (1957) for *P. pungens* which at hatching is some 5.0 mm. in length, uniform dark brown and without pattern. The pattern became evident at 3 months when her leeches had grown to 6.0 mm. and could extend to 15.0 mm.

A specimen 25.0 mm. long in full contraction, reached 55.0 mm. in full extension. At rest the anterior end is broad, low convex, continuous with the short heavy pregenital region which widens rapidly and progressively so that the body is generally heavy and broad in appearance, convex above, and wider than the posterior sucker. In extension the leech shows a distinct anterior sucker set off from the narrower cylindrical neck and an elongate cylindrical body narrower than the diameter of the posterior sucker. In life, the margin of the posterior sucker is clearly even though minutely scalloped, each such a minute convexity at the end of a radial band on the ventral face of the sucker which from time to time shows a well-formed and large clamp.

Annulation:

Somital and secondary sensillae and the lateral nephropores are clearly obvious. Interannular and intersomital furrows are equivalent and there was nothing persistent or regular in the way of couplets, triplets, or individually defined somites. All annuli are divided into areolae which carry somital sense

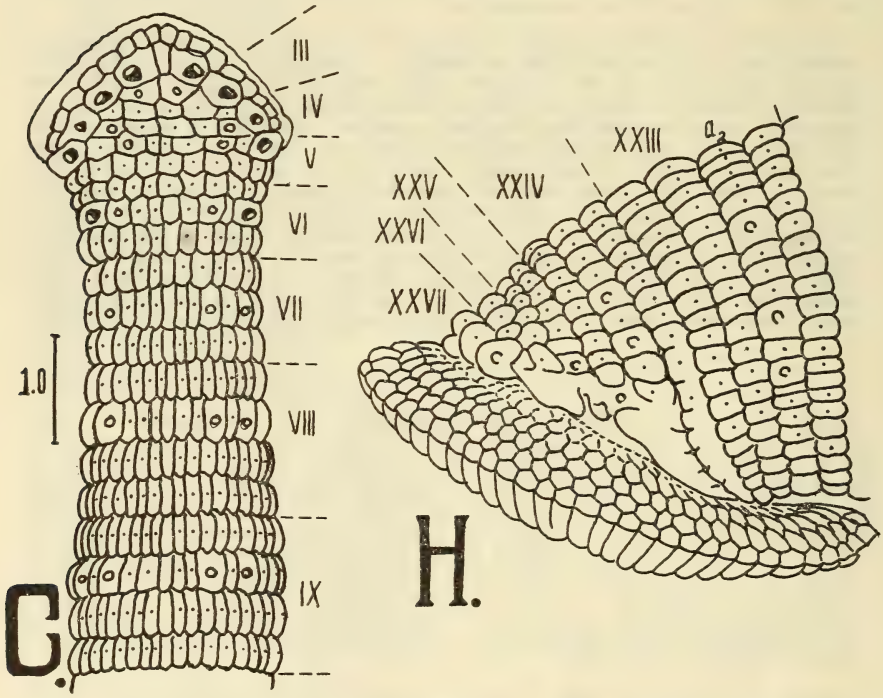


Figure 2. *Neoterrabdella australis,* n.g., n.sp. G. Dorsal view of velum, anterior sucker and pregenital region to somite ix; H. Right lateral aspect somites xxiii to xxvii of a specimen with xxv 2-annulate, showing auricle, dorsal and margin of ventral surface of posterior sucker.

organs and sensillae on the a_2 annuli and sensillae only on other annuli. The areolae are thrown into high convex papillae in contraction.

The velum is short, thick and thick margined, formed by i, ii, iii, and iv which are transversely tesselated and bordered by the narrow clear margin of the velum. Somite ii carries the 1st pair of eyes; iii, the 2nd pair with the first pair of paramedian somital sense organs between the eyes; iv, 2-annulate between the eyes with the paramedians in the posterior annulus but there is no indication of subdivision of either of the areolae carrying the 3rd pair of eyes. Somite v is 2-annulate above, with the 4th pair of eyes in $a_1a_2>a_3$, and uniannulate below where it forms the lateral and ventral margins of the sucker; vi, 3-annulate above with $a_1<a_2<a_3$, the 5th pair of eyes in a_2, and 2-annulate below; vii, fully 3-annulate with $a_1<a_2<a_3$, and in one specimen with the intermediate sense organs pigmented and eye-like in all respects; viii, 4-annulate with $a_1=a_2>b_5=b_6$. Somite ix carries the first of the laterally situated nephropores on the posterior portion of a_1, and is 4-annulate. Somite xxiii is the last 4-annulate somite, carries the last of the laterally situated nephropores, so that there is a total of 16 complete somites. In ix to xiiii, $a_1<a_2<b_5>b_6$; xiv to xx, $a_1<a_2=b_5>b_6$; xxi to xxiii, $a_1=a_2=b_5>b_6$. There is some difficulty in determining the relative lengths of the annuli in ix to xxiii, a_1 being nearly equal to a_2 and appearing either slightly longer or shorter than it; a_2 is commonly nearly equal to b_5; but b_5 is constantly and obviously larger than b_6 throughout the greater number of the complete somites. Somite xxiv is 3-annulate with $a_1=a_2>a_3$. Somite xxv, characteristically uniannulate in the land-leeches, is uniannulate in 3 specimens but definitely 2-annulate in 2 specimens with a_1a_2 carrying well-marked intermediate sense organs and $a_1a_2>a_3$. Somites xxvi and xxvii are uniannulate. The anus is at the posterior margin of xxvii. There are 8 or 9 annuli posterior to xxiii a_2.

The auricles are large and prominent, obvious, and formed along the lateral margins of xxiv a_2 to xxvii; xxiv a_1 is incompletely areolated along the lateral portion which lies anterior to the auricle. Accordingly the auricle is margined by 6 or 7 annuli depending on whether xxv is undivided or divided into 2 annuli. The annuli between the auricles are transversely abbreviated, xxiv a_1 being the last annulus complete on the venter.

The dorsum of the sucker is areolate in 4 concentric rows, shows only one pair of paramedians, and the marginal areolae or tesselations match to the radial bands on the ventral surface of the sucker, which are in the order of 64 in number. The clamp is large and includes about 12 radial bands.

Alimentary tract.

The pharynx contains a single median dorsal muscular ridge which terminates anteriorly in a small barely elevated transverse short pad, and two pairs of ventrolateral ridges which each fuse to a single ridge before entering the jaw. The jaws are low, moderately compressed, the dental edge long, low convex, and for the greater part the jaws are retractable into open pockets. There is a single row of closely approximated minute sharp teeth on each jaw. These as seen in the chitin withdrawn from the sucker cavity, total 23 to 28, are broad based with an erect sharp-tipped cylindroid median portion. A large tooth is no more than 8.0 mu. tall.

The pharynx terminates at viii b_5/b_6 and is suspended by obvious radial muscles which extend also back into x. The salivary glands are very obvious as many large gland cells packed in irregular clusters along a few, possibly 3 or 4 main ducts on each side, extending back into x, and nowhere forming compact adherent masses. The crop consists of 11 compartments in ix to xix each with a single pair of simple lateral caeca which increase in size posteriorly and from xiii extend posteriorly into the following somite. Those of xix form the postcaeca which reach into xxiv.

There is no indication of lambertian organs. The postcaeca end simply and bluntly.

The intestine commences at xix/xx, initially of the width of the postcaecum and with a prominent pair of lateral caeca which are low, of the length of a somite, and open freely lengthwise into the intestine. These in position and form present the appearance of lambertian organs, but their nature as lateral intestinal caeca is shown in the free movement of the intestinal contents into and out of these structures. Posterior to xxi, the intestine tapers, is thrown into a single 'S' loop before joining the short and wider rectum.

Reproductive system.

This is haemadipsoid in general organisation and in regional morphology.

The genital pores open at xi b_5 and xii b_6, the male pore in the anterior half of b_5, a_2/b_5, a_2; the female pore median in b_6.

There are 10 pairs of simple sac-like testes in the median chamber in xxii/xxiii to xiii/xiv, each connecting by a short vas efferens to the vasa deferentia in the paramedian chamber. The left vas deferens enters the median chamber at xi/xii, the right at xi b_5/b_6, and each extends posteriorly as a simple primary loop within the median longitudinal chamber, the initial limb being recurrent, the terminal limb, procurrent. The recurrent limb of the loop on the left male duct consists of a length of vas deferens which elaborates as epididymis at xii/xiii continuing to xiii/xiv where the recurrent limb commences as a compactly coiling thin-walled sperm duct which becomes a simple straight sperm duct running from about xii b_5/b_6 to the small but definitely strongly muscular ejaculatory bulb in xi, so that the greater length of both limbs of this loop are vas deferens and straight sperm duct extending from the posterior annuli of xii, into xi. The loop on the right male duct is short, extending back to about xii b_5. The recurrent limb is very briefly vas deferens and then epididymis, and the terminal procurrent limb is, almost entirely compactly coiling thin-walled sperm duct. In this way, the elaborated loops lie with the right anterior to the left in the median chamber, and the elaborated portion of the left loop extends back to be dorsal to the median region of the female system, and all completely ventral to the crop. The minute ejaculatory bulbs are entirely within xi, similar in form and size, lack defined cornua, and continue by very short non-muscular delicate ducts which enter independently low on the anterior face of the male atrium. This atrium is micromorphic, small, weakly muscled, entirely ventral to the nerve cord, but standing above the muscular layers of the body-wall envelope.

The single pair of ovaries are elongate, tubular, briefly folded on themselves, and situated in the posterior two annuli of xii. The delicate thin-walled oviducts are short, of the length of the ovaries and join in xii to the median region with no indication of a formed atrium.

The female median region has the form of a posteriorly directed loop with an expanded sac formed from the posterior face of the loop.

The recurrent limb is narrow, but one half the width of the procurrent limb, weakly but definitely muscular although not showing a strongly organised circular layer. The lumen is relatively narrow. The wall thick. It enters the anterior face of the sac immediately adjacent to the end of the procurrent limb which is thick walled, strongly muscular with an obvious layer of circular muscle, a very reduced lumen. It passes directly to the bursa.

The wall of the sac is thinly muscular, without indications of any strongly organised muscle layers, and glandular in texture internally. The limbs open into it and from it without any indication of sphincter or other valves. The anterior wall of the sac is thickened and somewhat more muscular in an area around the connections of the limbs.

The prostate is diffuse, extensive, covering the atrium, the anterior ends of the ejaculatory bulbs and extending posteriorly between them.

There is no indication of albumen glands in these specimens.

Acknowledgements.

I am most grateful to John and Susan Aldrick of Darwin, Northern Territory, and John Goode of Frankston, Victoria, for specimens of the new leech described here; to Dr. J. C. Yaldwyn, now of the Dominion Museum, Wellington, N.Z., Miss E. Pope of the Australian Museum, Dr. R. E. Barwick, Australian National University, for assistance with literature and in other ways; as also to Dr. M. C. Meyer, Orono, Maine, for help with difficult literature. Dr. A. Soos, Natural History Museum of Hungary, has been a most helpful correspondent. The Science and Industry Endowment Fund has assisted with microscopic and other equipment.

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OBITUARY

Francis Alexander McNeill, F.R.Z.S.
(Plate IX)

Francis Alexander McNeill, F.R.Z.S., devoted the whole of his professional life to his museum career and his recent death came as a painful surprise to a wide circle of friends and colleagues in Australia and overseas.

Frank was born at Summer Hill on June 2, 1896 and, after schooldays at Dulwich Hill, another Sydney suburb, joined the staff of the Australian Museum in May 1914 under the cadet system then operating. First he held a clerical position at the library, then became a "Zoologist's Clerk", when his chief task was to assist A. R. McCulloch who taught him museum techniques and how to draw scientific illustrations. Frank McNeill studied zoology at the Sydney Technical College under E. A. Briggs and knew Professor W. A. Haswell of the University of Sydney, one of the authors of the text-book he used, Parker & Haswell's *Textbook of Zoology*. McNeill's museum duties involved the care of fishes, crustaceans and reptiles. In 1920, some 15,000 specimens of fishes, followed by many invertebrates, were arranged in the Spirit House according to a system of letters similar to the Dewey classification of library books. With the catalogue cards, this arrangement enabled any specimen to be found in a couple of minutes. McNeill was meticulously neat and accurate in his labelling and painstaking in writing the fullest data on the cards and in the registers. Moreover, he continued, for over forty years, McCulloch's card-index to carcinological literature.

In the Australian Museum, any invertebrates other than molluscs and arthropods were grouped into the so-called Department of Lower Invertebrates (established by Thomas Whitelegge in the 1880's), which meant that a bewildering assortment of animals from protozoa to ascidians became the charge of a curator who could, of course, only select from a number of phyla the subjects for his research. When Rex Bretnall retired in 1921, Frank McNeill was placed in charge of the Department and energetically built up the collections and catalogues for the next forty years. The Department was divided into two in 1957, with Miss E. Pope in charge of worms and echinoderms, leaving McNeill with crustacea and coelenterata. The latter were taken over five years later by Dr. J. C. Yaldwyn when McNeill reached the age of retirement, and are now in Dr. D. Griffin's care.

McNeill joined the Royal Zoological Society of New South Wales in 1925 and became Chairman of the Marine Zoological Section in 1934. In 1960, he was elected a Fellow. A member of the Great Barrier Reef Committee, he was personally largely responsible for having turtles protected by the Queensland Government from exploitation.

Frank enjoyed lecturing to the public and for 3½ years in the 1940's he broadcast as "Sandy the Naturalist" in the Argonauts' children's session on the Sydney radio station 2FC. He was an active member of staff social organizations (being particularly helpful to the younger people) and in Union proceedings. He supervised the production of various groups and exhibits of invertebrates for the museum galleries and was one of the team which produced the elaborate "Invertebrate Tree", opened in 1959.

I do not think McNeill ever travelled beyond the eastern States of Australia, except for a science congress in New Zealand, but he collected specimens up and down the local coasts. In 1928 he was a guest of the British Great Barrier Reef Expedition, centred on Low Isles. In the 1920's several museum zoologists, notably Tom Iredale and F. A. McNeill were active in the field with officers from the Sydney Harbour Trust—and later (1936) with the Queensland Forest Service, Brisbane—investigating the marine borers which caused thousands of pounds worth of damage to wooden wharves, boats, piles and other structures in harbours and rivers. The various

species of borers were not well known scientifically so the work took a considerable time, but detailed reports were subsequently published and were an outstanding example of museum work applied to economic zoology. Frank McNeill's main collecting was done in Queensland: he accompanied and often organized many trips to the Great Barrier Reef, acting as guide and lecturer. When H.R.H. Princess Alexandra visited Lindeman Island during Queensland's centenary year in August-September 1959, McNeill was appointed naturalist-guide to the royal party. He also accompanied his American friend, Colonel J. K. Howard, on game-fishing and collecting trips. McNeill had an extraordinary flair for finding rare specimens and he would discover, for example, several fishes new to Australia on a brief visit to some lagoon which had been expertly collected over on previous occasions.

A genus of crustacea (*Macneillena*) and a number of species of fishes and invertebrates have been scientifically named in his honour.

After his retirement, McNeill was appointed an Honorary Zoologist (later Honorary Associate) of the Australian Museum and completed his long-awaited Report on the crustaceans of the Low Isles expedition of forty years before. In 1969, he was obliged to undergo surgery but failed to rally from the effects of operations and he died in Sydney on 24th February. He had taken pride in his physical fitness, having followed the Sandow system in his youth, so that his sudden relapse was the more unexpected. Marine zoologists particularly will deplore the loss of a kindly, conscientious and enthusiastic colleague and join Frank's many friends to extend their sympathy to his widow, sons, daughter, grandchildren and great grandchildren.

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It is doubtful if a complete bibliography of F. A. McNeill's writings can be prepared because he contributed articles to various newspapers, magazines, tourist or angling literature, and publications not now current. Also some of his notes were printed anonymously. However, the list of his scientific writings given below (totalling about 175 items and spanning half a century) is believed to contain references to his most important work. Some of the books, written with collaborators, have run into several editions, not all of which may be collated here. Frank McNeill modestly assumed that even the first edition of *The Great Barrier Reef and adjacent isles* would not sell and did not believe me when I told him I thought it would become a collector's piece and would go into several editions (as it subsequently did). Writing did not come easily to him, he revised and rewrote in longhand, slowly and laboriously until satisfied with the result. His curatorial responsibilities at the Museum produced the subject-matter for most of his work: he was mainly concerned with crustacea and coelenterata in pure and applied science. He also wrote papers on birds (1923, 1932, 1939, 1946, 1951, 1954, 1967), reptiles (1939, 1955), fishes (1918, 1946), mollusca (1938, 1964) and butterflies (1937) and made noteworthy contributions to the literature on destructive marine borers and dangerous marine invertebrates. But most of all, his writings speak to us of happy, halcyon days spent on his beloved coral reefs and islets and of the quiet beauties of their marvellous inhabitants.

The sequence of the bibliography below is approximately in order of dates of publication, but exact chronology has been abandoned here and there for practical purposes (for example, to prevent too much scattering of references to Destruction of Timber by Marine Organisms, or to keep together editions of books). Joint authors are mentioned after the titles of their papers. Unless otherwise stated, place of publication is the Sydney area.

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A shy nocturnal prowler. *Austr. Mus. Mag.*, 11 (6), June 15, 1954, pp. 203-204, fig. [Stone curlew, Queensland.]

An elusive jellyfish from fresh water. *Austr. Mus. Mag.*, 11 (7), Sept. 15, 1954, pp. iii, 225-227, front cover & 2 text-figs. [*Craspedacusta*.]

Book Reviews. 'Field work in animal biology.' *Austr. Mus. Mag.*, 11 (7), Sept. 15, 1954, pp. 237-238.

Saving the Green Turtle of the Great Barrier Reef. *Austr. Mus. Mag.*, 11 (9), March 15, 1955, pp. 278-282, 3 figs.
One Tree Island—remote outpost of the Capricorns. *Austr. Mus. Mag.*, 11 (10), June 15, 1955, pp. 333-337, 6 figs.
The Australian Stomatopoda (Crustacea) in the collections of the Australian Museum, with a check list and key to the known Australian species (By W. Stephenson and F. A. McNeill). *Rec. Austr. Mus.*, 23 (5), Sept. 1, 1955, pp. 239-265, fig. 1.
Coral paradise of One Tree Island. *Austr. Mus. Mag.*, 11 (12), Dec. 15, 1955, pp. 404-408, 5 figs.
A "barking" crayfish. *Austr. Mus. Mag.*, 12 (2), June 15, 1956, pp. 52-53, fig. [*Linuparus trigonus*, referred to *in ibid.*, 9, 1949, p. 337, fig., as *Puerulus carinatus*.]
Nature quiz. [Anon. = by F. A. McNeill.] *Austr. Mus. Mag.*, 12 (3), Sept. 15, 1956, pp. 81-82; *et ibid.*, 12 (5), March 15, 1957, p. 142; 12 (6), June 15, 1957, p. 193; 12 (7), Sept. 15, 1957, p. 220; 12 (9), March 15, 1958, p. 306; and 12 (10), June 15, 1958, p. 313.
Australian marine crayfish. [Anon.] *Austr. Mus. Leaflet*, 16, Dec. 1956 (1957), pp. 1-4, 2 figs. Reprinted 1965.
Gordian worms. [Anon. ? by F. A. McNeill.] *Austr. Mus. Leaflet*, 30, Jan. 1957, pp. 1-2, 2 figs.
Jellyfish stings. [Anon.] *Austr. Mus. Mag.*, 12 (6), June 15, 1957, p. 195.
Invertebrate animals. [Anon.] *Handbook of the Australian Museum*, 1957 (published Feb. 25, 1958), pp. 45-51, 2 figs.; 58-62, 2 figs. and pp. 71-73, fig. *Ibid.*, ed. 2, 1962.
The Great Barrier Reef. *Austr. Mus. Leaflet*, 44, May 1958, pp. [1-8], 2 figs. Revised ed., 1965.
Crabs. *Austr. Encylopaedia*, 3, early June 1958, pp. 82-90, 5 figs.
Crayfish and allies. *Austr. Encyclopaedia*, 3, June 1958, pp. 90-93, 3 figs.
Crustacea. *Austr. Encyclopaedia*, 3, June 1958, pp. 136-137.
Hermit crabs and allies. *Austr. Encyclopaedia*, 3, June 1958, pp. 489-492, 3 figs.
Prawns and shrimps. *Austr. Encyclopaedia*, 7, early June 1958, pp. 255-257, 4 figs.
The Australian prawn industry. *Austr. Mus. Mag.*, 12 (10), June 15, 1958, pp. 321-326, 7 figs.
Marine crayfish. [Anonymous.] *Austr. Mus. Mag.*, 12 (10), June 15, 1958, p. 332 [*Panulirus ornatus* newly recorded from New South Wales].
"Crabs' eyes" were a mediaeval "cure-all". *Austr. Mus. Mag.*, 13 (1), March 15, 1959, pp. 28-29, fig.
The Great Barrier Reef and adjacent isles (By K. Gillett & F. A. McNeill). (Sydney: Coral Press.) First Australian edition, Nov. 1959, pp. i-xiv + 1-194, pls. 1-161 (27 in colour), maps, text-figs. 1-3. Second (revised) edition, Sept. 1962, pp. i-xiv + 1-210, pls. 1-168 (27 in colour), maps, text-figs. 1-3. Third edition, 1967, pp. i-xiii + 1-209, 2 frontispieces, pls. 1-168 (29 in colour), maps, text-figs. 1-3. [Third ed. includes first general natural history of the Swain Reefs in a book.] American edition by Stechert-Hafner.
Underwater saboteurs.* *Austr. Mus. Mag.*, 13 (7), Sept. 15, 1960, pp. 211-216, 4 figs. [See also 1946 ref., above.]
The robber crab—a crustacean mystery.* *Austr. Mus. Mag.*, 13 (9), March 15, 1961, pp. 283-286, 2 figs.
Destructive marine borers. *Fisheries Newsletter* (Canberra: Commonw. Director of Fisheries), 20 (5), May 1961, pp. 17-20, illustr.
Retirement of museum curator. *Austr. Mus. Mag.*, 13 (11), Sept. 15, 1961, p. 353, portrait. [Autobiographical.]
Crabs of the Sydney foreshores. *Austr. Nat. Hist.*, 14 (2), June 15, 1962, pp. 37-43, 16 figs. Also as *Austr. Mus. Leaflet*, 62, Aug. 1964, pp. 1-8, 6 figs.
Mermaid's pennies. [Anonymous. ? by F. A. McNeill.] *Austr. Nat. Hist.*, 14 (3), Sept. 15, 1962, p. 87, fig. [Foram, *Discobotellina biperforata*.]

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* Permission was requested for this article to be reprinted in *South Pacific Planter*, but it did not appear therein.

Aggressive creatures. Suppl. *Bull. Post Graduate Committee in Medicine, Univ. Sydney,* 18 (12), March 1963, part iii, Sci. Sect. Proc. 1st Internat. Convention Life Saving Techniques, March 1960, "B" Group, pp. 8, 11, general discussion on pp. 13 & 14 and 26 & 27, etc. to p. 64, etc., 106, 122-125, fig. on p. 117.

Invertebrates. Stinging coral and so-called stinging seaweed. *Ibid., loc. cit.,* March 1963, pp. 65-66.

Report of the sectional chairman. *Ibid., loc. cit.,* March 1963, pp. 129-130.

Sea anemones. *Austr. Nat. Hist.,* 14 (7), Sept. 15, 1963, pp. 201-209, 6 figs. Also as *Austr. Mus. Leaflet,* 63, Aug. 1964, pp. 1-12, 5 figs.

Urges commemoration of Flinders' landing. *Daily Mercury* (newspaper, Mackay, Queensland), Oct. 30, 1963.

Long. Is. wreck from India or East Indies? *Daily Mercury* (Mackay), Nov. 7, 1963, p. 5.

Souvenir of McLean's Roylen Cruises. (Queensland), 4 pages, no date.

The marvel of anemones. [= sea anemones.] *Land of Wonder* (Sydney: Angus & Robertson), 1964, pp. 308-310; second reprint, 1966.

Shells of the Great Barrier Reef. *Austr. Nat. Hist.,* 14 (12), Dec. 15, 1964, pp. 372-378, 6 figs.

Australian marine crayfish. *Austr. Mus. Leaflet,* 16, 1965. Reprint of 1956 leaflet.

The Great Barrier Reef—Part I: its character, structure and development. Part II: the coral polyp. *Austr. Mus. Leaflet,* 44, 1965, pp. 1-8, fig. & map. [Revised edition of 1958 leaflet.]

Birds of a tropic isle. *A Treasury of Australian Wildlife* (Sydney: Ure Smith), Nov. 1967, pp. 108-114, 6 figs.

Deserters from the sea. *A Treasury of Australian Wildlife,* Nov. 1967, pp. 307-311, 3 figs. [Slaters and "lice".]

Sea-anemones. *A Treasury of Australian Wildlife,* Nov. 1967, pp. 346-354, 5 figs.

Crustacea, Decapoda and Stomatopoda. *Gt. Barrier Reef Exped. 1928-29 Sci. Rept.* (London: Brit. Mus. (Nat. Hist.)), 7 (1), public. no. 668, March 26, 1968, pp. 1-98, pls. 1-2, text-figs. 1-2. [To this, McNeill circulated a 2-page roneo'd addendum: "The following information will be found useful if added as footnotes on the pages indicated in your personal copy of my work . . ."]

Acknowledgments:

In preparing this bibliography I have received help, which is gratefully acknowledged, from Miss E. C. Pope, Dr. D. J. G. Griffin and Mr. T. Iredale, of the Australian Museum, and from lists made by the late F. A. McNeill, incomplete at the time of his death. Books and papers have been consulted at the Mitchell Library and Public Library of New South Wales and the Australian Museum, Sydney. Mrs. A. McNeill has also been most helpful, and Dr. J. C. Yaldwyn of Wellington.

The portrait on plate IX shows the late F. A. McNeill with colleagues in Sydney in 1928. It appeared in the *Daily Telegraph* pictorial, Sydney, 13th July 1928, and is here reproduced by kind permission of the Editor of the *Daily Telegraph*. Other photographs of McNeill appeared in Bruce Halstead (1965, *Poisonous and Venomous Marine Animals*, 1, p. 132, fig. 139), in Gillett & McNeill (1959 etc., dust-cover) and in *Proc. Roy. Zool. Soc. N.S.Wales*, 1960-1964 (1965), p. 36.

New names:

The following new names, all for Crustacea, were proposed by McNeill, sometimes in joint authorship:

cambrica, Chelura, Iredale & McNeill, Austr. Mus. Mag., 3, 1928, p. 199.
haigae, Polyonyx, McNeill, Gt. Barr. Reef Sci. Rept., 7 (1), 1968, p. 38.
livingstonei, Mycteris, McNeill, Rec. Austr. Mus., 15, 1926, p. 119.
striolata, Atva, McCulloch & McNeill, Rec. Austr. Mus., 14, 1923, p. 55.
vomeris, Uca marionis var., McNeill, Rec. Austr. Mus., 13, 1920, p. 106.

—G. P. WHITLEY

DR. E. A. BRIGGS
(1890-1969)
(Plate X)

The death of Dr. E. A. Briggs on 29th March, 1969 at Cheltenham, New South Wales, removed from scientific circles a well-known University teacher and a former curator of lower invertebrates of the Australian Museum. Edward Alfred Briggs was born in Melbourne on 26th April, 1890. He joined the staff of the Australian Museum in 1912 and followed E. F. Hallmann when given charge of the Department of Lower Invertebrates. With Charles Hedley, Briggs made extensive collections of marine animals from the northern parts of the Great Barrier Reef, but he resigned from the museum in 1919 to take up a teaching appointment with the University of Sydney. His former department was taken over by Rex Bretnall (1919) and F. A. McNeill.

Briggs was Lecturer in Zoology at Sydney Technical College from 1916 to 1932 and I am personally grateful to him for teaching me zoology there 47 years ago. He was a very clear lecturer and demonstrator in the Haswellian tradition and made sure his students understood every point before proceeding to more difficult matters. He was Lecturer in Zoology at the University of Sydney, 1919 to 1933, Reader in Zoology since 1945 and Assistant Professor He had graduated B.Sc. in 1912, M.Sc. in 1924 and D.Sc. in 1929, all at the University of Sydney. Briggs was an Honorary Zoologist at the Australian Museum from July 1921.

He led expeditions into little-known parts of New Guinea in the 1920's and, being a keen photographer and cinematographer, obtained valuable pictures there as well as on his other travels, particularly in China.

Briggs had published a number of papers between 1912 and 1940 on the structure, habits and development of marine animals, principally hydrozoa and anthozoa but including the crustacean family Caprellidae, and the freshwater medusa. He also wrote travel articles and book reviews in the *Australian Museum Magazine* and popular science journals, *Salt,* etc., generally illustrated by his own fine photographs and drawings. From 1928-32, he edited the Mawson Antarctic Expedition Reports and, in association with Valerie Gardner, prepared the report on Hydroida of the Great Barrier Reef Expedition (*Sci. Rept.,* 4(6), 1931). He wrote articles on coelenterata for the *Australian Encyclopaedia* of 1925 and that of 1958. He was also the author of text-books for students: *Anatomy of Animal Types* (ed. 1, 1934; ed. 2, 1940) and *Anatomy of the Sheep's Brain* (1939).

Known to his friends and students as "Teddy" Briggs, our late friend was not an active member of scientific societies, preferring to concentrate on teaching and research. However, he joined the Royal Zoological Society of New South Wales in 1922 and contributed to the *Australian Zoologist* in that year.

—G. P. Whitley

BOOK REVIEWS

The Royal Zoological Society of New South Wales has received for review a number of books from the Israel Program for Scientific Translations, P.O. Box 7145, Jerusalem, Israel. All are translations from Russian works of slightly earlier years into English. In order of zoological classification, they are as follows.

"The Mammals of the Caucasus. A History of the Evolution of the Fauna", by N. K. Vereshschagin, 1959. Israel Program for Scientific Translation cat. no. 1704, Jerusalem, 1967, pp. 1-820, illustr. Price $28.00.

Deals with the development of the landscapes and the mammal fauna in the Tertiary and Quaternary and analyses the origin of the mammal fauna. A survey of the distribution of extinct and recent mammals is made and data provided on their variation. Changes in the distribution of mammals due to man and the production of pelts are discussed. Well illustrated and with an extensive bibliography.

"Wild Ungulates of Yakutia", by O. V. Egorov, 1965. ISPT Cat. no. 1840, printed 1967, published 1968, pp. i-viii + 1-204, illustr. Price $11.50.

The various species are described, with information on their biology and habitat. The formation of the skeleton, competition between species, enemies and parasites, the influence of environment on distribution, and economic exploitation are other subjects covered.

"Bony Fishes of the Maikop Deposits of the Caucasus", by P. G. Danil'chenko, 1960. IPST Cat. no. 1885, 1967 (1968), pp. 1-256, illustr. Price $10.25.

Marine biologists, taxonomists and palaeontologists will be interested in the Maikop burials which have yielded 72 satisfactory preserved species of fishes, each of which is described and figured in detail, especially as regards osteology and body parameters. It may be noted that the generic name *Acanthognathus,* preoccupied, was replaced in 1933 by *Dunckerocampus.*

"Fishes of the Sea of Japan and the adjacent areas of the Sea of Okhotsk and the Yellow Sea. Part 1: Amphioxi, Petromyzones, Myxini, Elasmobranchii, Holocephali," by G. U. Lindberg and M. I. Legeza, 1959. IPST Cat. no. 1772, 1967 (1968), pp. i-iv + 1-198, figs. 1-108 and map. Price $10.25.

The Sea of Japan is of recent origin and is geomorphologically isolated, so this treatment of its primitive fishes, embracing all relevant data on the area, is an important addition to a biological library.

"Fauna of the U.S.S.R. Diptera. Vol. iii, no. 2. Phlebotomidae (Sandflies)", by P. P. Perfil'ev, 1966. IPST Cat. no. 5105, 1968, pp. i-vi + 1-364, illustr. Price $16.50.

Australians are well aware of the nuisance of Sandflies, species of which are important in the transmission of disease. Here is an extensive history of the family Phlebotomidae, with details of morphology and anatomy, development, distribution and biology. Chapters deal with the role of sandflies in transmitting pappataci fever, leishmaniasis and other diseases, control, methods of collection and study. There is a survey of the classification of the family, keys to the Russian species with detailed descriptions of these species and their distribution. Three new subspecies are described.

"Calanoida of the Far Eastern Seas and Polar Basin of the USSR", by K. A. Brodskii, 1950. IPST Cat. no. 1884, 1967, pp. i-iv + 1-440, illustr. Price $17.75.

An encyclopaedic work on the morphology, biology, geographic distribution, economic value, etc. of the Crustacean group, Calanoida. Concise keys to families, genera and species with characteristic of each taxonomic group.

"Helminthofauna of Marine Mammals (Ecology and Phylogeny)", by S. L. Delyamure, 1955. IPST Cat. no. 1886, 1968, pp. i-x + 1-522, illustr. Price $19.00.

A comprehensive work on the worm fauna of marine mammals inhabiting all seas and oceans, this is the first book on this subject and the first attempt at a zoogeographical analysis of all helminths parasitic on pinnipeds, whales and other marine animals of the world.

"Essentials of Nematodology: Ascaridata of animals and man and the diseases caused by them, by A. A. Mozgovoi, 1953. IPST Cat. no. 1556, 1968, pp. i-x + 1-390, illustr. Price $17.25.

This volume on parasitic worms is the first comprehensive monograph on the suborder Ascaridata and deals with morphology, classification, biology, distribution, and medical and veterinary aspects. A new classification of the suborder is given, as well as keys and diagnoses of families and genera. The various types of life-cycles are correlated with the systematic groups. The ascariasis of humans, domestic and wild animals is dealt with, with keys to the species and data on epidemiology, diagnosis, pathology, treatment and prophylaxis.

—G.P.W.

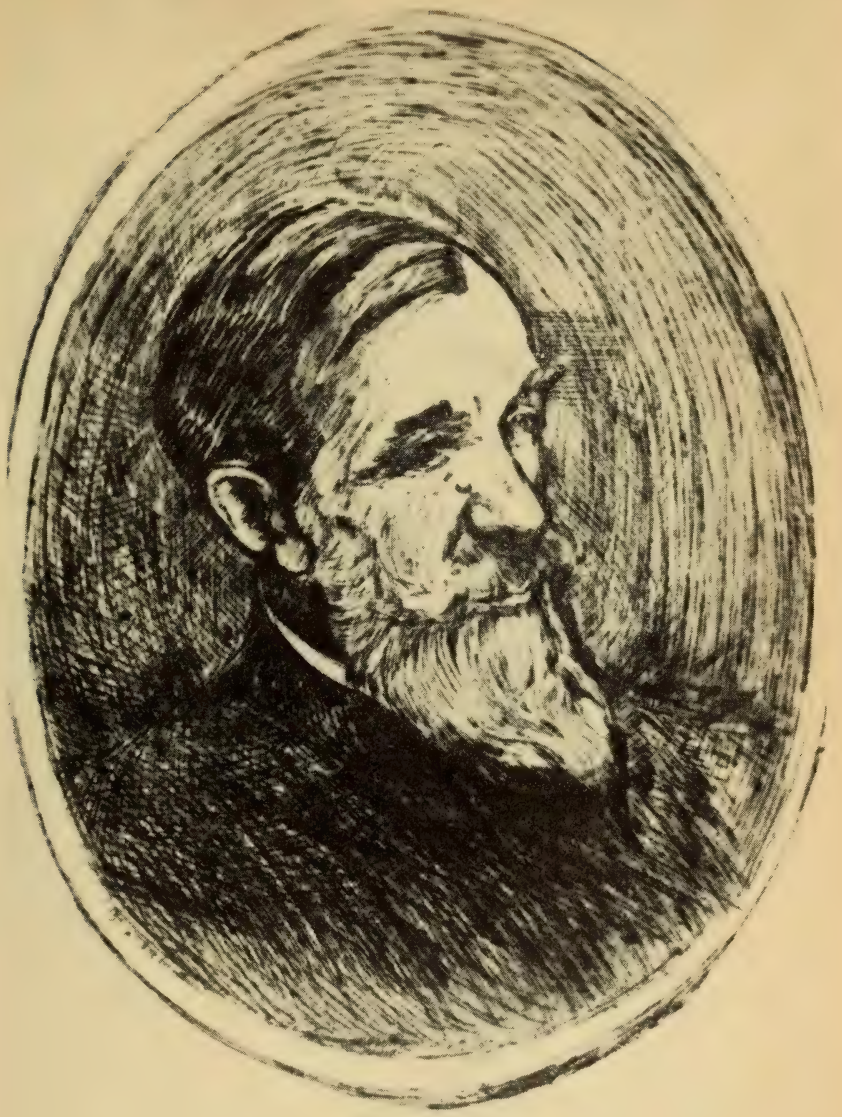
"Ophiuroids of the USSR Seas" by A. M. D'yakonov, Edited by A. A. Strelov. Keys to the Fauna of the USSR—from the Zoological Institute of the Academy of Sciences of the USSR, No. 55. Translated from Russian by Rae Finesilver under the Israel Programme for Scientific Translations, Jerusalem, 1967. (Originally published in Moscow, 1954). 55/- Sterling.

This is mainly a systematic survey, and, although it deals with a tremendously wide geographical area, ranging from Arctic seas into the North Pacific, only two of the species—*Asteronyx loveni* and *Amphipholis squamata*—of the 114 described from Russia, are also found in the Australian fauna. The first of these species is a deeper water form with a wide distribution and the second is also world wide in its occurrence so their appearance in the two faunas is not surprising. However, this lack of overlap in the faunas means that from the point of view of naturalists in the Southern hemisphere, the book has little to offer, in spite of its good keys for identification and its many illustrations.

It is a well-produced book that must have a wide appeal to echinodermologists, working on faunas from colder waters, in the Northern Hemisphere and one which should find a place in all good zoological reference libraries.

—E.C.P.

Authors alone are responsible for the opinions expressed and for the accuracy of the facts in their contributions.



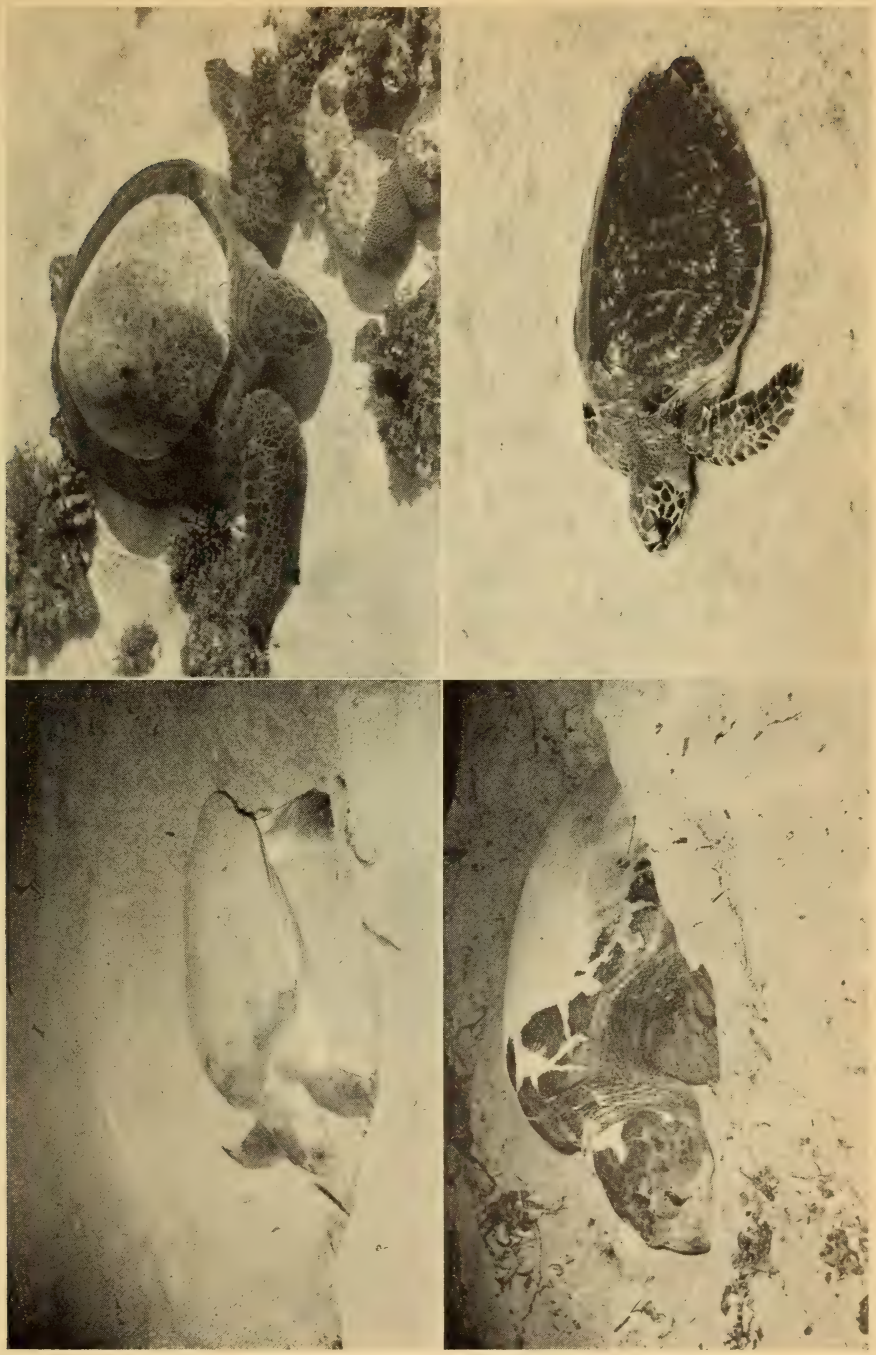
Dr. Jan Danysz
Etching on a steel plate after sculpture by Konstanty Brandel
By courtesy of the Warsaw University Library

Nesting area (inside dotted line) of *Chelodina longicollis* and pond at Canberra, A.C.T.

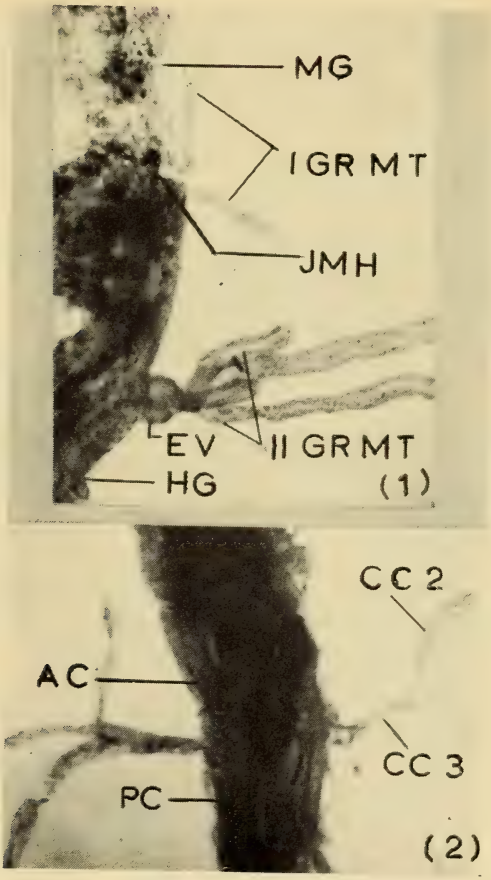
Potoroo on the hop: note that it holds the body horizontally to the ground, a characteristic of this species which provides a clear identification in the field. The photograph was taken in Tasmania where the species is common. Photo by Harry Frauca: Australian News & Information Bureau.

Young tortoise, *Chelodina longicollis*, leaving nest cavity.

Marine Turtle (For explanation see page 159)



Marine Turtles (For explanation, see page 159)



Malphigian tubules of *Aulacophora*

(For explanation, see page 198)

Left to right: F. A. McNeill (1896-1969), A. A. Livingstone (1903-1951), W. Boardman (1906-1963), T. Iredale (1880-) and G. P. Whitley (1903-), about to depart for the Great Barrier Reef in 1928.
Photo by courtesy of *The Daily Telegraph*, Sydney.

The late E. A. Briggs

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The Australian Zoologist, published at irregular intervals since 1914.
Proceedings, published since 1933-34.

Australian Zoological Handbooks and special reprints:
"A Check List of the Birds of Paradise and Bower Birds", by T. Iredale, 1948.
"Revision of the New South Wales Turridae", by C. F. Laseron, 1954.
"The published writings of Tom Iredale, with an index of his new scientific names", by D. F. McMichael and G. P. Whitley, 1956.
"A reclassification of the Order Odonata", by F. C. Fraser, 1957.
"Dragonflies of Australia", by F. C. Fraser, 1960.
"A Catalogue of the Psocoptera of the World", by C. N. Smithers, 1967.
"A Check List of the Fishes recorded from the New Zealand region", by G. P. Whitley, 1968.

Orders and enquiries should be sent to the Honorary Secretary, Royal Zoological Society of New South Wales, Taronga Zoo, Mosman, New South Wales, 2088.

CONTENTS OF THIS PART

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THE AUSTRALIAN ZOOLOGIST

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THE AUSTRALIAN ZOOLOGIST
VOL. XV PART 3

LEITH'S PARROTS (1883), CAMPBELL'S NESTS AND EGGS ("1883"), AND THE SOUTHERN SCIENCE RECORD

by K. A. HINDWOOD

(Plate XI)

In 1883 there was published in Melbourne, Victoria, a small book entitled *The Parrot Family and Parrots of Victoria.* The author was T. Augustus Forbes Leith who had earlier written a series of five papers on the parrots of Victoria in *The Southern Science Record* between November 1882 and April 1883. The five articles were then used to make up the sixteen pages of *The Parrot Family and Parrots of Victoria,* demy 8vo in size, with the addition of a title-page, worded "The Parrots of Victoria", and a pink paper cover with the full title. Copies of the work are extremely rare as is often the case with small paper-covered booklets, inexpensive at the time and of a limited distribution.

Recently (December 1969) at an auction of Australiana by Leonard Joel Pty. Ltd., of Melbourne, Leith's little book was offered under item 433 of the catalogue. It was bought by a Sydney bibliophile, William Russell of Parramatta, for a price equivalent to some four times its weight in gold at the present ruling rate. The original price of the book was one shilling. Perhaps this copy may have been the one offered a few years ago by N. H. Seward Pty. Ltd., of Melbourne, for much less than its weight in gold.

The only other copy of *The Parrot Family and Parrots of Victoria* I have been able to trace is that from the Nan Kivell Collection and which is now in the National Library, Canberra. Sir Harold White, then National Librarian, informed me that "Apparently Mr. Nan Kivell acquired it with some manuscript material by T. A. F. Leith. These manuscripts include thirteen chapters of Australian history and a collection of five booklets containing poems by Leith. "Inserted in the pamphlet on the Parrot Family are a number of newspaper cuttings mentioning or reviewing the pamphlet, together with a photograph of Leith taken on May 11, 1888 when he was 53". (*in litt.* 12.12.1969).

An earlier book by Leith was issued in 1879 under the title *Short Essays.* It is an 8vo of pp. i-viii + 1-109 and contains 143 essays on a wide range of subjects many of which are treated in a sermonising manner. The dedication is "To the Honoured Memory of George Washington"; and in concluding his preface the Author offers this bit of sound advice to his readers:- "Remember you cannot touch pitch without being defiled, so avoid bad company". His address is given as Augustus Cottage, Martin Street, Albert Park, Melbourne, Victoria. He died at Reigate, Surrey, England on December 8, 1896, aged 62 years. (*Victorian Naturalist,* vol. 13, 1897, p. 139).

Another interesting item (No. 161) in the Joel Catalogue was A. J. Campbell's *Nests and Eggs of Australian Birds* (1883), a limp-covered 8vo book of pp. i-vi + 73 + i-xxx. The versos of the title-page and the dedication page are not included in the pagination and page 73 is unnumbered. The latter section of 30 pages, headed "Scraps about Bird-nesting", is in the form of several essays on camping, shooting and egg-collecting, while the main part of the book is based on a series of papers, published between September 1881 and December 1883, in *The Southern Science Record* under the title "Oology of Australian Birds".

Unlike Leith, whose Parrot book was priced at 1/-, Campbell appears to have published his book only for subscribers to whom, in a "Memorandum" on page 73, he apologises for the "extraordinary delay" in the issue of the work; but, if the date on the title-page, i.e. 1883, is taken as correct there could have been no delay because the last of the "Oology" papers appeared in *The Southern Science Record* of December 1883 (vol. 3, No. 12) and that paper was included in the book. Despite the year 1883 on the title-page it would seem that the correct year is 1884 as shown by a review in the *Victorian Naturalist* (vol. 1, pt. 4, April 1884, p. 32) wherein it is stated that "Mr. A. J. Campbell has brought out a volume on the 'Nests and Eggs of Australian Birds'."

It would not be the first occasion that a title-page has been wrongly dated. A possible explanation is that the early sections were printed well before the latter and that the title-page was not altered when the sheets were assembled and bound. In view of the above remarks the date of issue is likely to have been either March or April 1884, not "1883". The few copies I have examined have all been autographed in ink by Campbell.

On page 73 of Campbell's book is the imprint of J. Wing, the publisher of *The Southern Science Record.* However, the following 30 pages of essays are without an imprint and, from appearances, are probably by another printer. The whole is stapled in sections with a drawn-over pink paper cover printed in black. The title *Oology of Australian Birds* appears along the spine and the dedication is to the Marquis of Normanby, G.C.M.G.

The comprehensive title-page, which is the same as the cover, reads:-

Nests and Eggs/of/Australian Birds./Embracing papers on/"Oology of Australian Birds"./Read before the Field Naturalists' Club of Victoria,/ supplemented by other/Notes and Memoranda;/also,/an appendix of several outs—nesting,/shooting, &c./by/Archd J. Campbell./Melbourne:/published by the Author./MDCCCLXXXIII./All Rights Reserved.

In the introduction to his book Campbell makes a strong plea for the protection of our indigenous birds and their nests and eggs "except to prove some portion of their economy for scientific knowledge". In passing he mentions the remarkable lyrebird and says "shortly it will only be found in the fastness of the Gippsland mountains except our Legislature intervene". His warning shows a change of heart since his description of a week spent in the wilds of Gippsland in 1877, some six years earlier, in which, on page xvii, he records how he succeeded in "bagging seven really beautiful cock-birds . . . out of ten I fired at . . . two of which I dropped while they were scampering through the ferns". He continues:- "I am glad to see that lately the Governor-in-Council has been pleased to place them under the Game Law . . . Close Season from the 1st August to 31st January in each year."

Campbell's *Nests and Eggs of Australian Birds* of "1883" was the forerunner of his large work of the same title, comprising 1102 pages, a map, coloured plates and photographs, issued in 1900 and bound in either one or two volumes. Some copies bear the year 1901 on the title-page.

At the Joel sale in December 1969 the Campbell book of "1883" fetched somewhat more than its weight in gold, a determined lady buyer outbidding all opposition, and in so doing caused the Auctioneer to ask the assembled company to pause while he regained his composure. What his reaction was later when Leith's book was sold was not recorded. Some time in the future I must enclose my copy of Campbell's "1883" book (for which I paid a few shillings years ago) in a hand-tooled fine leather slip-case by Sangorski and Sutcliffe of London—or else sell it for what it bought at the above auction.

J. A. Ferguson (*Bibliography of Australia,* vol. 5, A-G, 1963, p. 520) notes copies of Campbell's *Nests and Eggs* of "1883" in both the Mitchell Library, Sydney and the National Library, Canberra, so it is not as scarce as Leith's *Parrots* of 1883, which item the great bibliographer does not list;

neither is it to be found in Whittell or in the *Checklist to the Mathews Ornithological Collection* (1968).

Some remarks on *The Southern Science Record,* in which journal both Leith and Campbell published papers, later to appear in book form, may be of interest.

The Southern Science Record, an 8vo journal, was printed and published by J. Wing of 33 Wellington Street, Collingwood, a suburb of Melbourne. The first part of volume 1 appeared in December 1880 and thereafter monthly until December 1881, making 13 parts for the volume with a total of 216 pages. Twelve monthly parts, issued in 1882, comprise volume 2 with a total of 303 pages. Volume 3, in which the title was altered to *The Southern Science Record and Magazine of Natural History* and the price changed from 6d to 1/-, was made up of 12 parts of 280 pages in all, dated monthly for the year 1883. According to F. G. A. Barnard "the later numbers of that volume became gradually smaller owing to want of financial and other support, and did not appear till some months after the months named on their covers, consequently several were not issued until well on in 1884". (*Victorian Naturalist,* vol. 16, 1899, p. 112). The delay in issuing the later parts of volume 3 may not have been as long as Barnard intimates because Campbell's "Oology" paper appearing in part 12 of December, 1883 was used in his book which was reviewed in April, 1884.

Up to this time three volumes, in all 37 parts, had been published; then, according to some accounts, only five more parts were issued before the Journal ceased. Barnard, who contributed papers to the *Southern Science Record,* mentions (*loc. cit.*) that a New Series was commenced in 1885, part 1 of volume 1 being dated January 1885, with three more numbers dated February, March and April of that year, then publication again stopped. "However, [says Barnard] nothing daunted, the indefatigable proprietor started again, in January, 1886, with the first number of volume ii, New Series, 24 pages at one shilling, intending to gradually supply the missing numbers for the past year, but did not get any further". Barnard then continues: "of the four numbers for 1885, and the one for 1886, I believe few copies reached the general public . . . The magazine, no doubt, did not receive the financial support requisite to enable the proprietor, Mr. Joseph Wing, to carry on except at a great sacrifice of both time, energy and money. For the first two years it was subsidised to a small extent by the Field Naturalists' Club of Victoria, but during 1883 the Club decided to publish its own proceedings, and in January 1884, the first number of the *Victorian Naturalist* appeared".

The late Dudley Dickison, of Melbourne, wrote on the subject in 1932 (*Emu,* vol. 31, p. 193) and stated that 42 parts formed a complete set of the *Southern Science Record,* and this agrees with Barnard's reckoning. Obviously both writers were not aware at the time that a fifth part of volume 1, New Series, dated May 1885, was issued. However, in an unpublished note of May 1965, Dickison, having apparently examined a copy of the "missing" fifth part of 1885 (possibly the one in the National Herbarium, Victoria, or that in the State Library of Victoria), had this to say:- "No one knows what constitutes a complete set of the 'Southern Science Record' as men who lived when the Journal was published claimed that they got every copy that appeared, but some copies got out unknown to them.

"There were about 43 parts published for certain but there are reprints at the National Herbarium, Victoria, showing that they had been taken off numbers of which none seems to have survived; but on the other hand there is the possibility that they were printed in anticipation of printing the Journal later and this (the printing of the Journal) was never done".

A run of 43 parts is in the library of the National Herbarium: thus it is clear that at least 43 parts, not 42 as generally accepted, were issued. In his remarks of 1932 Dickison stated that the Journal was first printed in December 1881; the correct date is December 1880.

The Field Naturalists' Club of Victoria was formed in May 1880 and until January 1884, when its official journal, the *Victorian Naturalist,* was launched, members published their papers in *The Southern Science Record.* In the Introduction to volume 1 of the *Victorian Naturalist,* which covers in 15 parts the proceedings of the Society from January 1884 to April 1885, it is stated that "Hitherto the proceedings of the Society have appeared in the *Southern Science Record,* published by Mr. J. Wing, but it is now deemed time to bring out a periodical of our own". About 150 members were on the roll at the time.

Blanche E. Miller, in a paper on the early years of the *Victorian Naturalist* remarked that "For various reasons, the arrangement between the Club and the proprietor of the *Southern Science Record* was not entirely satisfactory. It is evident that there were faults on both sides. The *Record* states, August, 1881: 'We had not received a report of the usual monthly meeting of the Field Naturalists' Club of Victoria previous to going to press'. Obviously, the editor could not publish matter that had not come to hand. Alternatively, an early number of the *Victorian Naturalist* informs us that, the *Southern Science Record* being fully six months in arrears, and there being little prospect of the proprietor bringing it up to date, it was decided, after careful consideration, to issue an independent publication". (*Victorian Naturalist,* vol. 51, 1934, p. 32).

Among the many contributors to *The Southern Science Record* were such well-known scientists and naturalists as Baron von Mueller (famous botanist), Charles French, senior (later to become Government Entomologist of Victoria), Dr. T. P. Lucas (entomologist), Rev. J. E. Tenison-Woods (priest, scientist and author), Thomas G. Sloane (entomologist), W. H. D. LeSouef (later, Director of the Melbourne Zoological Gardens); and A. J. Campbell and T. A. Forbes Leith, both of whom have been discussed earlier.

Apart from his articles on parrots Leith contributed to *The Southern Science Record* notes on petrels and on eagles, and was co-author with A. J. Campbell of a list of the birds of Victoria published in volume 1 of the *Victorian Naturalist.* An interesting and, for the period, informative paper by F. J. Williams on the habits of the lyrebird appeared in volume 1 (part 6, pp. 87-9) of *The Southern Science Record.*

Both Leith's "Parrots" (1883) and Campbell's "Nests & Eggs" ("1883") had their genesis in *The Southern Science Record*: these two small books, and *The Southern Science Record* itself are desiderata in the field of Australiana. Perhaps one of the items in particular, Leith's *The Parrot Family and Parrots of Victoria,* may be termed, in words that antiquarian booksellers are sometimes wont to use, "excessively rare", or "almost unique".

Acknowledgements

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Permission to reproduce the photograph of T. Augustus Forbes Leith has been kindly granted by Mr. Rex Nan Kivell of London and Sir Harold White.

THE "DOBROYDE" ORNITHOLOGICAL COLLECTION

by K. A. HINDWOOD

The historically interesting and important "Dobroyde" collection of bird skins and eggs was assembled over a period of more than 30 years (c.1859-1892) by the brothers Ramsay, i.e. James (1838-1913), Edward Pearson (1842-1916) and John Simeon (c.1846-1929). Edward, who was more closely associated with the collection than were his brothers, was baptised Edward Pearson Ramsay, though he generally used Pierson instead of Pearson in his natural history writings. His grandmother's maiden name was Pearson.

The "Dobroyde" estate, after which the collection was named, was originally a grant to Nicholas Bayly of the New South Wales Corps. It was later purchased by Simeon Lord. It is now part of the Sydney suburb of Haberfield. Nicholas Bayly had a lot to do with the affairs of the Colony in the early days. His first appointment to the army was as Ensign in June 1797, and he became a Lieutenant in 1802. He appears to have exercised considerable influence in public affairs in the time of Governors Hunter and King.

Simeon Lord arrived in the Colony in 1791 and, within a few years, became a successful and influential citizen (see *Australian Encyclopaedia,* vol. 5, 1958, pp. 367-8, for biography). Lord gave "Dobroyde" as the dowry of his eldest daughter, Sarah Ann, on her marriage to Dr. David Ramsay by whom she had ten children: of their five sons the three mentioned earlier assembled the "Dobroyde" collection of bird skins and eggs.

In current usage the name of the district is spelled Dobroyd (without an "e") and as such it was the name of the home of Simeon Lord's mother in Lancashire. However, Lord decided on "Dobroyde" and it is so used in a document, dated February 1825, at present in the possession of John Simeon Pearson Ramsay (1884-) of Woolwich, Sydney, a great-grandson of Simeon Lord and a well-known naturalist and pioneer bird photographer.

Edward Pearson Ramsay became Curator of the Australian Museum in 1874 at the age of thirty-two and held that position until 1894 when he retired because of ill-health. He was an outstanding scientist with wide interests and was a prolific writer on birds, fishes and mammals, describing many new species in those fields of science. In 1886 he received the honorary degree of Doctor of Laws from the Senate of St. Andrews College, University of Sydney (for an extended account of Dr. Ramsay's scientific achievements see *Records of the Australian Museum,* vol. 2, no. 9, 1917, pp. 205-217, portrait).

The "Dobroyde" collection was offered to the New South Wales Government by John Simeon Ramsay (Dr. Ramsay's brother) in 1896 and was accepted by the Trustees of the Australian Museum on behalf of the Government. The price paid for the collection was £500.0.0, payment being made in February 1898.

Although the transaction was finalised in 1898 the specimens totalling 1712 bird skins (incuding a number of types from Australia, New Guinea and the Pacific Islands) and 1602 sets of eggs, were not registered until 1912 (Museum Register, Birds, 0.3). A. J. North (1885-1917), the Australian Museum's Ornithologist, who had earlier served under Dr. Ramsay, wrote up the register. Also in the Museum is a private catalogue of less than 1,000 of the "Dobroyde" bird skins collected between 1859 and 1868. It is in the handwriting of Dr. Ramsay on foolscap legal blue paper, the sheets having been bound in boards with a printed title-page bearing the imprint "Printed at the Australian Museum, 1917", the Museum having its own hand printing-press.

Originally it was intended that the "Dobroyde" collection should be kept as a sepaarte entity, at least during Dr. Ramsay's lifetime. However, in the course of time, it was incorporated with the general collections, possibly when registered by North in 1912.

The collection contains many historically important specimens, including type material, and some of the skins, still in excellent condition, are more than 100 years old. An outstanding specimen is that of the Eyrean Grass-Wren, *Amytornis goyderi,* the third known example and a paratype (see *Emu,* vol. 44, 1945, pp. 321-3). Types and paratypes of birds from Australian localities in the "Dobroyde" collection were listed in 1946 (see *Records of the Australian Museum,* vol. XXI, no. 7, June 24, 1946, pp. 386-393).

It is of interest to note the presence on the "Dobroyde" estate, in the 1860-1890 period, of such birds as the Eastern Shrike-Tit, Brown Warbler, Variegated Wren, Heath Wren, Turquoise Parrot and the Red-browed and the White-throated Tree-creepers. How different the environment must have been from what is now the populous suburb of Haberfield.

My sincere thanks to Mr. J. S. P. Ramsay of Woolwich, Sydney, for information about his forbears: and to Dr. F. H. Talbot, Director of the Australian Museum, for permission to examine Minute Books and Letter Books in the Archives of the Museum.

THE GUISES OF "BUDGERIGAR"

by A. H. CHISHOLM

Although not having as many "aliases" as is the case with certain other birds (as, for example, the Grey-crowned Babbler), the Budgerigar has been the subject of a considerable number of variants on the one name.

To those already listed by Iredale & Whitley (*Proc. Roy. Zool. Soc. N.S.Wales,* 1968-69, 1970, pp. 36 to 39) may now be added two more.

In *Always Morning,* by Cyril Pearl (Cheshire, Melb., 1960), a fascinating biography of the poet R. H. Horne, it is recorded that on the ship *Lady Jocelyn,* bound from Melbourne to England in 1869, a "fellow-passenger" of Horne's was a small parrot known as a "Budgee-Regara". It was a companionable creature and was wont to say "Come and kiss me", "Won't you kiss me, dear boy?" and "Oh, you naughty pretty boy".

My second offering is drawn from another notable biography. Adelaide Lubbock's *Owen Stanley R.N.* (Heinemann, London, 1968). There it is recorded that when the widow of Captain Stanley's brother Charles (who had died in Hobart) was returning to England, on H.M.S. *Rattlesnake* in 1850, her few possessions included "a cage of bougerigards". The ship's surgeon, it is added, helped to care for the birds during bad weather.

"Budgee-Regara" (despite the capitals and hyphen) is only a slight variant of a name already cited, but "bougerigard" may well be ranked as a novelty. It is almost as impressive as the Rev. John Graham's nomination of 1861, "buggery-gong".

I note in Suzanne Mourot's book, *This was Sydney,* 1969, p. 72, a tribute of 1845 to the "budgerry" and one of 1855 to the "boodjerigah" or "shell-parrot".

Incidentally, the chattering performance of the enterprising bird of 1869—with its "Come and kiss me", etc.—appears to be one of the earliest records of the remarkable talking ability of this highly popular little parrot. But, of course, later examples have achieved much more extensive repertoires. A blue budgie held in New Zealand some years ago began talking at the age of two months, was credited at five years with 670 words, and was said to be still learning.

Presumably that array of words included various mouth-fillers—or beak-fillers. This was so in the case of a blue budgie my wife once owned. Among many phrases, he learned to proclaim, with perfect clarity, "I belong to the Australian Encyclopaedia!"

FIRST TASMANIAN RECORD OF THE GULF GURNET PERCH, **NEOSEBASTES PANTICUS** McCULLOCH & WAITE, 1918 (SCORPAENIDAE), WITH REPORTS OF POISONING BY THIS SPECIES AND SOME OTHER TASMANIAN FISHES

by E. O. G. SCOTT

(Figure 1)

ABSTRACT

The Tasmanian species of Scorpaenidae are briefly reviewed; the Gulf Gurnet Perch, *Neosebastes panticus* McCulloch & Waite, 1918, is added to the list. An instance of poisoning caused by a cephalic spine of this species is reported. Outlines are given of case histories involving other venomous Tasmanian fishes, the red gurnard, *Currupiscis volucer* Whitley, 1931, the cobbler or soldier, *Gymnapistes marmoratus* (Cuvier, 1829), the 'spotted gurnet' (*Neosebastes nigropunctatus* McCulloch, 1915), and an unidentified scorpaenid, possibly *Helicolenus papillosus* (Bloch & Schneider, 1801).

The first case of stinging by the Old Wife, *Enoplosus armatus,* is recorded.

THE FAMILY SCORPAENIDAE IN TASMANIA

With *Glyptauchen* Günther, 1860 retained in the Scorpaenidae [as in Waite (1923), McCulloch (1927); not McCulloch (1929) (Synancejidae), Whitley (1931) (Glyptauchenidae)], the family contains 10 species reported from Tasmania by various writers. The appearance also among the Scorpaenidae in the local lists of Johnston (1883, 1891) of *Holoxenus cutaneus* Günther, 1876 and *H. guntheri* Johnston, 1883—both synonyms of *Gnathanacanthus goetzeei,* Bleeker, 1885; Gnathanacanthidae—calls for no more than formal mention here.

These 10 species—for a key to which see Scott (1960:93)—are: *Ruboralga* Whitley, 1931, (*i*) *R. jacksoniensis* (Steindachner, 1866) [appears in the Check-List (McCulloch, 1929), in Lord (1923), and in Lord & Scott (1924) as *Scorpaena cardinalis* Richardson, 1842; not noted by Johnston]; (*ii*) *R. ergastulorum* (Richardson, 1842) [in the Check-List referred to genus *Scorpaena* Linné, 1758; in Lord and in Lord & Scott entered as *S. cruenta* Richardson, 1842 (*S. ergastulorum* has line priority), and earlier in Johnston by the same name, but with the species credited to Solander (on whose MS. Richardson's account is based)]: (*b*) *Helicolenus* Goode & Bean, 1895, (*iii*) *H. papillosus* (Bloch & Schneider, 1801) [given by Lord and by Lord & Scott as *H. percoides* (Richardson, 1842); by Johnston as *Sebastes percoides* Solander, with reference to Solander's MS name]: (*c*) *Neosebastes* Guichenot, 1867, (*iv*) *N. scorpaenoides* Guichenot, 1867; (*v*) *N. panda* (Richardson, 1842) [in Johnston in *Scorpaena,* as in the original description]; (*vi*) *N. thetidis* Waite, 1899; (*vii*) *N. nigropunctatus* McCulloch, 1915: (*d*) *Centropogon* Günther, 1860, (*viii*) *C. australis* (White, 1790): (*e*) *Gymnapistes* Swainson, 1839, (*ix*) *G. marmoratus* (Cuvier, 1829) [in all local lists referred to genus *Pentaroge* Günther, 1860]: (*f*) *Glyptauchen* Günther, 1860, (*x*) *G. insidiator mirandus* Whitley, 1931 [in the Check-List and in all published Tasmanian lists appears as *G. panduratus* (Richardson, 1850): however, Whitley (1931) has noted that the eastern Australian representatives of *Glyptauchen,* which genus had previously been regarded as monotypic, are specifically distinct from the typical *G. panduratus* from Western Australia (type locality, King George's Sound), and has described them as *G. insidiator,* with a Tasmanian subspecies, *G. i. mirandus*].

Of the species listed above, (*iv*), (*vi*), (*vii*), (*viii*) are not credited to Tasmania in the Check-List. No. (*iv*), not included in the list of Lord (1923), or earlier lists, appears (with a somewhat confused note on pectoral rays)

in Lord & Scott (1924:84), unaccompanied by any locality record. Opportunity is here taken to note confirmation of the right of (*iv*), *N. scorpaenoides,* to a place in the Tasmanian list: Harrison & Scott (1929) have recorded an example trawled by the Japanese research vessel *Umitaka Maru* south of Bruny Island on 15th January 1968; while the writer has examined specimens in the collections of the Queen Victoria Museum, Launceston, from several localities on the northern Tasmanian coast. Though not recognised as Tasmanian in the Check-List, (vi) was noted in the *Endeavour* report (McCulloch, 1915:154) as being 'very abundant in waters of 60-100 fathoms deep off the eastern coast of Tasmania.' No. (vii) was first reported for this State by the writer (1942:51), the record being based on a beach-dried specimen from West Ulverstone, Devon: a number of examples from several localities along the northern coast have since been examined. Lord & Scott observe of (viii), 'This species is occasionaly taken on the N.E. Coast': there appear to be no other reports of its occurrence south of New South Wales, and the writer has to date failed to secure any confirmation of its presence in this State—however, it should be noted several fish have been recorded from New South Wales and Tasmania without there being any formal notice of them from either Victoria or South Australia.

Neosebastes panticus McCulloch & Waite, 1918, hitherto known only from South Australia (type-locality, Spencer Gulf) and Western Australia, can now be added to the Tasmanian list, a local example having been determined by Mr. G. P. Whitley, Honorary Associate, Australian Museum, Sydney, under the circumstances noted below.

POISONING CAUSED BY CEPHALIC SPINE OF *NEOSEBASTES PANTICUS*

In April 1968, on behalf of their client, Mr. F. A. H. Dobson, of Scottsdale, Dorset, Tasmania, who had suffered an injury when handling a fish, a Launceston legal firm, Shields Heritage Stackhouse & Martin, approached Mr. W. F. Ellis, Director, Queen Victoria Museum, Launceston, with a request for information on the degree of toxicity known to be associated with a wound inflicted by what was then called a "bite" from a 'gurnet fish'. Mr. Ellis referred them to Mr. Whitley, author of a number of papers on dangerous fishes (*e.g.,* 1930, 1931, 1932, 1943*a,* 1943*b*) and co-author with Dr. B. W. Halstead of an annotated bibliography of the poisonous and venomous fishes of Australia (1955). Assuming that the 'gurnet fish' was probably a member of the family Scorpaenidae, Mr. Whitley observed, 'a bite from the teeth of any of these would not be serious, but a sting from a spine of the head or the dorsal fin would be venomous, painful and annoying'. Adding 'I cannot recall any case-histories of stinging by these fishes', he suggested further inquiries be made of Dr. B. W. Halstead, Director, World Life Research Institute, Colton, California, U.S A. Dr. Halstead later reported he had no data on this fish—at that stage determined generically only. A visit by Mr. Dobson to the Queen Victoria Museum having established that the type of fish he had been wounded by was not represented in the institution's collections, he undertook to secure a specimen for identification. An example from Bridport, Dorset, forwarded through Mr. R. H. Green, the Museum Zoologist, to Sydney was there determined, on 20th June 1967 by Mr. Whitley as *Neosebastes panticus* McCulloch & Waite, 1918. The specimen—noted by Mr. Whitley as being about 13½ inches long, and apparently of record size (281 mm., standard length)—has been deposited in the Australian Museum (Registered no. IB.8324).

On the writer's return, after a year in Italy, to Tasmania in February 1968, Mr. Whitley entrusted him with his letter-file, suggesting he should record this addition to the local faunal list, at the same time making some on-the-spot inquiries regarding the circumstances surrounding Mr. Dobson's injury. However, a legal action was involved, and the matter necessarily remained *sub judice* till December 1968, when a letter from the solicitors to Mr. Ellis made available the following information: wound suffered in tip of right index finger by Francis Allan Dobson on 4th January 1964 at

Bridport, as the result of 'sting by spike of gurnet fish', resulting in agonising pain.

In response to an inquiry by the writer, Mrs. F. A. H. Dobson (G. E. Dobson) has kindly supplied (*in litt.,* 1st May 1969) much interesting information, the gist of which is noted below. The accident occurred while the fish, which was about 12 inches long, was being cleaned, the spine causing the laceration being on the side of the head (the rest of the catch consisted of flathead). 'The onset of the pain', writes Mrs. Dobson, 'was almost immediate but grew in intensity, until at the end of about half an hour my husband was nearly mad with pain. The pain was confined to the finger. We sought medical aid (a doctor was living only about a hundred yards from our caravan). He was given tablets to relieve the pain and told to return to the doctor if the pain continued. In less than an hour we were forced to return as the pain was so severe that I had to get a friend to come with us for the short drive, as I couldn't keep my husband on the car seat. He was literally rolling on the floor. This time a local anaesthetic was given and while the finger was numb the doctor lanced the wound and then had it put in hot water (This was in fact almost boiling, the end of the finger was cooked, and out of this the case arose, my husband having lost the end of his finger, after months of treatment etc. etc.) but there was no more pain'.

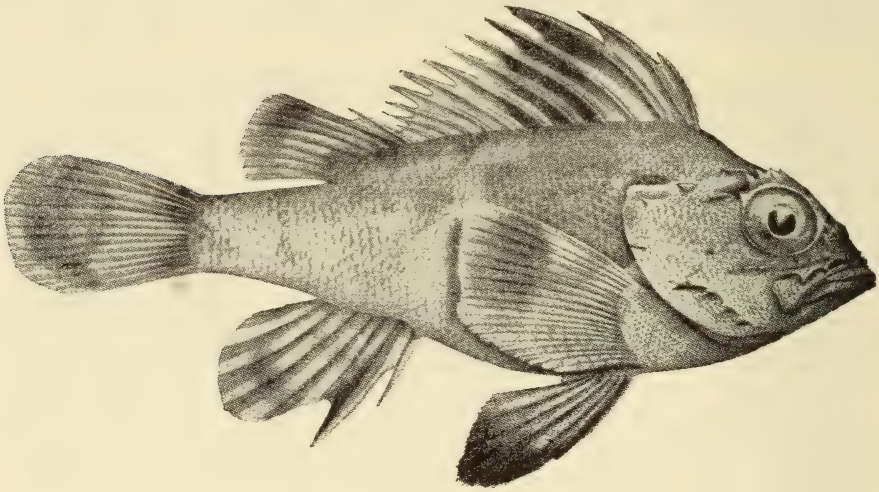

Figure 1.—The Gulf Gurnet Perch, *Neosebastes panticus.*

After McCulloch & Waite.

Mrs. Dobson states the fish is quite well known among fishermen, and remarks that Mr. Dobson and she were very surprised to learn from the Museum authorities that the species appeared to be one not formally recorded from Tasmania.

She adds, 'We know of others who have had similar trouble with this kind of fish' [it may be remarked, in passing, that the species of *Neosebastes* recorded from Tasmania are rather similar in general appearance] 'at Bridport and other places in the area, one quite recently at Flinders Island. He had the same intense pain and was treated by the doctor there, who just soaked his finger in warm water and the pain gradually eased.

'Professional fishermen won't have the fish in their boats. They just knock them off the hook as soon as they see what they are. There are

tales told about men going mad and jumping overboard with pain but of course I do not know how much truth there is in them. Fishermen say the remedy for the sting is ammonia and so when away from medical aid they urinate on the wound.'

Mrs. Dobson's observation that professional fishermen will not have this fish in their boats received corroboration during the course of a conversation (17th May 1969) with Mr. B. C. Mollison, University of Tasmania, who informs me the statement is applicable to all Tasmanian members of the family Scorpaenidae, which the shark fishermen simply swing on the snood and knock off the hook, not risking direct contact with the fish.

Mr. Mollison recalls he was a member of a fishing party, out from Stanley, Wellington, about 1937, when a Mr. Holmes, of Stanley, in attempting to swing a gurnet off the hook misjudged his aim and was struck by the fish on the inside of the upper arm, the spines piercing the skin through oilskin and jumper. Mr. Holmes was in such pain that an immediate return to Stanley, about a day's journey away, was decided on. During much of the trip the patient lay moaning in his bunk, delirious, and partly paralysed. By the time the port was reached he had largely recovered. Mr. Mollison considers this scorpaenid was most probably *Helicolenus papillosus* (Bloch & Schneider, 1801).

SOME OTHER VENOMOUS TASMANIAN FISHES

An appeal in the Tasmanian press, issued through the Queen Victoria Museum, in October 1968 for information on other cases of toxic lesions caused by Tasmanian fishes elicited replies from Mr. Owen Ferguson, Nelson, New Zealand, and Mr. Michael J. Roads, Lilydale, Dorset, Tasmania.

Mr. Ferguson writes, *inter alia,* 'I can recall one occasion when I was in my teens fishing near Stanley racecourse in a channel at West Inlet seeing a spotted gurnet' [*Neosebastes nigropunctatus* McCulloch, 1915?] 'swimming in shallow water. I stepped into the water and stabbed the fish with my pocket knife and of course got my hand well stabbed with his dorsal spines, and then the pain started. I rolled on the beach crying in agony; the pain was terrible but I managed to get to the Dr. at Stanley (Dr. McCauseland) who was out on a visit, but his wife made me put my hands in hot water and Condy's crystals which relieved the pain and numbness. Stayed at Stanley that night, reporting to the doctor next morning, then walked 8 miles to my home at Forest. On seeing the fish swimming along it seemed to be going along very slowly, but it was a gurnet with blackish spots on it. I am now 73 years of age and it's a long time ago, but I will never forget the agony of that encounter with a poisonous fish'.

Of his 'one unpleasant episode' in an extensive experience of skin diving all around Tasmania, excepting the south end, Mr. Roads writes, 'It was at Bridport that I speared a *Currupiscis kumu* (Lesson and Garnot, 1826)' [parentheses, required by nomenclatural convention, added] 'known to me as a Gurnard. I recognised the fish and decided to take great care in getting rid of it and swam ashore to detach it from my spear. As I walked up the beach my flipper foot caught a small rock, I stumbled and my hand holding the spear dipped, thus the Gurnard slid gently down and made contact with my hand through a glove, the poison came from the spines along the back. The pain was instantaneous and very very severe and increased for approx. 2½ hours, by which time my fingers were swollen and bright red which travelled up my arm to just beneath the elbow. By this time I was beginning to get anxious but gradually the pain eased and was quite bearable after 5 hours. Two days later my only effect was a stiff hand and a pricked pride'. The fish designated *Currupiscis kumu* (Lesson & Garnot, 1826) by Mr. Roads appears in the Check-List (McCulloch, 1929:394) as *Chelidonichthys kumu* (Lesson & Garnot, 1826): in the most recent overall list of Australian fishes, that of Whitley (1964:57) it is entered under th name used in the introductory systematic section of the present communication, namely *Currupiscis volucer* Whitley, 1931.

A striking account of poisoning resulting from the handling of a specimen of the fish called the Cobbler [or, *fide* Lord & Scott (1924:85), in Tasmania the Soldier], *Gymnapistes marmoratus* (Cuvier, 1829)—the venomous nature of whose spines is well known—has been supplied by Mr. B. C. Mollison. In January 1968, while handling a seine net at Trial Harbour, Montague he grasped a large *Gymnapistes,* receiving 4-5 dorsal spines in the palm of the right hand. Within about ten seconds he experienced frightful pain, most severe in the axilla, and lost effective use of the hand muscles. Unable to flex the fingers to pull on an oar, he sculled back to shore. The pain, which remained intense for about an hour, was accompanied by a sensation of chill and by sweating, together with involuntary spasmodic exhalation of the breath. During some three hours the pain gradually subsided, leaving only a burning and tingling feeling, located mainly in the hand, but with some extension on to the arm.

Mr. Mollison has found that the result of a single puncture by either the erectile, preorbital spine or the preopercular spine of the Cobbler is, at least in his cases primarily mechanically traumatic, not, or barely, toxic.

The following passage from the not-readily available *The Poisonous and Stinging Animals of Tasmania,* by A. M. Lea, originally published in three parts in the long-since defunct *The Tasmanian Mail* (issues of 14th, 21st, 28th November 1903), reprinted as a folding sheet, with 16 figures (figures not seen) is, in the present context, of more than merely historical interest:

'Many fish are poisonous, both scaled and scaleless, although a large[r] proportion of scaleless fish are poisonous than those with scales. The scales of many edible fish are capable of inflicting a painful wound, a prick from the common flathead, for instance, sometimes causing pain for hours. In Tasmania the "soldier fish" (*Pentaroge marmorata*), known in Sydney as the "Fortescue" or "forty-skewers", can inflict a highly painful wound. Mr. R. M. Johnston has written to me of this fish as follows:- "This fish is small, scaleless, but with fine scarcely visible needle-like spines in the head and opercles. Touch any of these, however slight[ly], and the pain is more acute than from any possible wound or burn. Cases of loss of hand or finger have been reported. I have suffered agony for hours from a gentle prick, not visible under the lens." I have also been told by others who have been stung that the pain for the first half hour is horrible in its intensity, and not infrequently brings on cold sweating and vomiting. On a specimen before me, measuring five inches in length, there are four stout spines on the head: these are embedded, two on each side, in front of the eyes; the front ones each measure two-thirds of an inch, the hind ones an inch and a quarter. Although many of its other spines (especially those on the dorsal fin) can inflict severe stings, it appears to be usually those on the head that are used, and the front pair of these can be turned in almost any direction: they are partly covered in skin, but the tips are exposed. There are other spines on the head, but they are much smaller in size'. Lea makes mention also of the sting in the tail of the stingaree, observing it ' can inflict a nasty wound, which does not heal as a clean cut will'.

DISCUSSION

The primary purposes of the present communication being to put on record the occurrence in Tasmania of *Neosebastes panticus* McCulloch & Waite, 1918, and to note several cases of poisonous injury sustained during the handling of this and of several other locally-occurring species, no attempt will here be made to discuss the toxicology of these instances, not yet formally investigated, or to embark on any general survey of venomous Tasmanian or other Australian fishes. However, a few general observations may be offered.

As pointed out by Mr. G. P. Whitley in a letter to Mr. R. H. Green (20th June 1967) there is no published record of stinging by *Neosebastes panticus*: however, remarks by Mrs. F. A. H. Dobson and Mr. B. C. Mollison, quoted above, indicate widespread fear of it among professional fishermen in this State. Reports, both from Australia and abroad, involving other members of the family Scorpaenidae (scorpion fishes, sting fishes) are numerous, some

dating back to Aristotle. Genera that have been indicated as venomous include *Scorpaena* Linné, 1758, *Pterois* Cuvier, 1817 [or *Pterois* Schinz, 1822], *Apistes* Cuvier 1829, *Erosa* Swainson, 1839, *Gymnapistes* Swainson, 1839, *Centropogon* Günther, 1860, *Paracentropogon* Bleeker, 1876, *Sebastes* Gill, 1877, *Notesthes* Ogilby, 1903. For painful effects of the type-species of the last-named genus, *N. robusta* (Günther, 1860) see Waite (1899) and Kesteven (1914); for an opinion that the species is not venomous see Ogilby (1903). *Synanceia* Bloch & Schneider, 1801 [or *Synanceja*: the first spelling, the definitive one in Bloch & Schneider's main account, p. 573, is preceded, on p. 194, by the second, treated by some systematists as a misspelling]—a genus that earlier regularly was, and by somes writers still is, accommodated in the Scorpaenidae, but that by others is referred to a separate family, Synanceiidae or Synancejidae—includes several dangerous species, among them the most notorious of all Australian venomous fishes, the common stonefish of Queensland, Western Australia, and Northern Territory, by some (*e.g.*, Taylor, 1964) regarded as conspecific with the widely-ranging extralimital *S. horrida* (Linné, 1758), by others (e.g., Whitley, 1964), as an endemic species, *S. trachynis* Richardson, 1842 (type locality, Port Essington, Northern Territory). An account of the venom apparatus of this species has been given by Duhig & Jones (1928*a*), while studies on the venom itself have been published by, among others, the same authors (1928*b*), by Duhig (1929) and by Halstead, Chitwood & Modglin (1956). Reference should be made by those interested in pursuing the subject to the comprehensive annotated bibliography of the poisonous and venomous fishes of Australia by Whitley & Halstead (1955), with particular reference to the third section of the paper (pp. 222-227).

A Tasmanian case of severe toxic symptoms consequent upon an injury by the dorsal spines of *Gymnapistes marmoratus* has been recorded above: see also the quotation from Lea (1903). Lord & Scott (1924:86) state the species is 'well known on account of the painful wounds which it can inflict by means of euctite [erectile] spines, particularly those dagger-like spines on each side of the snout'; while Scott (1962: 154), in his catalogue of South Australian fishes, observes, 'the pain caused by a sting from the spines of the head or the dorsal spines can be very excruciating'. As regards the nature of the wound inflicted by a single cephalic spine of this species, the writer's own experience is in agreement with that of Mr. Mollison, namely, that the trauma is primarily mechanical, associated with no or insignificant symptoms of toxicity—however, it would seem probable that there is here, as is well known to be the case with certain insect stings, considerable variation in individual susceptibility.

Stinging by an Old Wife

On the 19th February, 1970 the writer received for identification a fish that had been the occasion several days earlier of a distressing injury. The specimen, now in the collections of the Queen Victoria Museum, Launceston (Registered no. 1970.5.6) proved to be the Moonlighter, or Old Wife, *Enoplosus armatus* (White, 1790).

On 14th February, Mr. J. Temple-Smith was sailing in his 26 foot yacht from Devonport to Port Sorell, Devon, Tasmania, and dropped anchor on the western side of Wilson's Point, just west of the estuary of the Rubicon. Here he and his son Mark indulged in skin-diving, while Mrs. Temple-Smith paddled a dinghy, taking the captured fish from the spears. While trying to release the Old Wife from the barbs, she had the right middle finger punctured by a dorsal spine.

'The pain', writes Mr. Temple-Smith ('The Slipway', 156 Percy Street, Devonport; 4th March) 'was immediately excruciating and she rowed the dinghy back to the anchored yacht sucking the wound and spitting as she went.

'I now realise that this was perhaps the worst thing she could have done as the action of rowing probably accelerated the spread of venom through her body.

'I swam to the yacht and hauled myself aboard at about the same time she reached it and helped her into the cabin.

'The pain was very severe and my wife felt she could not stay in the cabin but came out into the cockpit and as she did so she suddenly lost all colour, her eyes rolled and she became unconscious. I thought for a few dreadful moments that I had lost her but although she was unconscious for at least half an hour I was soon able to detect a pulse and her colour was gradually restored.

'We were about an hour's sailing from Port Sorell jetty and with the engine flat out we set out immediately. By the time we had reached Port Sorell my wife was quite conscious although her arm from the tips of her fingers on her right hand to her elbow felt as though it was on fire.

'After obtaining medical advice at Port Sorell, I gave her some anti-histamine tablets and she lay in the cabin for about three hours gradually feeling better all the time. When she was fit enough to come ashore we came home to Devonport and she slept well and had fully recovered by the next morning, except for soreness in her finger. The curious thing is that apart from a slight swelling of her middle finger she had no other swelling or physical indication of the injury.

'She is now quite better, although the finger is slightly sore and she is most embarrassed at the trouble she seems to have caused.'

This species does not appear generally to be regarded as venomous. An *ad hoc* dissection at the bases of the anterior dorsal spines of the specimen has failed to disclose any positive indication of the presence of poison glands—however, in view of the somewhat cursory nature of this examination, the negative result should not be regarded as definitive evidence of the absence of venom-secreting tissue.

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ICHTHYOLOGICAL QUIDDITIES

by G. P. WHITLEY

(Plate XII; Figures 1-2)

Family HEMISCYLLIIDAE

Hemiscyllium hallstromi

Hemiscyllium hallstromi Whitley, Australian Zoologist, 14(2), 1967, p. 178. New Guinea.

The type-specimens, which are still alive at time of writing (June 1970) in the aquarium at Taronga Zoo, are illustrated on plate xii by permission of the Editor of the *Sun-Herald* (Sydney) newspaper, in whose edition of 20th August, 1967, this photograph first appeared. The holotype male is in the foreground.

Loc.—New Guinea, 1960 (Captain W. Wilding, M.V. "Bulolo").

Family CLUPEIDAE

Genus Leptogaster = Escualosa.

Leptogaster Bleeker, 1870, Atlas Ichth., 6, pl. 264, fig. 5, published before the text, pp. 102 & 168 (1872). Haplotype, *Clupea argyrotaenia* Bleeker.

Leptogaster Bleeker "has not been used as a senior synonym for over 50 years and is therefore a nomen oblitum", according to Whitehead, Boeseman & Wheeler (1966, Zool. Verhandelingen, 84, p. 70). A more cogent reason for rejecting the name, to my mind, is the fact, shown by Neave's *Nomenclator Zoologicus,* that *Leptogaster* is three times preoccupied by insect names. Bleeker's name is a synonym of my *Escualosa,* hereby reprieved.

Several new generic names appeared for the first time on Bleeker's plates and were missed by later nomenclators. In his *Index Animalium,* Sherborn refused to record names engraved below plates and figures, stating (Index Animalium, 1, 1902, p. vii):

"In the case of plates appearing before the text, the date of each is given if ascertainable (*e.g.,* Schreber's 'Saugthiere'), but in no case is the date of a plate accepted in preference to the date of text, for the reasons which follow:-

"The figure depicted on a plate may, or may not, be the drawing intended by the author; it is the work of the artist, who is also responsible for the descriptive legend. In numerous instances the descriptive legend on a plate is quite erroneous, and has been repudiated by the author in his text. Until the text descriptive of a plate appears, the names on the plate must be considered as *nomina nuda,* and it is open to anyone to describe and rename such *nomina nuda.*"

Here I diffidently disagree with my old friend. Surely plates and their legends were usually approved before publication by the authors of the books and papers they illustrated. Indeed the fact that P. Bleeker directed the production of his plates is often recorded below the plates themselves, which makes him responsible for the nomenclature thereon. A good figure is often more eloquent than much of the text so that I accept new names on plates. Several such Bleekerian cases are noted here, without upsetting, but rather strengthening, nomenclature.

Genus **Spratella**

Spratella Bleeker, 1870, Atlas Ichth., 6, pls. 266 to 268, figs. and 1871, *ibid.*, pl. 271; Atlas Ichth., 6, text 1872, pp. 110, and 1875, p. 168.

The type-species, by present selection, is *Clupeonia perforata* Cantor, 1850. Bleeker's name is preoccupied by *Spratella* Cuvier & Valenciennes (Hist. Nat. Poiss., 20, 1847, p. 356) and may equal *Fimbriclupea* but final allocation will depend on the current researches of Whitehead and others.

Three genera named Paralosa.

(1) Jordan (Genera of Fishes, part 3, 1919, p. 362) wrote, "*Paralosa* Bleeker, —. This name is quoted from Bleeker, but I fail to find it anywhere."

Eureka! References are: *Paralosa* Bleeker, 1868, Versl. Meded. Akad. Amsterd. (2) 2, p. 300 and Atlas Ichth., 6, 1870, pl. 269, fig. 5; 1872, p. 111 *et ibid.*, 1875, p. 168. The type-species is *Clupea melanurus* Bleeker.

(2) *Paralosa* Regan (Ann. Durban Mus., i, 1916, p. 167. Virtual haplotype, *Clupea durbanensis* Regan) was preoccupied by Bleeker, 1868, and was renamed *Hilsa* by Regan, Ann. Mag. Nat. Hist., (8) 19, 1917, p. 303.

(3) *Paralosa* Roule, 1925 (Poiss. eaux douces France, 1925, p. 80—*fide* Neave, Nomencl. Zool., 3, 1940, p. 577). Not listed by Golvan but probably a synonym of *Alosa*.

Family NEMICHTHYIDAE

Genus **Gavialichthys** = **Gavialiceps**

Gavialichthys Golvan (1963, Ann. parasito. hum. et comp., 1962, 37, 6 bis., fasc. suppl. p. 72), nom. nud. is doubtless a lapsus calami for *Gavialiceps* Alcock, 1889, in Nemichthyidae, to the synonymy of which it is hereby consigned.

Family NOTACANTHIDAE

Genus **Gnathacanthonotus** = **Gnathonotacanthus**

Gnathacanthonotus Golvan (1963, Ann. parasito. hum. et comp. 1962, 37, 6 bis., fasc. suppl., p. 73) is an error for *Gnathonotacanthus* Fowler, 1934. The matter may seem too trivial for mention, but when one is compiling an alphabetical list of all fish generic names for a proposed *Genera Piscium* such obstacles require to be demolished.

Family BELONIDAE

Genus **Pomatorrhaphis**

Pomatorrhaphis Bleeker, 1871, Atlas Ichth., 6, p. 43, ex Gunther [MS.]

This generic name is not in Jordan's *Genera of Fishes,* nor in Neave's *Nomenclator Zoologicus.* It was regarded by Mees as a good genus in Belonidae.

Family HOLOCENTHRIDAE

Tuleus, gen. nov.

Paraberyx Casier (1966, Faune ichth. London Clay, p. 182, pl. 24, fig. 2 and text-fig. 34), in the family Holocenthridae, is preoccupied by *Paraberyx* David (1946, Carneg. Inst. Publ., 551, p. 103), another genus of fossil fishes. Casier's generic name may be replaced by *Tuleus*, gen. nov., with *Paraberyx bowerbanki* Casier, *loc. cit.*, 1966, as type-species = *Tuleus bowerbanki*, comb. nov.

Genus et species indet.

(Figure 1).

A curious small fish, about 1½ inches long, was found years ago in the stomach of a pike (probably *Sphyraena*) from Waterfall Bay, New Britain, South Pacific. C.S.I.R.O. collection (Cronulla, New South Wales) No.A.509. It is not in good condition, is not a true Holocenthrid; I have been unable to find anything like it in literature and have not seen a second specimen. It has the following features: D. *circa* v, 28; A. *c.* ii, 15; P.?; V.i, 5. Head about one-third and depth about 2.4 in standard length. Eye 3½ in head. Depth of caudal peduncle about half head. Profiles of head roundly convex. Suborbital very narrow. Mouth undershot. Fine hooked teeth. Maxillary reaches below hind part of pupil of eye. Preoperculum with several serrae, one enlarged at angle. An opercular spine. Two fan-like bones above and slightly behind eyes: from a point over the hinder part of the eye, osseous ridges radiate until the edges of their fans interlock with their fellows along the median dorsal line. Predorsal profile and front of head spinose. Gill-membranes united across narrow isthmus.

Scales minute, about twenty predorsal. Small scales on cheeks, opercles, breast and elsewhere. Lateral line complete, about twelve rows of scales between it and the back. Dorsal spines short, increasing in length backwards. Soft dorsal and anal long-based. Pectoral and ventral fins very small.

Flesh-coloured (in formalin). A few greyish marks near the front arch of the lateral line. Occipital fans yellow. Eye blue.

The *Rhynchichthys* and other stages of Holocenthridae have much larger and fewer scales, more dorsal spines, and fewer dorsal and anal rays. Otherwise, the fan-like shields over the head, the large preopercular spine, rugose snout and undershot mouth of the New Britain fish parallel to a remarkable degree those characters in the Holocenthrid fishes.

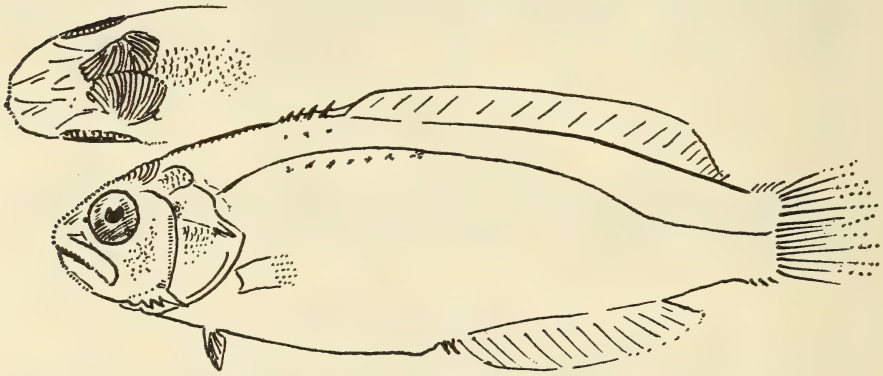

Figure 1.—Gen. et sp. indet., New Britain, South Pacific. Inset: top of head. Sketches, 3 times natural size, by G. P. Whitley.

PROSOSCOPIDAE, fam. nov.

The genus *Prososcopa* Rass (1961, Zoolog. Zhurnal, 40 (12), p. 1858. Haplotype, *P. stilbia* Rass from the Java Trench area) evidently requires a new family name, Prososcopidae, as Rass himself suggested (without naming it), "Represents probably a new family, perhaps, of the order Clupeiformes (notwithstanding the high position of P.)".

Eyes cylindrical, directed forwards. Skin naked. Differs from *Gigantura* in the structure of the head, pectorals and unpaired fins; from *Winteria* in the short snout, great width, form of body and absence of adipose fin.

Family POMACENTRIDAE

Machaenichthys and Mechaenichthys = Mecaenichthys

Machaenichthys Golvan (1963, Ann. Parasito. hum. & comp., 1962, 37 (6 bis), p. 203) and *Mechaenichthys* (*Ibid.*, pp. 120 & 203) are obviously synonyms of my *Mecaenichthys* (Whitley, 1929, Mem. Qld. Mus., 9, pp. 209 & 218).

Family CORIDAE

Coris aygula cyanea

One from Byron Bay in the Australian Museum.

New record for New South Wales.

Family KRAEMERIIDAE

Genus **Kraemericus**

Kraemericus Schultz (1966, U.S. Nat. Mus. Bull., 202 (3), pp. 4 and 8. Type species, *K. chapmani*) is evidently a synonym of my *Gignimentum* (Whitley, 1933, Rec. Austr. Mus., 19, p. 88) which I placed in the Eleotridae. *Gignimentum* was regarded by Tomiyama (1936, Jap. J. Zool., 7, p. 49) and Koumans (1940, Zool. Meded., 22, p. 170) as congeneric with *Xenisthmus* Snyder (1908, Proc. U.S. Nat. Mus., 35, p. 105), originally placed in Gobiidae, but now to be put in the family Kraemeriidae.

Family BLENNIIDAE

My late friend, Henry Weed Fowler (with whom I corresponded on the subject) was going to rename the following two species, but he died in 1965, so I provide new names for them here:

Blennius kossmanni, sp. nov.

New name for *Blennius cyclops* var. *punctatus* Kossman & Räuber (1877, Reisen Rothen Meer, i, Pisces, p. 21. Red Sea), preoccupied by *Blennius punctatus* Quoy & Gaimard (1824, Voy. Uranie, Zool., p. 250) and by Wood (1825, J. Acad. Nat. Sci. Philad., 4, p. 279).

Salarias fourmanoiri, sp. nov.

New name for *Salarias nitidus* Fourmanoir (1955, Mem. Inst. Sci. Madagascar 9A, p. 207, from Comores), preoccupied by *Salarias nitidus* Gunther (1861, Cat. Fish. Brit. Mus., 3, p. 243, from China).

Family SCORPAENIDAE

Yacius, gen. nov.

As foreshadowed in my paper, "Genera Piscium: Work in Progress" (1966, Austr. Zool. 13, p. 233), a new name is required for *Acanthodes* Fourmanoir & Crosnier (1964, Cahiers Orstrom 6, p. 23) which is preoccupied by *Acanthodes* Agassiz (1846, Rech. poiss. foss., 2, p. 19), a fossil shark. I propose *Yacius* to replace *Acanthodes*, preoccupied, with type-species *Acanthodes fragilis* Fourmanoir & Crosnier = *Yacius fragilis*, comb. nov.

Trachyscorpia (Mesoscorpia) eschmeyeri, nom. nov.

New name for *Scorpaena capensis* Gilchrist & Von Bonde, 1924, preoccupied by Gmelin, 1789 (for refs., see Eschmeyer, 1969, Occ. Pap. Calif. Acad. Sci., 79, pp. 50, 100, etc., fig. 5c).

Family TEUTHIDAE

Teuthis xanthopterus

(Figure 2).

Teuthis xanthopterus Cuvier & Valenciennes, 1835, is a commonly seen fish in both northern and southern Papua and is no. 932 of Munro's *Fishes*

of New Guinea, 1967. A painting of it by George Coates reproduced by Halstead (1967, Pois. Ven. Mar. Anim. World, 2, pp. 81, 173, 204, 276, pl. xxiv, fig. 4 [the Queensland fish] and pl. xxxi, fig. 1, as *Acanthurus*) indicates that it occurs in north Queensland waters, although it had not before been officially recorded under its proper trivial name from Australia.

The accompanying illustration was drawn from a Norfolk Island example (registered no. IB.6404) in the Australian Museum by Miss Lorraine Carter (now Mrs. L. Zirkzee).

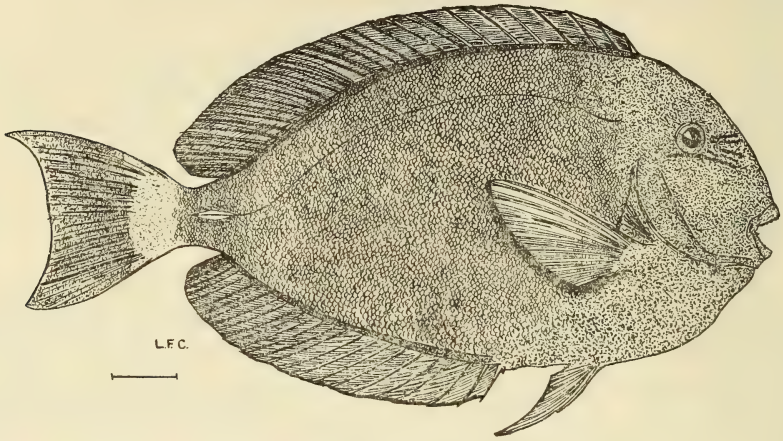

Figure 2.—Surgeon Fish, *Teuthis xanthopterus.* Norfolk Island. Mrs. L. Zirkzee del.

Teuthis maculiceps

Hepatus maculiceps Ahl, 1923, Mitt. Zool. Mus. Berlin, 11, p. 36, fig. 4. New Britain.

D.viii, 27; A.iii, 23 (24); P.ii, 16.

Head (34 mm., measured according to Randall) 3.9, depth (72) 1.8, snout (30) 4.4 in standard length (134). Width of mouth from rictus to rictus (12) 2.8 in head; caudal blade (9 mm.) 3.7 in head. Dental formula 17/17.

Colour in alcohol very dark brown. Traces of light spots on sides of head. A lighter area rings the posterior part of caudal peduncle. Fins dark brown like the body, except distal half or more of pectorals which are pale yellow. A blackish blotch behind uppermost part of gill-opening. Eye blue. Caudal blade with narrow surround of black. A dark blackish band along base of dorsal fins and perhaps a similar one, now faded, for anal fin. Thin white edge to caudal concavity.

Described from a specimen, seven inches long, from Hog Harbour, New Hebrides, collected by the late Professor A. J. Marshall. Australian Museum regd. no. IA.6212.

New record for the New Hebrides.

GALATHEATHAUMATIDAE, fam. nov.

The unique *Galatheathauma* Bruun* (which does not appear, at least to 1965, to have been listed in the *Zoological Record*) requires a new family name, Galatheathaumatidae, in the Order Lophiiformes or Pediculati. It differs from other families of angler fishes in having the luminous lure forked and hanging down from the palate inside the mouth. It has minute eyes near the corner of the mouth and grows to at least 47 cm. in length.

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* Bruun, 1953, Galatheas Jordomsejling, p. 174, fig. & cover-design of book. Type-species [orthotype], *G. axeli* Bruun from tropical western America. *Id.,* Wolff, 1961, Galathea Rept., 5, p. 137, coloured plate 9. *Id.,* Barry, 1962, Junior Natural History (New York), Feb. 1962, pp. 22-23.

Family LAGOCEPHALIDAE

Genus **Uranostoma** (syn. **Contusus**)

Uranostoma Bleeker, 1865, Atlas Ichth., 5, pp. 49, 61 & 63.

Type-species [haplotype], *U. guttata* Bleeker.

Jordan (1919, Gen. Fish. 3, p. 336) says "orthotype not stated" [by Bleeker], but on page 61 of his *Atlas,* Bleeker mentioned *Uranostoma guttata,* his only species, in the synonymy of *Tetraodon hypselogeneion* (Bleeker); both generic and trivial names were from Paris Museum labels, so were evidently from Bibron's manuscripts. Jordan (*loc. cit.*) says, "A synonym of *Spheroides* or of *Tetraodon*", but *T. hypselogeneion* is now considered (*fide* Munro) to be an *Amblyrhynchotes* (vernacular in Bibron, 1855 and latinized by Troschel, 1856, Arch. Naturg., 22(2), p. 88), a preoccupied name discussed by Abe (1952, Jap. J. Ichth., 2 (1), pp. 37 et seq.) and replaced by *Contusus* Whitley (1947, Austr. Zool., 11, p. 147). The orthotype of the latter, *Tetrodon richei* Freminville 1813 (Nouv. Bull. Sci. Soc. Philom. 3, p. 250, pl. iv, fig. 2), from southern Australia and New Zealand, should now be called *Uranostoma richei,* comb. nov.

OBSERVATIONS ON SOME AUSTRALIAN FOREST INSECTS

23. A REVISION OF THE GENUS *GLYCASPIS* (HOMOPTERA: PSYLLIDAE) WITH DESCRIPTIONS OF SEVENTY-THREE NEW SPECIES

by K. M. MOORE
(Forestry Commission of New South Wales)

(Figures 1-144)

SUMMARY

The taxonomy, phylogeny, and host associations of *Glycaspis* species, based on an Australia-wide survey, are reviewed, and 73 new species are described and figured. Four new species synonyms and a subgenus synonym are recorded.

The genus now contains 127 species, in three subgenera. The most primitive subgenus consists of 36 spp. which are associated with the renantherous *Eucalyptus* spp. of Blakely (1955); the intermediate subgenus contains 79 spp. which are associated with the non-renantherous *Eucalyptus* spp.; and there are 12 spp. associated with *Melaleuca* spp. and *Tristania conferta* in the most recent subgenus.

The genus is distributed throughout and beyond Australia, to the Philippine Islands.

The subgenus *Alloglycaspis* (Moore 1961) becomes a junior synonym of the subgenus *Glycaspis* which now contains those species previously assigned to *Alloglycaspis*. A new subgenus is erected to contain those species previously assigned to the former subgenus *Glycaspis*.

Because of limited early knowledge concerning the genus, descriptions by Dobson, Froggatt, Schwarz and Solomon were based on unsatisfactory characters. Illustrations based on slide preparations of the male genitalia are now considered to be essential for the separation of male specimens of the various species. Morphological characters suitable for separating females of species have not been determined.

Methods used to collect, prepare and describe specimens are given. To recognise, and correctly interpret previously described species, attempts were made to obtain these species from their type-localities, and comments are presented under the relevant species.

INTRODUCTION

Papers published by Dobson (1851), Schwarz (1898), Froggatt (1900, 1901, 1903) and Solomon (1936) indicated that species of the genus *Glycaspis* Taylor, 1960 were distributed throughout Australia, and that they were known to occur only on *Eucalyptus* spp. *Melaleuca* spp. and *Tristania conferta* were later determined to be hosts, and the known distribution of the genus was extended beyond Australia (Moore 1964b).

To examine the taxonomy, distribution and host associations of the Australian species, a limited collecting project in each State was made from April 1966 to March 1967. Collecting in discrete areas was limited to short periods during this project, while distance, time, weather conditions, the particular season then experienced in a locality, or the physiological condition of host plants, imposed further limitations, so that it is assumed that a number of *Glycaspis* spp. yet remains to be collected and described. The presence or absence of certain species was evident when collecting in various

discrete areas, e.g. at Perth, W.A., where *G. occidentalis,* which constructs round lerps, was not obtained from its host *E. gomphocephala,* although another species which constructs rectangular lerps on this host, was consistently obtained.

Some 190 *Eucalyptus* spp., have been sampled for *Glycaspis* spp. and a *Glycaspis*/host association established for about 133 spp. during, and prior to, this project.

METHODS

Collecting

The foliage of possible host plants was extensively swept with an entomological hand net of calico or similar material, collections being made from a host species in numerous widely separated localities when possible, to determine any variation in a discrete species of *Glycaspis* throughout its known range.

For purposes of host identification, epicormic growth or low branches of trees bearing seed capsules, were sampled for *Glycaspis* spp. when possible, so that samples of coppice or small regeneration not bearing seed capsules might be minimised, although at times it was necessary to procure samples of such material.

Adults obtained in the net were collected in 2 x ½" specimen tubes each containing a basal plug of cottonwool saturated with ethyl acetate, into which they readily sprang from the sides of the net. These specimens were then transferred to tubes of the same size containing 90% alcohol, and conveyed in wooden boxes each holding 100 tubes. Specimens from each locality and/or each host, were placed in separate tubes with relevant data. Between each box, rubber ball-and-cup separators were fitted to eliminate vibration and jolting.

Collection of botanical material was essential for the identification of the *Eucalyptus, Melaleuca* and *Tristania* spp., and so that the host specificity of each *Glycaspis* species could be examined; but because of the limited space available for conveyance, it was not possible to sample all foliage from which *Glycaspis* spp. were obtained. Such eucalypt species as *tetrodonta, miniata, phoenicea, tetraptera,* etc. were determined *in situ* by the writer; many species not so clearly defined, presented the problem of limitation of host sampling. Only those host species the identification of which did not remain in doubt, or those identified by the relevant State botanist, have been recorded without a query mark in this paper. The queried host identifications may thus represent the particular species, or a similar or contiguous species, but this is considered preferable to no indication of a probable host.

Glycaspis specimens in museums and other relevant institutions in each State were examined.

Preparing Specimens

All specimens collected were held in 90% alcohol until required for processing. Only occasional very slight damage occurs to specimens stored in this manner, and the procedure involves much less time, effort and care than mounting specimens on pins or cardboard points. Dried specimens are readily damaged, are rarely complete for examination, and extra time and care must be given when processing such specimens. Specimens stored in alcohol, rather than dried specimens, thus provide much more satisfactory material, the only possible disadvantage being the loss of green coloration which appears to be of little consequence in the taxonomy of species in this group.

The following procedures and formulae were adopted for the preparation of slide material:- Specimens were boiled in 90% alcohol in 2" x ½" tubes, in a water bath, for about 10 minutes (dried specimens 15-20 mins.); the

alcohol was then decanted and 10% potassium hydroxide added to the specimens which were again boiled, for 5 mins. (dried specimens 10-15 mins.); specimens were washed in 95% alcohol which was then decanted; clearing fluid was added to specimens and heated gently for 10-15 mins. Specimens were then ready for mounting on slides, and provided that the clearing fluid did not crystallise, could be retained in it indefinitely.

Clearing fluid formula:- Equal parts by weight of crystalline phenol and chloral hydrate melted together at a low temperature, and made isotonic or slightly hypertonic to mountant, by the addition of glucose syrup. Mounting fluid:- Gum arabic 12 gm., chloral hydrate 20 gm., glacial acetic acid 5 ml., 50% w/w glucose syrup, distilled water.

Describing Species

Most of the descriptions are based on specimens preserved in 90% alcohol, and all specimens listed were collected by the writer unless otherwise stated.

A large number of male specimens of each species for examining on slides is desirable, so that the stability of morphological characters for a species may be assessed, but large numbers were not always available.

The provision of accurate drawings of the male claspers and aedeagus, together with a definite host correlation, and perhaps an indication of general coloration, is at present considered to be the most satisfactory basis for the separation of species in the genus. By providing drawings at a consistent magnification and with a constant size reduction in their reproduction, together with measurements of aedeagi, and the study of the male genitalia and claspers, considerable accuracy in the determination of species is possible. All drawings of the claspers and aedeagus were prepared at the same magnification as those for previous papers, and were made with the aid of an ocular graticule, and faint blue-ruled ¼" squared statistic paper.

The use of written keys is considered by the writer to be redundant for *Glycaspis* spp. Although it has been considered advisable to record the general coloration of species described in this paper, the unreliability of colour as a means of identification of most species is emphasised. Because of this factor, more than one species may be included in some of the tubed material, and the coloration of some holotypes was not recorded prior to placing them on slides.

The illustrations used in previous papers by the writer have been reproduced in this Revision, to provide the sequence of known species.

Because of the limited knowledge available concerning each species described, and the small number of specimens of most species collected, it has been considered advisable, in the interests of future workers on this Australian group, to restrict dispersal of type-material collected by the writer. Unless otherwise stated, all specimens have been lodged with the Australian National Insect Collection, C.S.I.R.O., Canberra, Australian Capital Territory.

Institutions from which specimens have been received, or in which specimens have been lodged, are referred to by the following prefix letters:-

AM	Australian Museum, Sydney.
BM	British Museum (Natural History), London.
BP	Bernice P. Bishop Museum, Honolulu, Hawaii.
CS	Australian National Insect Collection, C.S.I.R.O., Canberra.
FC	Forestry Commission of New South Wales, Sydney.
NA	N S.W. Department of Agriculture, Sydney.
OM	Osaka Museum of Natural History, Osaka, Japan.
QF	Queensland Forests Department, Brisbane.
QP	Queensland Department of Primary Industries, Brisbane.
QU	University of Queensland, Brisbane.
SI	Waite Agric. Research Institute, Adelaide, South Australia.
SM	South Australian Museum, Adelaide.
TA	Tasmanian Department of Agriculture, Hobart.
UM	United States National Museum, Washington.
VM	National Museum of Victoria, Melbourne.
WA	Western Australian Department of Agriculture, Perth.

Taxonomic Concepts

Discussing the present status of various taxonomic concepts, Johnson (1968) considers that phylogeny is held to be the nearest approach to a firm basis of reference in nature for biological classification, and the necessity for compromise and continual synthesis is stressed. The desirability of such an approach became obvious during this study, and the genus is interpreted on that basis.

Taxonomically, species are arranged according to:- (a) Lerp shape when known; (b) Length and shape of vein Cu_1 of the hindwing of the adults; (c) Morphology of the male aedeagi and claspers; (d) Host associations.

Biological investigations and intensive observations on *Glycaspis* spp. are important, and are most necessary for some groups in *Glycaspis*, but the time available for this study allowed only limited investigations of these aspects.

The type-localities of all previously described *Glycaspis* spp. were sampled and collections made from all hosts considered as likely to be those of the described species, on the evidence given in the papers published by the various authors.

The present interpretation of the phylogeny of the genus *Eucalyptus* as presented by Blakely (1955) has been of limited value as a basis for correlation of the phylogeny of *Glycaspis* spp., and his sequence has not been followed. Information concerning the phylogeny and host associations of *Glycaspis* spp. may be of some value in a reappraisal of the genus *Eucalyptus,* and is presented in the accompanying paper in which the results gained from this project are discussed.

The advisability, or otherwise, of placing such a large number of species within the one psyllid genus, has been considered.

The genus *Eucalyptus* is a relatively homogeneous botanical group of some 400-500 spp. of small and large trees and shrub-like mallees. On present knowledge concerning their taxonomy and phylogeny, it would seem inappropriate to consider placing any group of these species in a separate genus. Present knowledge concerning species in the genus *Glycaspis* has shown a relatively close host association with a discrete eucalypt species or group of species, and when these associations are considered, objections to such a large number of species being referred to the genus *Glycaspis* appear to be obviated. Species in the most recent subgenus *Boreioglycaspis* are associated with *Melaleuca* and *Tristania* spp., but their morphology suggests a close phylogenetic link with the other two subgenera.

To erect separate genera for those species at present contained in the three *Glycaspis* subgenera, would appear to the writer to disrupt unnecessarily the sequence of their phylogeny within the genus as previously interpreted (Moore 1961, 1964b), so that the concept of the genus as a composite group containing species in three subgenera is retained.

TAXONOMY

A Correction

The type-species *Glycaspis flavilabris* (Froggatt) was designated by Taylor, 1960. The subgenus *Alloglycaspis* was later erected by the writer (Moore 1961), and *G. flavilabris* became the type-species of the subgenus *Glycaspis* under the rules of the International Code of Zoological Nomenclature.

Previously, on an initial examination of the single female specimen of *G. flavilabris,* attached by gum to a card, it was noted that the stem of M+Cu in the venation of the forewing was much shorter than that on specimens then placed in the subgenus *Alloglycaspis,* so that other species with the short M+Cu stem consequently were assigned to *Glycaspis* (*Glycaspis*) by the writer (Moore 1961, pp. 128-9, 132-148). This interpretation has since proved to be erroneous, for present knowledge concerning the genus now indicates

that the length of the M+Cu stem of the forewing, although relatively stable within each subgenus, exhibits some variation.

Only a single specimen of *G. flavilabris,* in the C.S.I.R.O. collection at Canberra, was known to the writer in 1961 and it was considered inadvisable, at that time, to process and place it on a slide for examination, as no constant morphological characters of female specimens had been determined whereby species could be separated. The importance of the vein Cu_1 of the hindwing was not fully understood, and the host association of this species was not known. Because the specimen was unique, and glued to a card, and so that possible damage to the specimen might be avoided, vein Cu_1 of the hindwing was not examined. However, this vein, and the host plant species which has since been determined as *E. goniocalyx* (= *E. elaeophora*), certainly refer *G. flavilabris* to *Glycaspis* (*Alloglycaspis*) of Moore 1961. The subgenus *Alloglycaspis* thus becomes a junior synonym of the subgenus *Glycaspis.*

The short M+Cu stem is apparently characteristic only of *G. flavilabris* within the revised subgenus *Glycaspis,* with that of *G. minuscula* intermediate to *G. flavilabris* and *G. eucalypti.* All other species at present known to have the stem of M+Cu short, are referable to the new subgenus erected in this paper.

Those species previously referred to the subgenus *Alloglycaspis* (Moore 1961, 1964, 1964a) must now be regarded as constituting the subgenus *Glycaspis* (*Glycaspis*) with *G. flavilabris* (*non G. baileyi* Moore 1961) as the type-species, and those species (except *G. flavilabris*) previously assigned to the old subgenus *Glycaspis* (*Glycaspis*) (see Moore 1961, 1961a) now constitute a new subgenus.

All further references to species and subgenera in this paper are used according to this corrected interpretation *sensu stricto.*

The corrected interpretation of the presumed evolution of species in *Glycaspis* is represented by the following sequence of subgenera, progressing from the most primitive group to the more recent:-

Subgen. nov. ——— *Glycaspis* ——— *Boreioglycaspis.*

The Genus *Glycaspis*

Glycaspis Taylor 1960, pp. 384-385, Pl. 1, figs. 2 & 3.

Spondyliaspis sensu Schwarz (non Signoret, 1879): Schwarz 1898, Proc. Ent. Soc. Washington, *4*:68-69.

Spondyliaspis sensu Schwarz: Froggatt 1900, Proc. Linn. Soc. N.S.W., *25*(2): 288-289.

Spondyliaspis sensu Schwarz: Tuthill & Taylor 1955, Aust. J. Zool. *3*(2): 230-231.

Type-species: *Glycaspis flavilabris* (Froggatt)

Type Locality: Rylstone, New South Wales.

Taylor defined the principal characters of the genus on knowledge concerning the species at that time. Additional information is now available, and the principal characters are re-defined as:-

Genal processes from about two-thirds as long as, to much longer than, the vertex; processes porrect to vertical.

Antennae longer than width of head.

Forewing long; acutely angulate to rounded, apically; pterostigma present; Rs long, almost parallel with costa and terminating near or at apex of wing; stem of M+Cu short or long.

Metatibia shorter than, or equal in length to, femur; enlarged distally and bearing a variable number of dark spines apically.

Proximal segment of metatarsus pad-like, swollen, bearing a strong ventral distal claw.

As suggested by Heslop-Harrison (1949), classification of any particular psyllid group presents inherent difficulties, and the genus *Glycaspis* appears to be no exception.

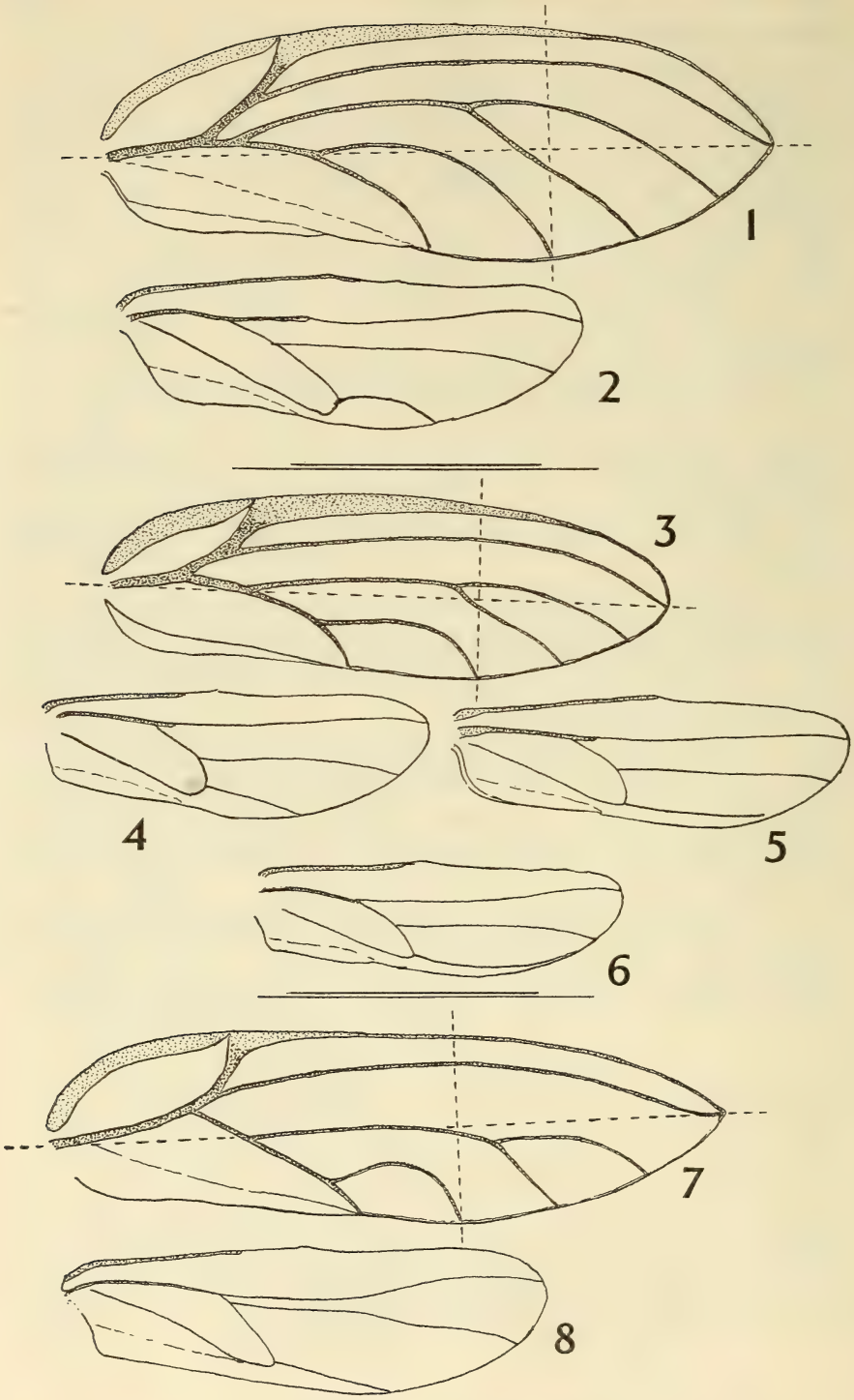
The three subgenera fall within loosely defined limits, and some characters whereby they may be separated, are presented. Single characters are dealt with serially, for ease of reference.

Characters by which the three subgenera may be separated

1. *Proximal angle of cell M of forewing*:
   Commencing well before the projected termination of Cu_1 from posterior border of forewing (Text-fig. 1) ..... Subgen. nov.
   Commencing near or at the projected termination of Cu_1 from posterior border of forewing (Text-fig. 3) ..... *Glycaspis*
   Commencing distal to the projected termination of Cu_1 from posterior border of forewing (Text. fig. 7) ..... *Boreioglycaspis*
2. *Cubital cell of forewing*:
   Large, long, with Cu_1 strongly curved towards its base (Text-fig. 1) ..... Subgen. nov.
   Intermediate in size, with basal half of Cu_1 more or less parallel with M (Text-fig. 3) ..... *Glycaspis*
   Small (Text-fig. 7) ..... *Boreioglycaspis*
3. *Stem of M+Cu of forewing*:
   Short (Text-fig. 1) (except *G. flavilabris*) ..... Subgen. nov.
   Short or long; that of *G. flavilabris* short, and that of *G. minuscula* intermediate to it and *G. eucalypti* (Text-fig. 3) ..... *Glycaspis*
   Long (Text-fig. 7) ..... *Boreioglycaspis*
4. *Forewing apically*:
   Subacute (Text-fig. 1) ..... Subgen. nov.
   More or less rounded (except *flavilabris*) (Text-fig. 3) ..... *Glycaspis*
   Acute (except *penangensis* & *forcipata*) (Text-fig. 7) .... *Boreioglycaspis*
5. *Claspers*:
   With or without dark pegs and/or strong basal spine (Text-figs. 9 to 44) ..... Subgen. nov.
   Without dark pegs or basal spine (Text-figs. 45 to 123) ..... *Glycaspis*
   With dark pegs but without basal spine (Text-figs. 124 to 131) ..... *Boreioglycaspis*
6. *Distal segment of male proctiger*:
   Much shorter than proximal segment (see Moore 1964b, Text-fig. 12) ..... Subgen. nov. & *Glycaspis*
   About equal to proximal segment (see Moore 1964b, Text-figs. 13 & 14) ..... *Boreioglycaspis*
7. *Aedeagus*:
   Single-jointed (Text-figs. 9 to 123) ..... Subgen. nov. & *Glycaspis*
   Two-jointed (Text-figs. 124 to 131) ..... *Boreioglycaspis*
8. *Origin of veins M & R of hindwings*:
   Well separated (Text-figs. 2 & 4 to 6) ..... Subgen. nov. & *Glycaspis*
   Close together (Text-fig. 8) ..... *Boreioglycaspis*

Characters under 1. and 2. are definitive for each subgenus, while those under 3. indicate a phylogenetic link between the new subgenus and *Glycaspis*.

Figures 1-8. Wings of *Glycaspis* spp. representative of the three subgenera.
(Figs. 1 and 2) *Glycaspis* (*Synglycaspis*)
(Figs. 3 to 6) *Glycaspis* (*Glycaspis*)
(Figs. 7 and 8) *Glycaspis* (*Boreioglycaspis*)



(For explanation of figures, see page 253)

Subgenus *Synglycaspis,* nov.
(Gr. *syn-* = together)

Glycaspis (*Glycaspis*): Moore 1961, pp. 128-148, Text-figs. 5 to 23, Pl. vi, figs. 1 to 4.

Type Species: *Glycaspis* (*Synglycaspis*) *longaeva,* sp. nov. (here designated).

Type Locality: Queen's Domain, Hobart, Tasmania.

Gall Formers

All species are very similar in coloration, usually being pale yellow to orange, with or without some dark markings, sometimes with green suffusion in living or dried specimens. Any deviation from this general coloration pattern is recorded under the relevant species.

Present taxonomic arrangement of the 15 gall-forming species studied, is based on the sequential reduction in size of the large internal basal spine on the male claspers. These spines are absent from the claspers of four species in which they are apparently replaced by a dense series of strong pegs or setae (Text-figs. 20 to 23).

Glycaspis (*Synglycaspis*) *brunosa,* sp. nov.
(*L. brunus* = brown; *-osus* = full of, prone to)

General Colour: Orange brown to dark brown; female wings suffused deep yellow.
Claspers & Aedeagus: As in Text-fig. 9.
Length of Aedeagus: (3 specimens) 0.293mm. to 0.315mm.
Host Plant: *Eucalyptus coccifera* Hook. f. (Mt. Wellington peppermint).
Type Locality: Mt. Wellington (near summit), Tasmania.
Types: Holotype male on slide labelled "Mt. Wellington, Tas., 3500'-4000', 21 xii 1966, *E. coccifera*". Paratypes (slides): 2 ♂s with same label data except date which is "14 xii 1966". (in alcohol): 1♂ 6♀s "Mt. Wellington, Tas., 14 xii 1966, *E. coccifera*"; 2♀s with same label data except date which is "21 xii 1966"; 1♀ "Cradle Mtn., Tas., 4500', 1 i 1967, *E. coccifera*". (dried specimens): 2♀s ,'Mt. Wellington, Tas., 2 xi 1959, K. L. Taylor, *E. coccifera*".

Glycaspis (*Synglycaspis*) *obvelata,* sp. nov.
(*L. obvelatus* = hidden, covered)

Claspers & Aedeagus: As in Text-fig. 10.
Length of Aedeagus: (1 specimen) 0.320mm.
Host Plant: *E. ?sieberi* L. Johnson (mountain ash).
Type Locality: 22 mi. north of Bicheno, Tasmania.
Type: Holotype male on slide labelled "22 mi. N. Bicheno. Tas. (1500'), 28 xii 1966, *E. ?sieberi*".
Other Specimens Examined: (Slides): 1♂ Mt. Macedon, Vic., 25 x 1963, A.N.", to VM. 3♂s "French's Forest, N.S.W., 11 vii 1951, K. L. Taylor, *Eucalyptus* sp.: 1♂ "Warrandyte, Vic., 25 vii 1928, G. F. Hill, emgd. 31 vii 1928."

Glycaspis (*Synglycaspis*) *occulta,* sp. nov.
(*L. occultus* = hidden)

Claspers & Aedeagus: As in Text-fig. 11.
Length of Aedeagus: (1 specimen) 0.302 mm.
Host Plant: *Eucalyptus ? simmondsi* Maiden (Simmond's peppermint).
Type Locality: Inglis River, Tasmania.
Type: Holotype male on slide labelled "Inglis Riv., Tas., 4 xii 1966, *E. ?simmondsii*".
Other Specimens Examined: (slide) 1♂ "Black Mtn. A.C.T. 5 xii 1956, K. L. Taylor, *E. macrorhyncha*".

Glycaspis (*Synglycaspis*) *perthecata,* comb. nov.
Glycaspis (*Glycaspis*) *perthecata* Moore 1961, p. 138, Text-fig. 13.

Claspers & Aedeagus: As in Text-fig. 12.
Length of Aedeagus: (1 specimen) 0.311 mm.

Host Plant: *E. haemastoma* Sm. (scribbly gum).
Type Locality: Ourimbah State Forest, N.S.W.
Type: Holotype in AM.

Glycaspis (*Synglycaspis*) *longaeva*, sp. nov.
(*L. longaevus* = of great age, ancient)

General Colour: Deep yellow to orange; wings suffused yellow.
Claspers & Aedeagus: As in Text-fig. 13.
Length of Aedeagus: (3 specimens) 0.279 mm. to 0.290 mm.
Host Plant: *E. linearis* Dehn. (white peppermint).
Type Locality: Queen's Domain, Hobart, Tasmania.
Types: Holotype male on slide labelled "Domain, Hobart, Tas., 17 xii 1966, *E. linearis*". Paratypes (slides): 2♂s with same label data. (in alcohol): 30♂s, 37♀s with same label data.
Other Specimens Examined: (dried) 2♀s "Domain, Hobart, Tas., 31 x 1959, K. L. Taylor, *E. linearis*."
Notes: The narrow leaves of the host plant are distinctively bent upwards from near the centre of their length where the gall is usually formed.

Glycaspis (*Synglycaspis*) *cellula*, sp. nov.
(*L. cellula* = a small cell or chamber)

Claspers & Aedeagus: As in Text-fig. 14.
Length of Aedeagus: (1 specimen) 0.290 mm.
Host Plant: *E. ? amygdalina* Labill. (black peppermint).
Type Locality: 5 mi. NW. of St. Helen's, Tasmania.
Type: Holotype male on slide labelled "5 mi. NW. St. Helen's, Tas., 29 xii 1966, reared from *E. ? amygdalina*, emgd. 1 i 1967."
Other Specimens Examined: (in alcohol) 1♀ "1 mi. W. Kimberley, Tas., 31 xii 1966, *E. ? amygdalina*."

Glycaspis (*Synglycaspis*) *cyta**, comb. nov.
Glycaspis (*Glycaspis*) *cytos* Moore 1961, pp. 135-136, Text-fig. 10.

Claspers & Aedeagus: As in Text-fig. 15.
Length of Aedeagus: (1 specimen) 0.403 mm.
Host Plant: *E. pilularis* Sm. (blackbutt).
Type Locality: Kincumber, N.S.W.
Types: Holotype, paratypes, in AM.

Glycaspis (*Synglycaspis*) *inclusa*, comb. nov.
Glycaspis (*Glycaspis*) *inclusa* Moore 1961, p. 135, Text-fig. 9.

Claspers & Aedeagus: As in Text-fig. 16.
Length of Aedeagus: (3 specimens) 0.309 mm. to 0.313 mm.
Host Plants: *E. umbra* R. T. Bak. (bastard mahogany); *? E. macrorhyncha* F. Muell. (red stringybark).
Type Locality: Mangrove Mtn., N.S.W.
Types: Holotype, paratype in AM.
Other Specimens Examined: (Slides) 1♂ "Black Mtn. ACT., 5 xii 1956, K. L. Taylor, *E. macrorhyncha*"; 1♂ "Clyde Mtn. N.S.W., 2400', 17 x 1960, I. F. B. Common & M. S. Upton; (Dried) 1♀ "Black Mtn., ACT., 5 xii 1956, K. L. Taylor, *E. macrorhyncha*"

Glycaspis (*Synglycaspis*) *encystis*, comb. nov.
Glycaspis (*Glycaspis*) *encystis* Moore 1961, p. 136, Text-fig. 11.

Claspers & Aedeagus: As in Text-fig. 17.
Length of Aedeagus: (3 specimens) 0.295 mm. to 0.320 mm.
Host Plant: *E. agglomerata* Maiden (blue-leaved stringybark).
Type Locality: Ourimbah State Forest, N.S.W.
Types: Holotype & paratypes in AM.
Other Specimens Examined: (Slide) 1♂ "Warrandyte, Vic., 25 vii 1928, G. F. Hill, Emgd. 31 vii 1928".

Glycaspis (*Synglycaspis*) *amplificata*, comb. nov.
Glycaspis (*Glycaspis*) *amplificata* Moore 1961, p. 135, Text-fig. 8.

Claspers & Aedeagus: As in Text-fig. 18.

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* The Greek word *kytos* is latinised and rendered in the feminine gender, to agree with *Glycaspis* which is of feminine gender.

Length of Aedeagus: (1 specimen) 0.274 mm.
Host Plant: *E. acmenioides* Schau. (white mahogany).
Type Locality: Ourimbah State Forest, N.S.W.
Type: Holotype in AM.

Glycaspis (*Synglycaspis*) *cyrtoma*, comb. nov.

Glycaspis (*Glycaspis*) *cyrtoma* Moore 1961, p. 136, Text-fig. 12.
Claspers & Aedeagus: As in Text-fig. 19.
Length of Aedeagus: (1 specimen) 0.315 mm.
Host Plant: *E. piperita* Sm. (Sydney peppermint).
Type Locality: Olney East State Forest, N.S.W.
Type: Holotype in AM.

Glycaspis (*Synglycaspis*) *belua*, sp. nov.
(*L. belua* = a monster)

Claspers & Aedeagus: As in Text-fig. 20.
Length of Aedeagus: (4 specimens) 0.323 mm. to 0.389 mm.
Host Plant: *E. niphophila* Maiden & Blakely (snow gum).
Type Locality: Mt. Gingera, Australian Capital Territory.
Types: Holotype male on slide labelled "Mt. Gingera, A.C.T., 20 ii 1953, K. L. Taylor, *E. niphophila*". Paratypes: (slides) 3♂s with same label data. (dried) 7♂s 7♀s with same label data.
Notes: This is the largest species of *Glycaspis* known. It is grouped with the following 3 spp. which do not bear a large basal spine on the male claspers.

Glycaspis (*Synglycaspis*) *commoni*, sp. nov.

(Named for Dr. I. F. B. Common, of the C.S.I.R.O., Canberra. who collected a large number of specimens of this genus).
Claspers & Aedeagus: As in Text-fig. 21.
Length of Aedeagus: (1 specimen) 0.243 mm.
Host Plant: Unknown.
Type Locality: Mt. Buangor, 13 mi. N.E. Beaufort, Victoria.
Type: Holotype male on slide labelled "Mt. Buangor, 1400', 13 mi. N.E. Beaufort, Vic., 14 ii 1956, I. F. B. Common".
Other Specimens Examined: (dried) 1♀ with same label data.

Glycaspis (*Synglycaspis*) *munita*, sp. nov.
(*L. munitus* = protected; referring to the nymph within the gall).

General Colour: Orange; numerous dark marks; wings of females yellow.
Claspers & Aedeagus: As in Text-fig. 22.
Length of Aedeagus: (2 specimens) 0.248 mm. and 0.270 mm.
Host Plant: *E. simmondsii*.
Type Locality: 22 mi. E. Queenstown, Tasmania.
Types: Holotype male on slide labelled "22 mi. E. Queenstown, Tas., 9 xii 1966, *E. simmondsii*". Paratypes: (slides) 1♂ with same label data. (in alcohol) 2♀s with same label data.

Glycaspis (*Synglycaspis*) *immaceria*, sp. nov.
(*L. im* = in; *maceria* = an enclosure, wall)

Claspers & Aedeagus: As in Text-fig. 23.
Length of Aedeagus: (1 specimen) 0.281 mm.
Host Plant: *E. rossii* R. T. Bak. & H. G. Smith (white gum).
Type Locality: Black Mountain, Australian Capital Territory.
Types: Holotype male on slide labelled "Black Mtn., A.C.T., 17 i 1967, *E. rossii*". Paratype (in alcohol): 1♀ with same label data.

Flat Lerp-formers

Two structural types of flat lerps are now known—(a) those of fine texture constructed in more or less the same plane as the leaf surface, with the nymphs forming pits in the leaf surface, in which they feed; (b) those of granular texture and slightly raised as a dome above the leaf surface, and with little or no pitting of the leaf.

From an examination of a large number of specimens constructing flat lerps, extensively collected from many areas during this project, and from numerous host species of the renantherous *Eucalyptus* spp., characters of the

adults do not appear to be sufficiently well defined to erect more than two new species, so that all recently collected material other than that from *E. rodwayi* (= Tasmanian *E. aggregata*), is included in a single new species. Because of present uncertainty with the morphological separation and recognition of species in this group, it is considered advisable to allow the previously described species to stand, until further essential intensive biological studies are made to resolve this uncertainty.

The species on *E. rodwayi* is being described as new, because of the distinctive lerp shape. Including the 2 species described here, there are now 5 spp. known which construct flat lerps.

Glycaspis (*Synglycaspis*) *planitecta*, sp. nov.
(*L. planus* = flat; *tectum* = a roof)

General Colour: Pale yellow to orange; with or without variable dark markings.
Claspers & Aedeagus: As in Text-fig. 24.
Length of Aedeagus: (34 specimens) 0.196 mm to 0.265 mm.
Host Plants: *E. obliqua* L'Herit. (messmate); *E. baxteri* (Benth.) Maiden & Blakely (Baxter's stringybark); *E. caliginosa* Blakely & McKie (broad-leaved stringybark); *E. oblonga* DC. (common sandstone stringybark); *E. ?macrorhyncha; E. diversifolia* Bonpl. (soap mallee); *E. simmondsii; E. robertsonii* Blakely. (Robertson's peppermint); *E. ?amygdalina; E. coccifera; E. stellulata* Sieb. ex DC. (black sally); *E. rossii; E. pauciflora* Sieb. ex Spreng. (cabbage gum); *E. niphophila; E. dives* Schau. (broad-leaved peppermint).
Type Locality: Mt. Lofty (near summit), South Australia.
Types: Holotype male on slide labelled "Mt. Lofty, S.A., 8 xi 1966, *E. obliqua*". Paratypes: (slides) 1♂ with same label data as the holotype; 1♂ "23 mi. S. Keith, S.A., 15 xi 1966, *E. obliqua* with affin. *E. baxteri*"; 3♂s "22 mi. S. Keith, S.A., 15 xi 1966, *E. diversifolia*"; 3♂s "Olinda Ck., Vic., 27 xi 1966, *E. obliqua*"; 3♂s "2 mi. E. Foster, Vic., 5 i 1967, *E. ?obliqua*; 1♂ "25 mi. E. Port Campbell, Vic., 21 xi 1966, *E. ?obliqua*"; 1♂ "2 mi. N. Cranbourne, Vic., 4 i 1967, *E. ?robertsonii*"; 1♂ "7 mi. NE. Loch, Vic., 4 i 1967, *E. robertsonii*"; 1♂ "22 mi. N. Bicheno, Tas., 28 xii 1966, *E. ?obliqua*"; 1♂ "Mt. Wellington, Tas., 21 xii 1966, *E. coccifera*"; 1♂ "1 mi. E. Ferntree (Hobart) Tas., 14 xii 1966, *E. amygdalina*"; 1♂ "9 mi. N. Triabunna, Tas., 27 xii 1966, *E. ?amygdalina*"; 2♂s "22 mi. E. Queenstown, Tas., 9 xii 1966, *E. simmondsii*"; 1♂ "Inglis Riv., Tas., 4 xii 1966, *E. amygdalina - E. simmondsii* cline"; 1♂ "Lake St. Clair, Tas., 10 xii 1966, *E. ?simmondsii*"; 2♂s "20 mi. N. Berridale, N.S.W., 10 i 1967, *E. ?pauciflora*"; 2♂s "5 mi. N. Adaminaby, N.S.W., 10 i 1967, *E. stellulata*"; 1♂ "Scammel's Spur, N.S.W., 9 i 1967, *E. dives*"; 1♂ "14 mi. S. Kiandra, N.S.W., 11 i 1967, *Euc.* sp."; 1♂ "Mt. York, Blue Mts., N.S.W., 1 ii 1967, *Euc.* sp."; 2♂s "Ben Bullen, N.S.W., 1 ii 1967, *Euc.* sp."; 2♂s "Black Mtn., A.C.T., 17 i 1967, *E. rossii*".
(in alcohol): 5♂s 7♀s, "Mt. Lofty, S.A., 8 xi 1966, *E. obliqua*"; 4♀s "23 mi. S. Keith, S.A., 15 xi 1966, *E. obliqua* affin. *E. baxteri*"; 15♂s 23♀s "22 mi. S. Keith, S.A., 15 xi 1966, *E. diversifolia*"; 1♀ "2 mi. E. Stoke's Bay, Kangaroo Id., S.A., 4 xi 1966, *Euc.* sp."; 1♀ "Kangaroo Id., S.A., 4 xi 1966, *E. ?diversifolia*; 1♂ 2♀s "Olinda Ck., Vic., 27 xi 1966, *E. obliqua*"; 2♀s "25 mi. E. Port Campbell, Vic., 21 xi 1966, *E. ?obliqua*"; 4♂s 10♀s "Foster, Vic., 5 i 1967, *E. ?obliqua*"; 2♀s "22 mi. N. Omeo, Vic., 7 i 1967, *E. pauciflora*"; 20♂s 40♀s "7 mi. NE. Loch, Vic., 4 i 1967, *E. robertsonii*"; 3♀s "2 mi. N. Cranbourne, Vic., 4 i 1967, *E. ?robertsonii*"; 2♀s "1 mi. along Rose's Gap Rd. (Grampians) Vic., 18 xi 1966, *E. baxteri*"; 1♀ "Mt Difficult (Grampians) Vic., 18 xi 1966, *Euc.* sp."; 1♂ 12♀s "22 mi. N. Bicheno, Tas., 28 xii 1966, *E. ?obliqua*"; 1♂ 1♀ "6 mi. S. Buckland, Tas., 27 xii 1966, *E. ?obliqua*"; 8♂s 17♀s "5 mi. S. Cygnet, Tas., 18 xii 1966, *E. ?obliqua*"; 5♀s "22 mi. E. Queenstown, Tas., 9 xii 1966, *E. simmondsii*"; 2♀s "Inglis Riv., Tas., 4 xii 1966, *E. amygdalina - E. simmondsii*

cline"; 1♀ "1 mi. W. Kimberley, Tas., 31 xii 1966, *E. ?amygdalina*"; 2♀s "Mt. Wellington, Tas., 21 xii 1966, *E. coccifera*"; 2♀s "Mt. Wellington, Tas., 14 xii 1966, *E. coccifera*"; 1♂ 7♀s "9 mi. N. Triabunna, Tas., 27 xii 1966, *Euc.* sp."; 2♀s "5 mi. NW. St. Helen's, Tas., 29 xii 1966, *Euc.* sp."; 8♀s "11 mi. W. Jindabyne, N.S.W., 10 i 1967, *E. pauciflora*"; 4♀s "4 mi. E. Jindabyne, N.S.W., 10 i 1967, *E. ?pauciflora*"; 1♂ 6♀s "20 mi. N. Berridale, N.S.W., 10 i 1967, *E. ?pauciflora*"; 4♀s "1 mi. W. and 8 mi. E. Thredbo, N.S.W., 9 i 1967, *E. ?pauciflora*"; 1♀ "3 mi. N. Goulburn, N.S.W., 18 i 1967, *E. rossii*"; 3♀s "18 mi. E. Armidale, N.S.W., 9 iv 1966, *E. caliginosa*"; 4♀s "3 mi. S. Kiandra, N.S.W., (4850'), 11 i 1967, *E. niphophila*"; 4♀s "5 mi. N. Adaminaby, N.S.W., 10 i 1967, *E. stellulata*"; 1♀ "14 mi. S. Kiandra, N.S.W, 11 i 1967, *Euc.* sp."; 2♂s 4♀s "Ben Bullen, N.S..W., 1 ii 1967, *Euc.* sp."; 1♀, same locality, "30 viii 1964"; 3♀s "6 mi. S. Rylstone, N.S.W., 1 ii 1967, *E. oblonga*"; 1♂ 1♀ "1 mi. W. Rylstone, N.S.W., 1 ii 1967, *E. ?oblonga*"; 1♂ 5♀s "Black Mtn., A.C.T., 17 i 1967, *E. rossii*"; 1♂ 2♀s "Black Mtn., A.C.T., 17 i 1967, *E. ?macrorhyncha*".

Other Specimens Examined: (Slides): 2♂s 1♀ "Grove, Tas., 4 i 1963, 14 i 1963, 21 i 1963, to TA; Newtown, Tas., 5 ix 1962; ex Moericke Yellow Tray", to TA; 1♂ Arve Riv. Tas., 23 ii 1963, I. F. B. Common & M. S. Upton"; 1♂ "Clyde Mtn., N.S.W., 2400', 17 x 1960, I. F. B. Common & M. S. Upton". (Dried): 2♂s 8♀s "Arve Riv., Tas., 23 ii 1963, I. F. B. Common & M. S. Upton"; 1♂ 1♀ "Arve Riv. Tas., 3 xi 1959, K. L. Taylor, *E. obliqua*".

Notes: Leaves on *E. diversifolia* are severely curled when attacked.

Glycaspis (*Synglycaspis*) *tagmata*, sp. nov.

(Gr. *tagmatos* = a division. Referring to the indication given by this species of a division from other known species constructing flat lerps).

Claspers & Aedeagus: As in Text-fig. 25.
Length of Aedeagus: (3 specimens) 0.200 mm. to 0.209 mm.
Host Plant: *E. rodwayi* R. T. Bak. & H. G. Sm. (= Tasmanian "*E. aggregata*").
Type Locality: Great Lake, Tasmania
Types: Holotype male on slide labelled "Great Lake, Tas., 28 x 1959, D. Martin, *E. rodwayi* (= *aggregata*)". Paratypes: (slides) 2♂s with same label data. (dried) 3♀s with same label data. A series of 9 lerps has also been examined.
Notes: The lerps of this species are of different form and structure from other flat lerps constructed by species reared by the writer (Moore 1961, Pl. vi, figs. 2 & 3). In structure, they are granular and similar to the conical round lerps of this subgenus. In shape they are more or less round with a flattened dome. A slight depression in the leaf surface below the lerp is evident.

Glycaspis (*Synglycaspis*) *nundlensis*, comb. nov.

Glycaspis (*Glycaspis*) *nundlensis* Moore 1961b, pp. 201-202, Text-fig. 1.

Claspers & Aedeagus: As in Text-fig. 26.
Length of Aedeagus: (2 specimens), each 0.214 mm.
Host Plant: *E. radiata subplatyphylla* Blakely & McKie (almond-leaved peppermint)
Type Locality: Nundle State Forest, New South Wales.
Types: Holotype & paratype in AM.
Specimens Examined: 1♂ "Black Mtn., A.C.T., 14 ii 1955, I. F. B. Common. Light trap."

Glycaspis (*Synglycaspis*) *phreata**, comb. nov.

Glycaspis (*Glycaspis*) *phreatos* Moore 1961, p. 138, Text-fig. 14.

Claspers & Aedeagus: As in Text-fig. 27.

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* The Greek word *phreatos* is latinised, and the gender is altered to agree with the generic name.

Length of Aedeagus: (3 specimens) 0.236 mm. to 0.250 mm.
Host Plant: *E. oblonga* DC. (common sandstone stringybark).
Type Locality: Wentworth Falls, N.S.W.
Types: Holotype in AM; paratypes in AM and CS.

Glycaspis (*Synglycaspis*) *planaria*, comb. nov.

Glycaspis (*Glycaspis*) *planaria* Moore 1961, p. 138, Text-fig. 15.

Claspers & Aedeagus: As in Text-fig. 28.
Length of Aedeagus: (1 specimen) 0.245 mm.
Host Plant: *E. piperita*.
Type Locality: Wentworth Falls, N.S.W.
Type: Holotype in AM.

Round Lerp-formers

This group now contains 16 species.

Three divergent sub-groups occur:- (i) one species occurring on *E. coccifera* and one on *E. linearis;* (ii) one species occurring on *E. acmenioides* and one on *E. umbra;* (iii) the remaining 12 spp. in this subgenus.

Glycaspis (*Synglycaspis*) *nigrocincta* (Froggatt), comb. nov.

Spondylaspis nigro-cincta Froggatt 1903, pp. 324-5, Pl. 5, figs. 2 & 6.
Spondyliaspis nigrocincta: Tuthill & Taylor 1955, p. 231.
Glycaspis nigrocincta: Taylor 1960, p. 385.
Glycaspis (*Glycaspis*) *nigro-cincta*: Moore 1961, p. 132.

General Colour: Yellow, extensively marked with black.
Claspers & Aedeagus: As in Text-fig. 29.
Length of Aedeagus: (5 specimens) 0.212 mm. to 0.221 mm.
Host Plants: *E. coccifera; E. delegatensis* R. T. Bak. (gum-top stringybark ash); *E. rodwayi.*
Type Locality: Mt. Wellington (near summit), Tasmania.
Specimens Examined: (slides) 1♂ "Summit of Mt. Wellington, Tas. (Lea)", (from card with 3♀s); to TA; 1♂ "Mt. Wellington, Tas., 3500'-4000', 21 xii 1966, *E. coccifera*"; 1♀ "Summit of Mt. Wellington, Tas. (Lea) 12/02, Type, 20 iii 1902, W.W.F."; 2♂s "Guildford Junction, Tas., 7 xii 1966, *E. rodwayi*"; 2♂s "24 mi. N. Tullah, Tas., 7 xii 1966, *E. delegatensis*". (in alcohol): 1♂ 3♀s Mt. Wellington, Tas., 3500'-4000', 21 xii 1966, *E. coccifera*"; 1♀ with same label data, but date "14 xii 1966"; 1♂ 6♀s "24 mi. N. Tullah, Tas., 7 xii 1966, *E. delegatensis*"; 1♀ "6 mi. S.E. Tarraleah, Tas., 11 xii 1966, *E. delegatensis*". (dried specimens): 3♀s on one card labelled "Summit of Mt. Wellington, Tas., (Lea)", to TA.; 1♀ "Cradle Mtn., Tas., Carter & Lea", to SM; 1♀ "on *Eucalyptus coccifera*".
Notes: At the conclusion of Froggatt's original description of this species, he gives the data:- "Hab.- Mt. Wellington, Hobart, Tasmania (on *Eucalyptus coccifera;* A. M. Lea; two specimens ♂)".

Specimens loaned from the Tasmanian Department of Agriculture collection included 1♂ 3♀s all mounted on a single card, with label data "Summit of Mt. Wellington, Tas., (Lea)". A single ♀ whole mount on a slide, loaned from the National Insect Collection, Canberra, A.C.T., bears label data "Summit of Mt. Wellington, Tas. (Lea)". Both of these labels are machine printed. On the label of the single ♀ specimen is the date "12/02" handwritten in ink, and the slide also bears a second label with the data "Type 20.3.1902. W.W.F.", also handwritten in ink. This second label bears 3 pinholes, indicating that it may have been transferred from other specimens.

From the relevant data given in Froggatt's paper and quoted above, it is considered that none of these specimens was before Froggatt when he described the species, so that they cannot be treated as syntypes.

The two male specimens referred to by Froggatt appear to be lost or destroyed, and the abovementioned specimens are being treated as *G. nigrocincta,* without designating a Neotype or Lectotype.

The only male specimen mentioned above, from the card also bearing 3 female specimens, has been placed on a slide as a whole mount. An additional male specimen collected by the writer from *E. coccifera* near the summit of Mt. Wellington, Tasmania, was also placed on a slide, and the morphology of the claspers and aedeagus of each specimen was found to correspond. These two male specimens are considered to be the material most suitable for the future recognition of the species *G. nigrocincta.*

During December, 1966, two other species forming galls and flat lerps respectively, were collected from *E. coccifera* near the summit of Mt. Wellington, where Lea apparently obtained his specimens. On comparison with the specimens collected by Lea, and with Froggatt's description of *G. nigrocincta,* it is clear that neither of these two species are *G. nigrocincta.*

All of the material mentioned under "Specimens Examined" is considered to be *G. nigrocincta.*

Glycaspis (*Synglycaspis*) *temenicola,* sp. nov.

(Gr. *temenos* = a piece of land marked off for common uses; *L. -icola* = an inhabitant. Referring to the type locality).

General Colour: Cream to pale yellow, with dark marks.
Claspers & Aedeagus: As in Text-fig. 30.
Length of Aedeagus: (8 specimens) 0.209 mm. to 0.234 mm.
Host Plants: *E. linearis; E. simmondsii; E. ?pauciflora.*
Type Locality: Queen's Domain, Hobart, Tasmania.
Types: Holotype male on slide labelled "Domain, Hobart, Tas., 17 xii 1966, *E. linearis*"; Paratypes: (slides) 2♂s with same label data; 3♂s "Point Lookout (E. of Armidale), N.S.W., 9 iv 1966, *E. ?pauciflora*"; 2♂s "22 mi. E. Queenstown, Tas., 9 xii 1966, *E. simmondsii*"; 1♂ "Domain, Hobart, Tas., 31 x 1959, K. L. Taylor, *E. linearis*". (in alcohol): *ca.* 150♂s 150♀s with same label data as the holotype; 15♂s 29♀s "Pt. Lookout, N.S.W., 9 iv 1966, *E. ?pauciflora*"; 4♂s 4♀s "22 mi. E. Queenstown, Tas., 9 xii 1966, *E. simmondsii*"; 1♀ "Guildford Junction, Tas., 7 xii 1966, *Euc.* sp.".
Notes: Adults may be distinguished from those of *G. nigrocincta* by their paler coloration and smaller size;; the spine on the claspers is nearer the base than that of *nigrocincta,* is different in shape, and bears fewer setae.

Glycaspis (*Synglycaspis*) *dreptodria,* sp. nov.

(Gr. *dreptos* = gathered; *drios* = a thicket)

Claspers & Aedeagus: As in Text-fig. 31.
Length of Aedeagus: (9 specimens) 0.281 mm. to 0.295 mm.
Host Plants: *E. simmondsii; E. pauciflora; E. ?radiata; E. ?stellulata; E. ?amygdalina; E. niphophila.*
Type Locality: 42 mi. E. Queenstown, Tasmania.
Types: Holotype male on slide labelled "42 mi. E. Queenstown, Tas., 9 xii 1966, *E. simmondsii*". Paratypes: (slides) 1♂ with same label data as holotype; 3♂s "Hanging Rock S F., N.S.W., 4100', 6 iii 1961, K. L. Taylor, *E. pauciflora*"; 4♂s "Lee's Spring, A.C.T., 4000', 27 iii 1951, I. F. B. Common, *E. niphophila*". (in alcohol) 3♀s with same label data as the holotype. (dried) 3♂s 12♀s "Hanging Rock S.F., N.S.W., 4100', 6 iii 1961, K. L. Taylor, *E. pauciflora*".
Other Specimens Examined: (slides) 5♂s "5 mi. N. Adaminaby, N.S.W., 10 i 1967, *E. stellulata*"; 1♂ "5 mi. NW. St. Helens, Tas., 29 xii 1966, *E. ?amygdalina*"; 2♂s "2 mi. NE. Woodside, Vic., 5 i 1967, *E. radiata*"; 1♂ "Arve Riv., Tas., 23 ii 1963, I. F. B. Common & M. S. Upton"; 1♂ "Point Lookout, Armidale, N.S.W., 9 iv 1966, *E. ?pauciflora.* (in alcohol) 12♂s 11♀s "5 mi. N. Adaminaby, N.S.W., 10 i 1967, *E. stellulata*"; 6♀s "5 mi. N. St. Helens, Tas., 29 xii 1966, *E. ?amygdalina*"; 1♂ 9♀s "2 mi. NE. Woodside, Vic., 5 i 1967, *E. radiata*"; 3♀s "9 mi. N. Triabunna, Tas., 27 xii 1966, *E. ?amygdalina*"; 1♀ "22 mi. E. Queenstown, Tas., 9 xii 1966, *E. simmondsii*";

1♀ "35 mi. W. Scottsdale, Tas., 29 xii 1966, *Euc.* sp."; 1♀ "5 mi. E. Smithton, Tas., 6 xii 1966, *E. amygdalina - E. simmondsii* cline". (dried) 2♀s "Lee's Spring, A.C.T., 4000', 27 iii 1951, I. F. B. Common, *E. niphophila*".

Glycaspis (*Synglycaspis*) *particeps*, sp. nov.
(L. *particeps* = a sharer. Referring to the occurrence of this species with another *Glycaspis* sp. on the same host).

Claspers & Aedeagus: As in Text-fig. 32.
Length of Aedeagus: (5 specimens) 0.236 mm. to 0.265 mm.
Host Plants: *E. baxteri; ?E oblonga; ?E. caliginosa; E. macrorhyncha; E. obliqua.*
Type Locality: 23 mi. S. Keith, South Australia.
Types: Holotype male on slide labelled "23 mi. S. Keith, S.A., 15 xi 1966, *E. obliqua*". Paratypes (slides) 2♂s "Keith, S.A., 18 vii 1963, T. C. R. White, eggs hatched 20 vii, adults emgd. 7, 10, 12 viii '63, Rearing Nos. 70, 80, 90, *E. baxteri*"; 2♂s "Wirrega, (nr. Brecon) S.A., 23 iv 1969, T. C. R. White, *E. baxteri*, reared in lab., emgd. 18-20 v 1969". (in alcohol) 2♀s with same label data as the holotype; 2♂s 3♀s "2 mi. E. Foster, Vic., 5 i 1967, *E.? obliqua*"; 1♂ "5 mi. S. Cygnet, Tas., 18 xii 1966, *E. ?obliqua*"; 2♂s 4♀s "Wirrega, (nr. Brecon) S.A., 23 iv 1969, T. C. R. White, *E. baxteri*, reared in lab., emgd. 18-20 v 1969"; 2♀s, nymph, "Keith, S.A., 18 vii 1963, T. C. R. White, eggs hatched 20 vii 1963, adults emgd. 7, 10, 12 viii 1963, Rearing Nos. 70, 80, 90, *E. baxteri*"; 1♀ "8 mi. W. Peterborough, Vic., 20 xi 1966, *E. obliqua*".
Other Specimens Examined: (slides) 2♂s "6 mi. S. Rylstone, N.S.W., 1 ii 1967, *E. oblonga*"; 1♂ "1 mi. W. Rylstone, N.S.W., 1 ii 1967, *E. ?oblonga*"; 5♂s "18 mi. E. Armidale, N.S.W., 9 iv 1966, *E. caliginosa*"; 1♂ "Stirling W., S.A., 8 x 1963, J. Bevan, *E. obliqua*", to SI; 1♂ "13 mi. E. Geehi, N.S.W., 9 i 1967, *E. ?robertsonii*"; 1♂ "7 mi. NE. Loch, Vic., 4 i 1967, *E. robertsonii*"; 1♂ "Emerald, (?Vic.) 16 v 1907"; 2♂s "Black Mtn., A.C.T., 17 i 1967, *E. ?macrorhyncha*". (in alcohol) 3♂s 9♀s "6 mi. S. Rylstone, N.S.W., 1 ii 1967, *E. oblonga*"; 7♂s 2♀s "18 mi. E. Armidale, N.S.W., 9 iv 1966, *E. caliginosa*". (dried) 1♀ "Emerald, (?Vic.) 16 v 1907"; 3♀s "Stirling W., S.A., 8 x 1963, J. Bevan, *E. obliqua*", to SI.

Glycaspis (*Synglycaspis*) *icterica*, sp. nov.
(Gr. *ikterikos* = yellowish)

General Colour: Yellow, sometimes with dark marks.
Claspers & Aedeagus: As in Text-fig. 33.
Length of Aedeagus: (3 specimens) 0.234 mm. to 0.243 mm.
Host Plants: *E. marginata* Donn. ex Sm. (jarrah); *?E jacksonii* Maiden (red tingle tingle).
Type Locality: 3.6 mi. N. Tuart Hill, Perth, Western Australia.
Types: Holotype male on slide labelled "3.6 mi. N. Tuart Hill, Perth, W.A., 1 ix 1966, *E. marginata*". Paratypes: (slides) 2♂s with same label data. (in alcohol) 9♂s 6♀s with same label data; 11♂s 1♀ "4.5 mi. N. Tuart Hill (Yanchep Rd.), Perth, W.A., 15 ix 1966, *E. marginata*"; 6♂s 3♀s "4 mi. N. Scarborough Beach, Perth, W.A., 14 ix 1966, *E. marginata*"; 1♂ 1♀ "25 mi. SE. Nannup, W.A., 19 ix 1966, *E. marginata*"; 1♀ "17 mi. NW. Deep Riv., W.A., 20 ix 1966, *?E. jacksonii*".
Other Specimens Examined: (dried), 1♀ "Nedlands, W.A., 5 iv 1960, M. M. H. Wallace, Light trap"; 1♀ "15 mi. NW. Walpole, W.A., 15 xi 1958, I. F. B. Common".
Notes: The species occurring on *E. marginata* is the only species in which the median pegs on the male claspers are not dark. It apparently evolved in isolation in Western Australia, and it is presumed that the pale median pegs are an evolutionary result of this long isolation.

Glycaspis (*Synglycaspis*) *hirsuta* (Froggatt), comb. nov.
Spondylaspis hirsutus Froggatt 1903, pp. 323-4, Pl. 4, Fig. 6, Pl. 5, figs. 4, 5.

Spondyliaspis hirsutus: Tuthill & Taylor 1955, p. 231.
Glycaspis hirsuta: Taylor 1960, p. 385.
Glycaspis (*Glycaspis*) *hirsuta*: Moore 1961, p. 132.

Claspers & Aedeagus: As in Text-fig. 34.
Host Plants: ?*E. pilularis* Sm. (blackbutt); ?*E. robusta* Sm. (swamp mahogany); ?*E. cypellocarpa* L. Johnson (spotted mountain gum).
Type Locality: Thirroul, N.S.W.
Type: Holotype ♀ (dried specimen) labelled "Hairy Shell Lerp, Thirrol, N.S.W., 18 vi 1901, W.W.F. Type W.W.F. 1901, *Glycaspis* (*Synglycaspis*) *hirsuta* (Froggatt) Holotype".
Other Specimens Examined: (slides) 2♂s "1 mi. S. Thirroul, N.S.W., 20 i 1967, *E. pilularis*"; 4♂s "Jigamy Ck., Eden, N.S.W., 3 x 1962, K. G. Campbell, *E. ?goniocalyx*" (probably *cypellocarpa*); 1♂ "Sugar lerp, Thirroul, N.S.W., W.W.F.". (in alcohol) 1♂ 1♀ "1 mi. S. Thirroul, N.S.W., 20 i 1967, *E. pilularis*"; 3♂s 10♀s "Jigamy Ck., Eden, N.S.W., 3 x 1962, K. G. Campbell, *E. cypellocarpa*". (Dried) 1♂ 1♀ "Sugar lerp, Thirroul, N.S.W., W.W.F.".
Notes: Lerps round. In his original description, Froggatt does not state the sex of the specimen on which he based his description of *G. hirsuta*. The only available syntype from Thirroul (a female specimen) appears to be the specimen on which he based his description, and as it also bears the label "Type", it is here interpreted as being the holotype. His description of the lerp, and his fig. 5, Pl. 5, are based on specimens of 2 lerps labelled with the same data as the holotype, but as previously mentioned (Moore 1961, p. 132), these lerps obviously were not constructed by any species of the genus *Glycaspis*. Froggatt has labelled these lerps "Hairy shell lerp". His figs. 4 & 5, Pl. 5, are captioned "*Spondyliaspis nigro-cincta*", but on examination of the adult ♀ labelled "Type", and the two lerps, there is no doubt that the caption should read "*S. hirsutus*".
During 20 January, 1967, the type locality was visited by the writer. *Glycaspis* specimens were collected approximately 1 mi. S. of the township of Thirroul, in an area where it was considered that there may have grown previously, specimens of *E. robusta* (the eucalypt species from the leaves of which Froggatt recorded that he collected the species *G. hirsuta*). No locality could be found in the vicinity of Thirroul where *E. robusta* at present occurs. The species *E. pilularis* occurred there, and *E. robusta* sometimes occurs in association with this species.
In that area on the above date, 3♂s and 1♀ constructing round lerps were collected from *E. pilularis*, and these specimens appear to be conspecific with *G. hirsuta*. Superficially, the foliage of the *E. pilularis* trees, and particularly of the regeneration on the area, appeared very similar to that of *E. robusta*, as leaves were much broader than those usually found on the former species. This foliage was quite atypical, and it is considered that Froggatt may have mistaken *E. pilularis* for *E. robusta*.

Glycaspis (*Synglycaspis*) *fuliginis*, sp. nov.
(L. *fuliginis* = soot, black paint)

General Colour: Numerous dark marks.
Claspers & Aedeagus: As in Text-fig. 35.
Length of Aedeagus: (3 specimens) 0.216 mm. to 0.225 mm.
Host Plants: *E. globoidea* Blakely (round fruited stringybark); *E. andreana* Naudin (kayer-ro, or river peppermint).
Type Locality: 5 mi. W. Lakes Entrance, Victoria.
Types: Holotype male on slide labelled "5 mi. W. Lakes Entrance, Vic., 6 i 1967, *E. globoidea*". Paratypes: (slides) 2♂s with same label data. (in alcohol) 1♂ 7♀s with same label data.
Other Specimens Examined: (slides) 4♂s "Greig's Flat, Eden, N.S.W., 19 xi 1965, *E. andreana*"; 4♂s "12.5 mi. N. Bega, N.S.W., 30 x 1962, K. G. Campbell, *E. andreana*" (in alcohol) 11♂s 32♀s "Greig's Flat,

N.S.W., 19 xi 1965, *E. andreana*"; 4♂s 5♀s "12.5 mi. N. Bega, N.S.W., 30 x 1962, K. G. Campbell, *E. andreana*".

Glycaspis (*Synglycaspis*) *seriata*, comb. nov.

Glycaspis (*Glycaspis*) *seriata* Moore 1961, pp. 141-2, Text-fig. 18.

Claspers & Aedeagus: As in Text-fig. 36.
Length of Aedeagus: (19 specimens) 0.216 mm. to 0.250 mm.
Host Plant: *E. pilularis*.
Type Locality: Ourimbah State Forest, N.S.W.
Types: Holotype in AM, Paratypes in AM, BM, CS.

Glycaspis (*Synglycaspis*) *conserta*, comb. nov.

Glycaspis (*Glycaspis*) *conserta* Moore 1961, pp. 143-5. Text-fig. 20.

Claspers & Aedeagus: As in Text-fig. 37.
Length of Aedeagus: (12 specimens) 0.267 mm. to 0.284 mm.
Host Plant: *E. sieberi*.
Type Locality: Somersby, N.S.W.
Types: Holotype in AM; paratypes in AM, BM, CS and FC.
Specimens Examined: (slides) 2♂s "Launceston, Tas., Littler, Bred", to BM; 3♂s "Launceston, Tas., Littler, Bred"; 2♂s "Sydney, N.S.W., 4 xii 1921, W. W. Froggatt, Sugar lerp, *E. sieberi*. (dried) 3♂s, 1 nymph, "Sydney, N.S.W., 4 xii 1921, W. W. Froggatt, Sugar lerp, *E. sieberi*"; 2♂s 5♀s "Sydney, N.S.W., 4 xii 1921, W. W. Froggatt, Sugar lerp, *E. sieberi*", to NA.

Glycaspis (*Synglycaspis*) *salebrosa*, comb. nov.

Glycaspis (*Glycaspis*) *salebrosa* Moore 1961, pp. 145-6, Text-fig. 22.

Claspers & Aedeagus: As in Text-fig. 38.
Length of Aedeagus: (23 specimens) 0.250 mm. to 0.270 mm.
Host Plants: *E. piperita; E. andrewsii* Maiden (New England blackbutt).
Type Locality: Somersby, N.S.W.
Types: Holotype & paratypes in AM, paratypes in BM, CS and FC.

Glycaspis (*Synglycaspis*) *cyanoreia**, comb. nov.

Glycaspis (*Glycaspis*) *cyanoreios* Moore 1961, p. 145, Text-fig. 21.

Claspers & Aedeagus: As in Text-fig. 39.
Length of Aedeagus: (4 specimens) 0.245 mm. to 0.252 mm.
Host Plant: *E. stricta* Sieb. ex Spreng. (Blue Mountain mallee).
Type Locality: Wentworth Falls, N.S.W.
Types: Holotype in AM, paratypes in AM, BM, CS.

Glycaspis (*Synglycaspis*) *conflecta*, comb. nov.

Glycaspis (*Glycaspis*) *conflecta* Moore 1961, pp. 142-3, Text-fig. 19.

Claspers & Aedeagus: As in Text-fig. 40.
Length of Aedeagus: (12 specimens) 0.239 mm. to 0.263 mm.
Host Plants: *E. eugenioides* Sieb. ex Spreng. (small-leaved stringybark); *E. ?oblonga* DC.; *E. ?agglomerata; E. ?rossii, E. ?macrorhyncha*.
Type Locality: Kurrajong, New South Wales.
Specimens Examined: (slides) 3♂s "4 mi. S. Broke, N.S.W., 25 iv 1967, *E. eugenioides*"; 1♂ "3 mi. N. Goulburn, N.S.W., 18 i 1967, *E. ?rossii*"; 1♂ "Mittagong, N.S.W., 1905, Koebele"; 1♂ "Black Mtn., A.C.T., 10 iii 1955, I. F. B. Common, light trap"; 3♂s "Nelson Bay, N.S.W., 12 xi 1960, I. F. B. Common & M. S. Upton"; 1♂ "3 mi. W. Rylstone, N.S.W., 6 iv 1966, *E. rossii*"; 2♂s "Pearson's lookout, Ben Bullen, N.S.W., 1 ii 1967, *Euc.* sp."; 2♂s "Goodna, Qld., 8 ix 1966, R. A. Yule", to QF; 2♂s "Black Mtn., A.C.T., 17 i 1967, *E. ?macrorhyncha*"; 2♂s "1 mi. W. Rylstone, N.S.W., 7 iv 1966, *E. macrorhyncha*"; 3♂s "3 mi. E. Appin, N.S.W., 20 i 1967,

* The Greek name is latinised, and the gender is altered to agree with the generic name.

E. agglomerata, adults emgd. 21 i 1967"; 2♂s "1 mi. W. Rylstone, N.S.W., 1 ii 1967, *E. ?oblonga";* 1♂ "26 mi. S. Tumut, N.S.W., 11 i 1967, adult emgd. 17 i 1967, *E. macrorhyncha";* 3♂s "3 mi. N. Booral, N.S.W., ii 1955, P. B. Carne, on twigs *Euc.* sp."; 5♂s Toowoomba, Qld., xi 1950, A.M., *Eucalyptus",* to BM; 1♂ "Toowoomba, Qld., 30 xi 1950, J. Letchford", to QU.; 1♂ "Eltham, Vic., Pres. 12 v 1925, G. F. Hill", to VM. (in alcohol) 5♀s "4 mi. S. Broke, N.S.W., 25 iv 1967, *E. eugenioides";* 1♀ "Rylstone, N.S.W., 30 viii 1964, *E. ?macrorhyncha";* 1♂ 4♀s "1 mi. W. Rylstone, N.S.W., 7 iv 1966, *E. macrorhyncha";* 1♂ 4♀s "1 mi. W. Rylstone, N.S.W., 1 ii 1967, *Euc.* sp."; 1♂ 8♀s "Black Mtn., A.C.T., 17 i 1967, *E. ?macrorhyncha";* 7♂s 4♀s "3 mi. E. Appin, N.S.W., 20 i 1967, *E. agglomerata,* adult emgd. 21 i 67"; 2♂s 2♀s "3 mi. E. Appin, N.S.W., 20 i 1967, *E. agglomerata";* 1♀ "26 mi. S. Tumut, N.S.W., 11 i 1967, adult emgd. 17 i 1967, *E. macrorhyncha".* (dried) 3♀s "Goodna, Qld., 8 ix 1966, R. A. Yule"; 1♀ with same label data but date "1 viii 1967"; 6♀s "3 mi. N. Booral, N.S.W., ii 1955, P. B. Carne, on twigs *Euc.* sp."; 2♀s "Nelson Bay, N.S.W., 12 xi 1960, I. F. B. Common & M. S. Upton"; 1♀ "Eltham, Vic., Pres. 12 v 1925, G. F. Hill", to VM; 4♀s "Toowoomba, Qld., 30 xi 1950, J. Letchford", to QU; 4♂s 1♀ "Toowoomba, Qld., xi 1950, A.M., ex Eucalypt" to BM.

Glycaspis (*Synglycaspis*) *aggregata,* comb. nov.

Glycaspis (*Glycaspis*) *aggregata* Moore 1961, pp. 146-8, Text-fig. 23.

Claspers & Aedeagus: As in Text-fig. 41.
Length of Aedeagus: (12 specimens) 0.252 mm. to 0.270 mm.
Host Plants: *E. haemastoma; E. rossii.*
Type Locality: Somersby, N.S.W.
Types: Holotype in AM; paratypes in AM, BM, CS and FC.
Specimens Examined: (slides) 2♂s "Hornsby, N.S.W., 5 i 1899, W.W.F., Lerp"; 1♂ "Black Mtn., A.C.T., 17 i 1967, *E. rossii".* (dried) 1♀ "Lerp psylla, Hornsby, N.S.W., 5 i 1899, W.W.F.".

Glycaspis (*Synglycaspis*) *endasa,* sp. nov.

(Gr. *en* = in; *dasos* = a thicket or forest)

Claspers & Aedeagus: As in Text-fig. 42.
Length of Aedeagus: (3 specimens) 0.169 mm. to 0.182 mm.
Host Plant: *E. robertsonii* Blakely (Robertson's peppermint).
Type Locality: Towamba, N.S.W. (South Coast).
Types: Holotype male on slide labelled "Towamba, N.S.W., 20 xi 1965, *E. robertsonii".* Paratypes: (slides) 2♂s with same label data. (in alcohol) 12♀s with same label data.

Glycaspis (*Synglycaspis*) *mactans,* comb. nov.

Glycaspis (*Glycaspis*) *mactans* Moore 1961, p. 139, Text-fig. 16.

Claspers & Aedeagus: As in Text-fig. 43.
Length of Aedeagus: (31 specimens) 0.173 mm. to 0.212 mm.
Host Plants: *E. acmenioides* Schau. (white mahogany); *E. umbra* R. T. Bak. (bastard mahogany).
Type Locality: Lisarow, N.S.W.
Types: Holotype in AM. Paratypes in AM, BM, CS, FC.
Other Specimens Examined: (slides) 2♂s "12 mi. W. Gympie, Qld., 20 iv 1966, *E. acmenioides";* 2♂s "12 mi. E. Mareeba, Qld., 17 v 1966, *E. acmenioides";* 2♂s "5 mi. SW. Mt. Garnet, Qld., 21 v 1966, *E. acmenioides";* 1♂ "Ourimbah S.F., N.S.W., 14 xii 1956, K. L. Taylor, *E. acmenioides".* (in alcohol) 6♂s 7♀s "12 mi. W. Gympie, Qld., 20 iv 1966, *E. acmenioides";* 2♂s 5♀s 1 nymph "Mt. Archer (1400') (Rockhampton) Qld., 28 v 1966, *E. acmenioides";* 8♂s 10♀s "12 mi. E. Mareeba, Qld., 17 v 1966, *E. acmenioides";* 1♂ 1♀ "5 mi. SW. Mt. Garnet, Qld., 20 v 1966, at light (Tilley lamp)"; 4♂s 13♀s 26 mi. E. Mt. Garnet, Qld., 20 v 1966, *E. acmenioides";* 8♂s 6♀s

"5 mi. SW. Mt. Garnet, Qld., 21 v 1966, E. *acmenioides;* 1♂ "Mt. Coot-tha, Brisbane, Qld., 17 iv 1966, *Euc.* sp.". (Dried) 5♀s "Alderly, Qld., 30 viii 1941, 9263", to QP.; 4♂s "Ourimbah S.F., N.S.W., 14 xii 1956, K. L. Taylor, *E. acmenioides*".

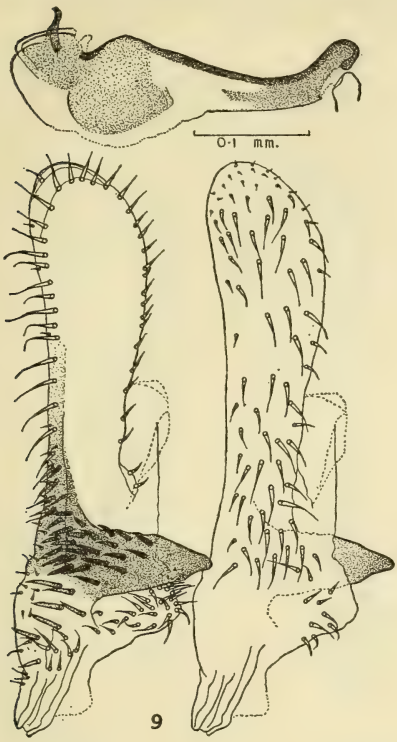
Notes: Although the aedeagi of the Queensland specimens are longer than those from N.S.W., and the yellow coloration more intense with an absence of dark markings, there appears to be no doubt that all specimens are referable to this species. The known distribution of this species is from the Hawkesbury River in N.S.W. to near Cairns in Qld.

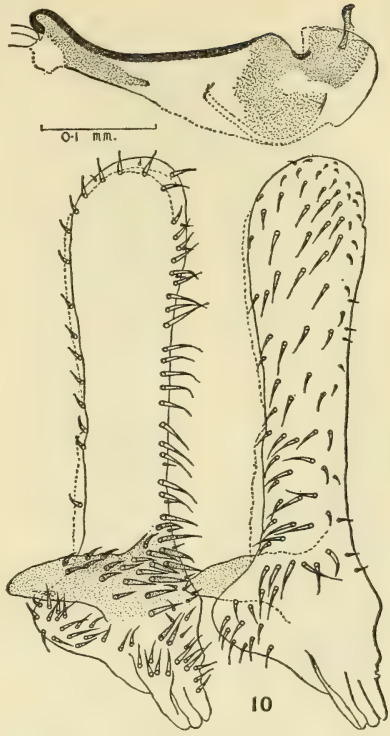
Glycaspis (*Synglycaspis*) *orientalis*, comb. nov.

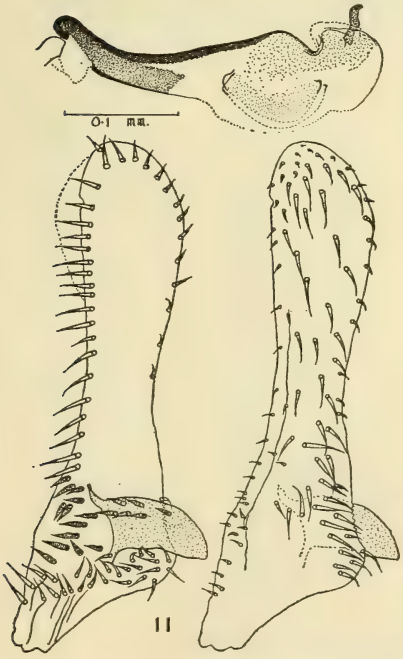
Glycaspis (*Glycaspis*) *orientalis* Moore 1961, pp. 139-141, Text-fig. 17.

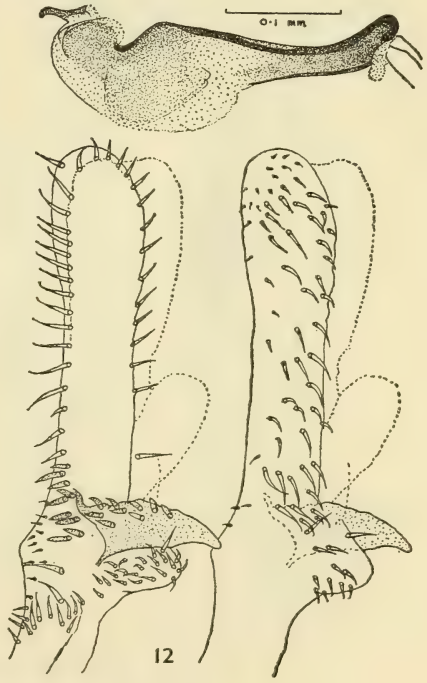
Claspers & Aedeagus: As in Text-fig. 44.
Length of Aedeagus: (7 specimens) 0.225 mm. to 0.230 mm.
Host Plant: *E. umbra*.
Type Locality: Somersby, N.S.W.
Types: Holotype in AM, Paratypes in AM, BM, CS, FC.
Specimens Examined: (dried) 1♀ "Ourimbah S.F., N.S.W., 14 xii 1956, K. L. Taylor, *E. acmenioides*".

Fig. 9. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *brunosa*, sp. nov.
Fig. 10. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *obvelata*, sp. nov.
Fig. 11. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *occulta*, sp. nov.
Fig. 12. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *perthecata*, comb. nov.
Fig. 13. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *longaeva*, sp. nov.
Fig. 14. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *cellula*, sp. nov.
Fig. 15. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *cyta*, comb. nov.
Fig. 16. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *inclusa*, comb. nov.
Fig. 17. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *encystis*, comb. nov.
Fig. 18. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *amplificata*, comb. nov.
Fig. 19. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *cyrtoma*, comb. nov.
Fig. 20. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *belua*, sp. nov.
Fig. 21. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *commoni*, sp. nov.
Fig. 22. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *munita*, sp. nov.
Fig. 23. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *immaceria*, sp. nov.
Fig. 24. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *planitecta*, sp. nov.
Fig. 25. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *tagmata*, sp. nov.
Fig. 26. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *nundlensis*, comb. nov.
Fig. 27. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *phreata*, comb. nov.
Fig. 28. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *planaria*, comb. nov.
Fig. 29. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *nigrocincta*, comb. nov.
Fig. 30. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *temenicola*, sp. nov.
Fig. 31. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *dreptodria*, sp. nov.
Fig. 32. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *particeps*, sp. nov.
Fig. 33. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *icterica*, sp. nov.
Fig. 34. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *hirsuta*, comb. nov.
Fig. 35. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *fuliginis*, sp. nov.
Fig. 36. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *seriata*, comb. nov.
Fig. 37. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *conserta*, comb. nov.
Fig. 38. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *salebrosa*, comb. nov.
Fig. 39. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *cyanoreia*, comb. nov.
Fig. 40. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *conflecta*, comb. nov.
Fig. 41. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *aggregata*, comb. nov.
Fig. 42. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *endasa*, sp. nov.
Fig. 43. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *mactans*, comb. nov.
Fig. 44. Claspers & aedeagus of *Glycaspis* (*Synglycaspis*) *orientalis*, comb. nov.

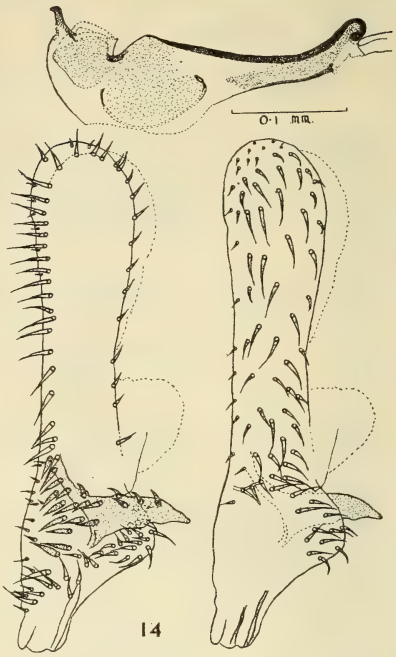


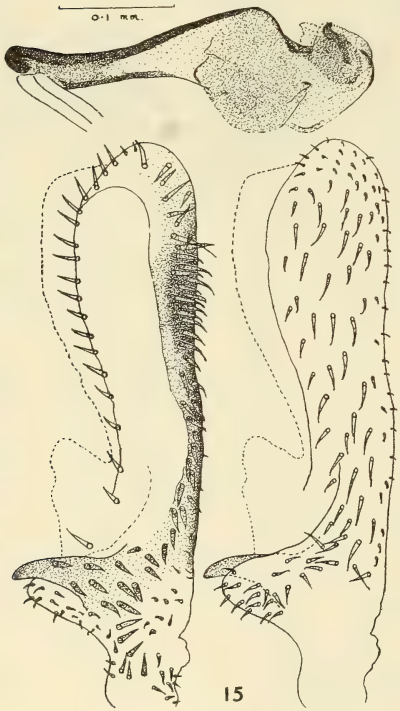


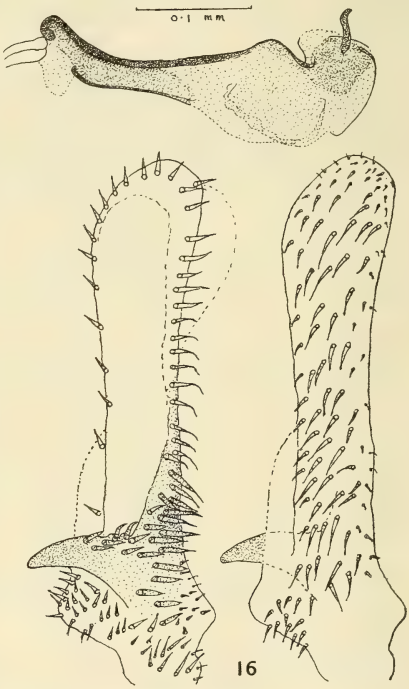




(For explanation of figures, see page 266)







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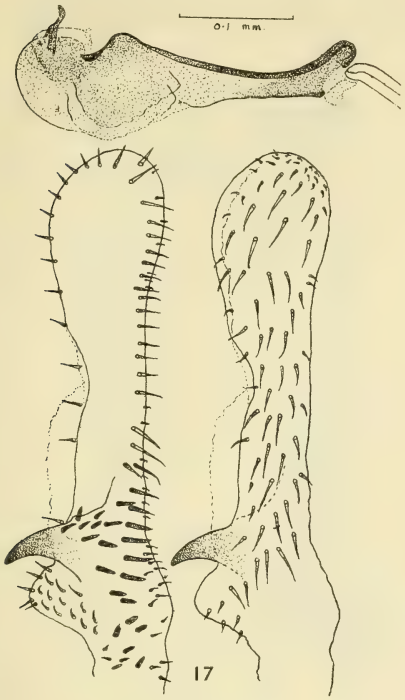

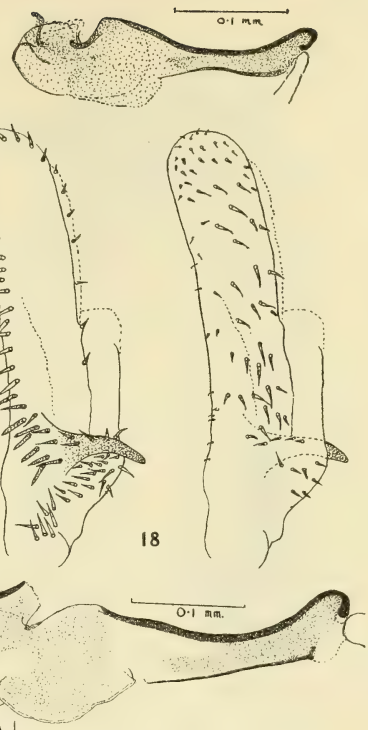

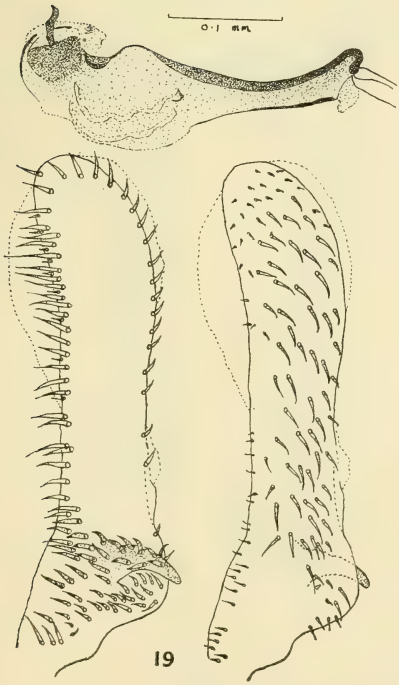

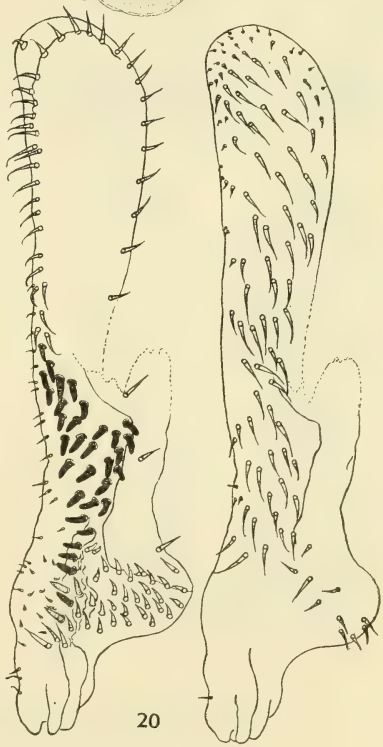

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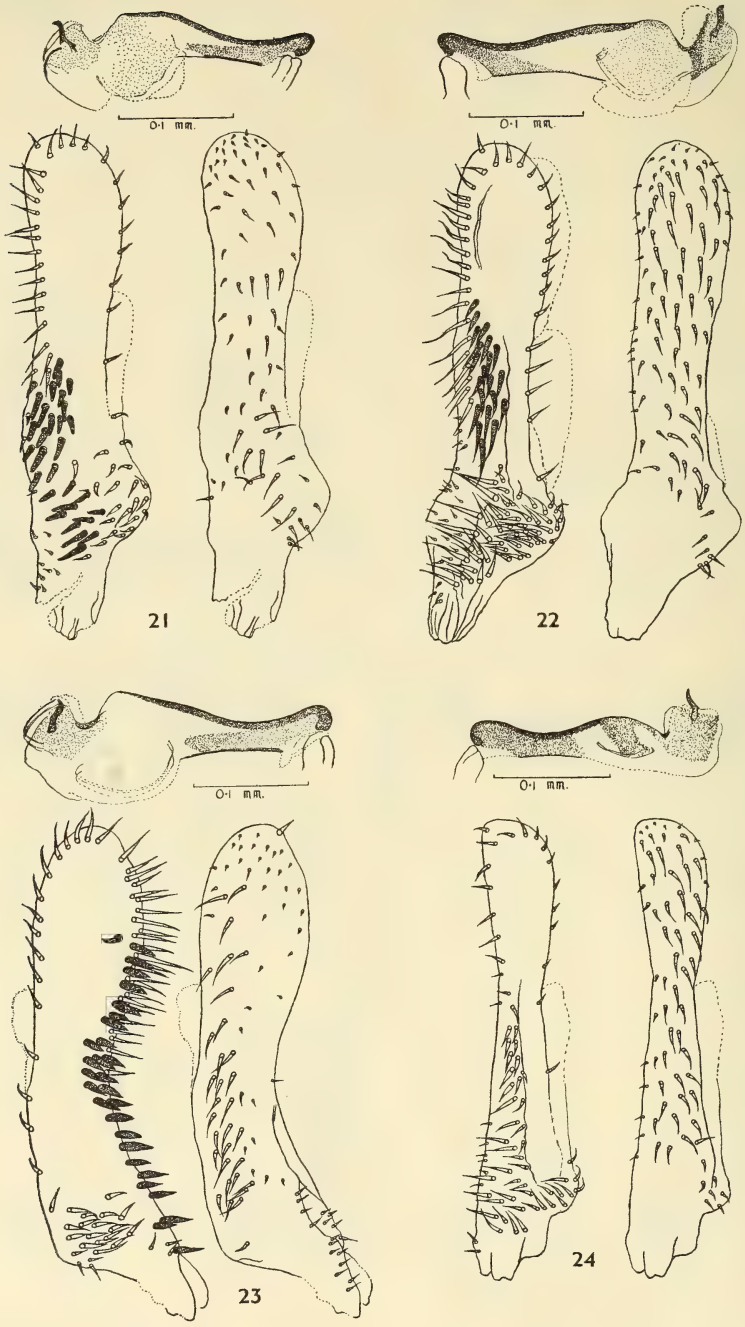

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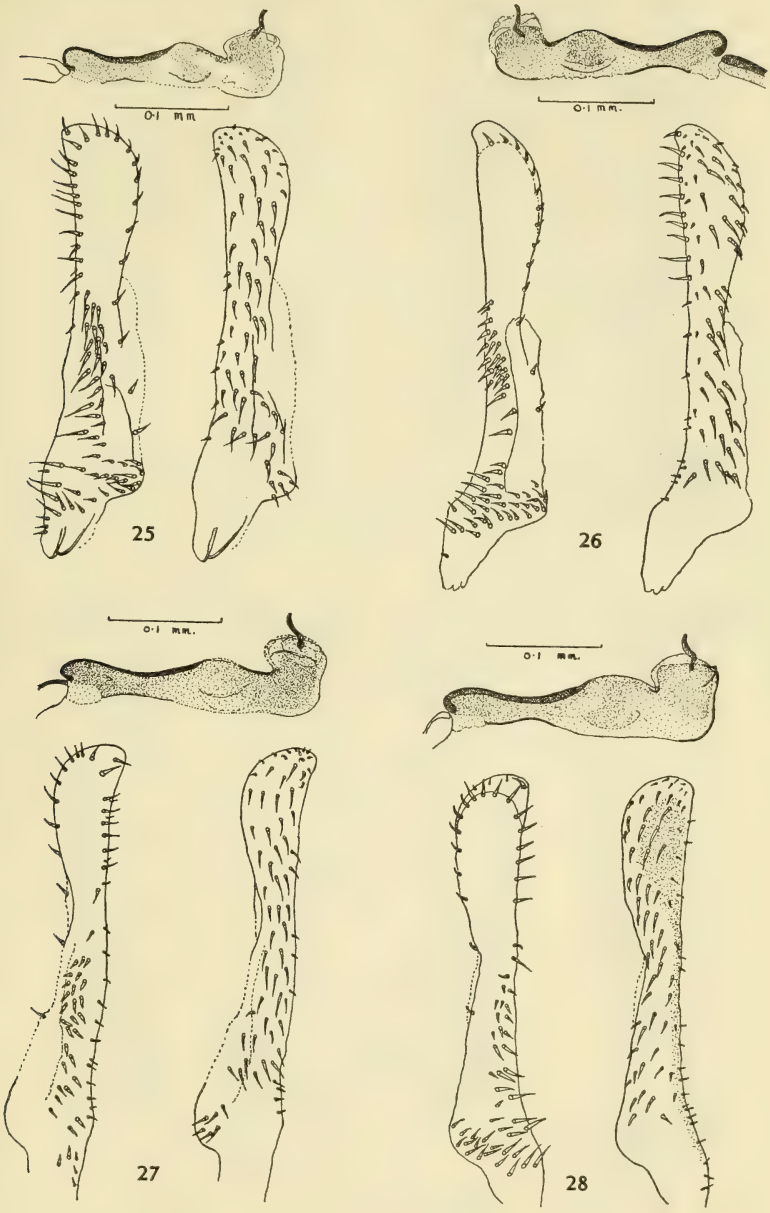

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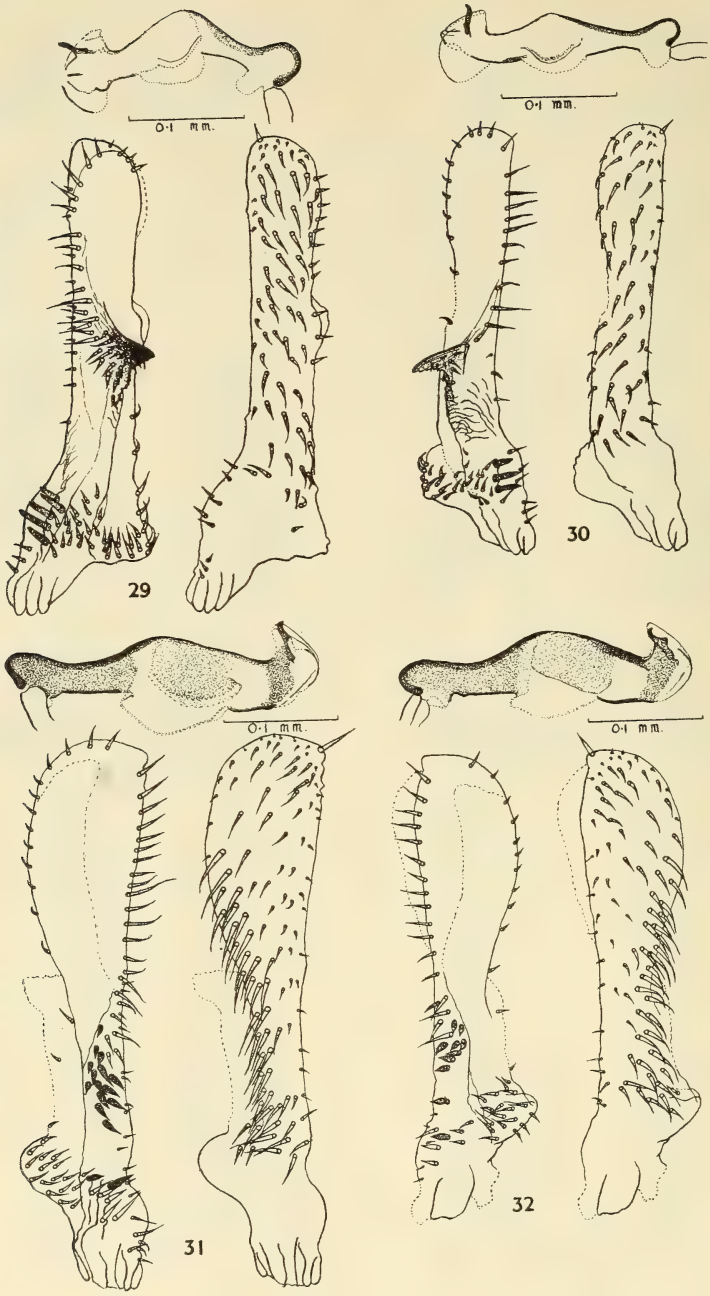

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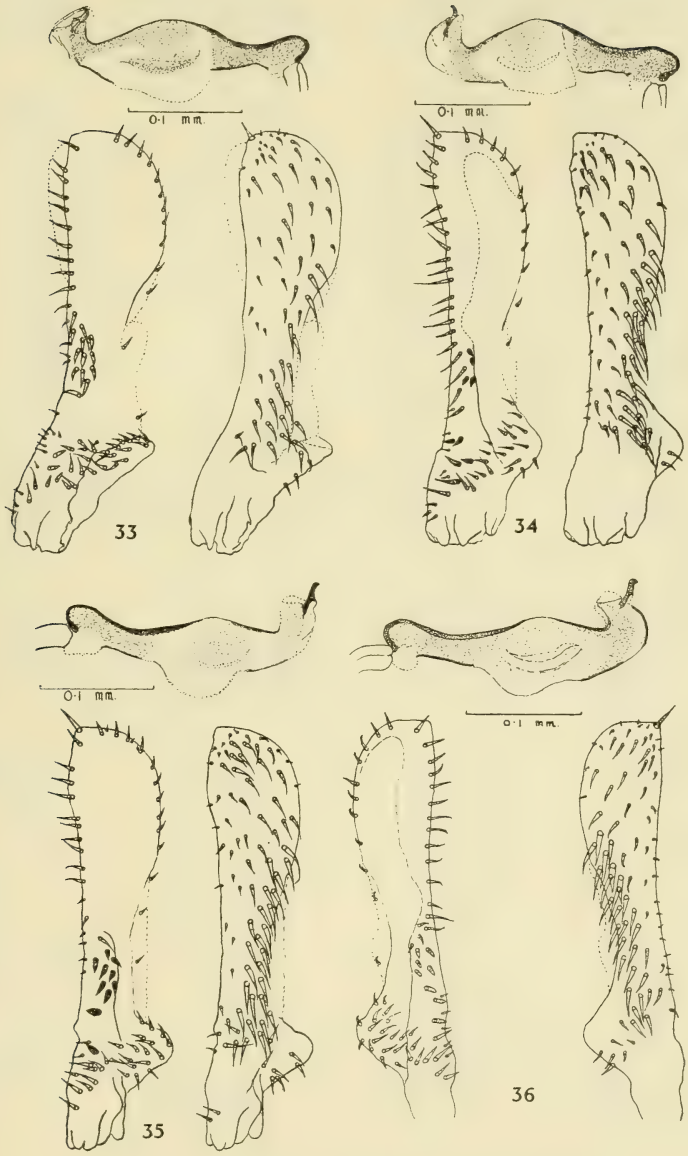

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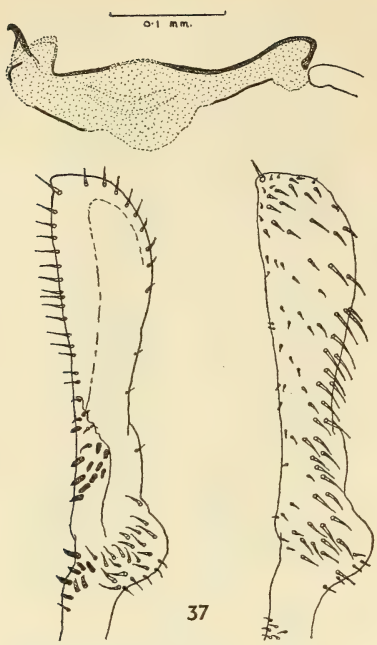

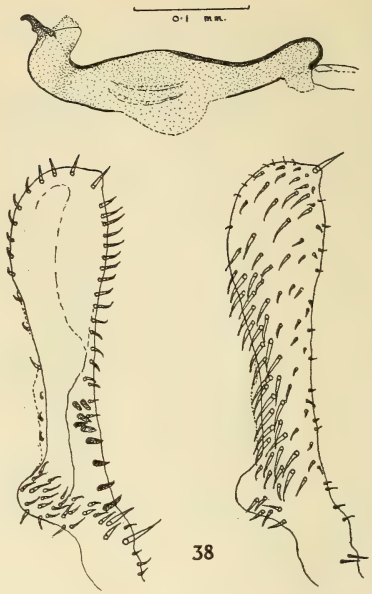

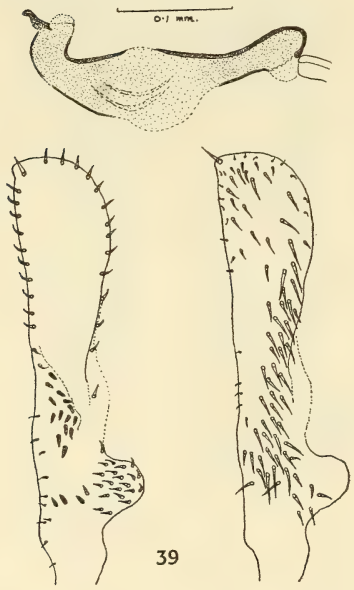

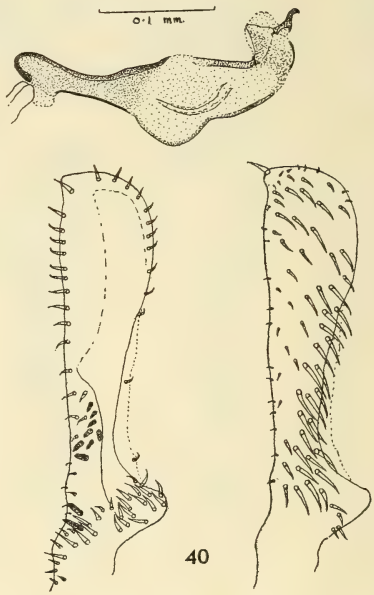

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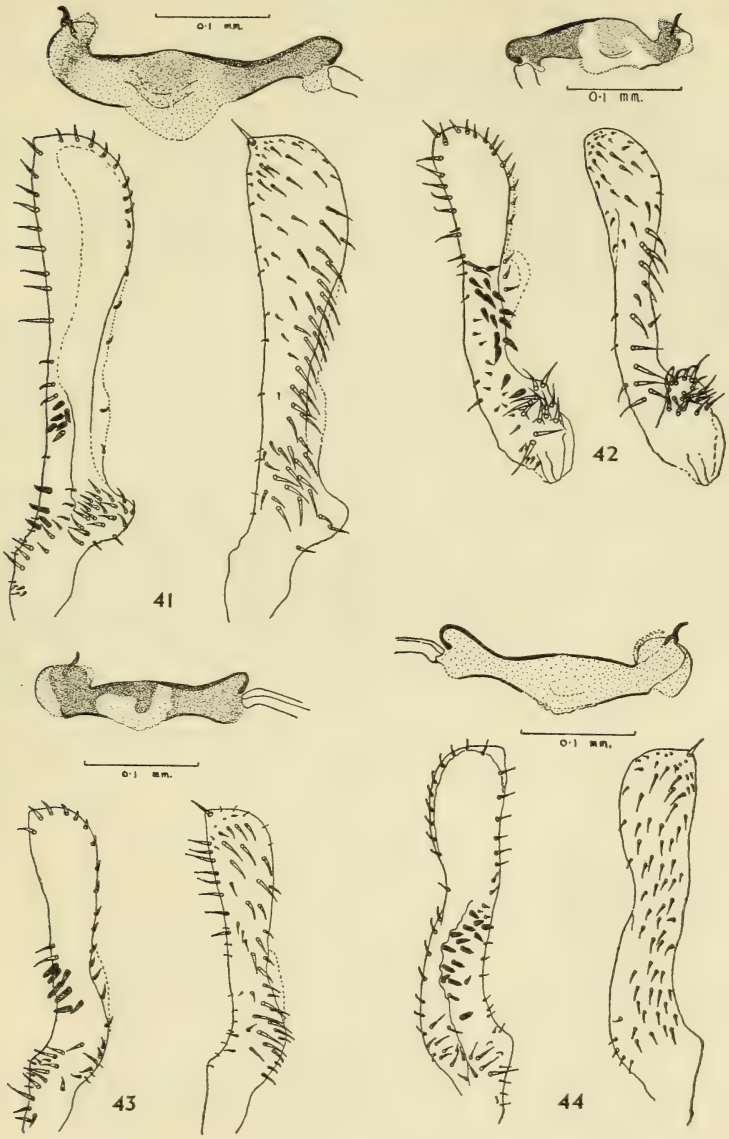

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Subgenus *Glycaspis*

Glycaspis (*Alloglycaspis*) Moore 1961, pp. 129-132, 148-166, Text-figs. 1 to 4, 24 to 48, Pl. vii, figs. 5 to 10. *syn. nov.*

Type Species: *Glycaspis* (*Glycaspis*) *flavilabris* (Froggatt), designated Taylor, 1960 (non *Glycaspis* (*Alloglycaspis*) *baileyi* Moore 1961).

Type Locality: Rylstone, New South Wales.

Host Plant: *Eucalyptus goniocalyx* F. Muell. ex Miq. (bundy).

This, the largest subgenus, is considered to be of intermediate phylogeny to the subgenera *Synglycaspis and Boreioglycaspis.*

The 79 species contained in it, construct round, oval and rectangular lerps, and its species are distributed throughout Australia, and in New Guinea.

Various taxonomic arrangements of species in *Glycaspis* (*Glycaspis*) were considered, and the arrangement adopted is that considered to be most utilitarian for the future identification of species.

The taxonomic arrangement is, as with the previous subgenus, mainly based on the lerp shape, although consideration of the clasper shape has been of importance within each lerp-shape group. The length and shape of vein Cu_1 of the hindwing is variable, but this character combined with those mentioned above, provides a basis for grouping the species constructing round lerps.

Progression from the primitive "scimitar" shape of the claspers, and a progressive extension of the basal prominence on the claspers, together with a narrowing of the median area, is evident in the round and oval lerp-forming groups.

The general similarities of claspers of the species are also utilised to interpret the sequence in this subgenus. Such an arrangement has permitted the retention of most species within their respective groups indicated by the hindwing vein Cu_1, i.e. the length of Cu_1, from 0.047mm. to 0.115mm. indicates primitive species (Group (i)); 0.115mm. to 0.162mm. the intermediate species (Group (ii)); 0.162mm. to 0.207mm. the recent species (Group (iii)).

The taxonomic arrangement is commenced with three round lerp-forming primitive species showing similarities in the aedeagi, which, together with the length of the M+Cu stem in the forewing, suggest species of close affinities. These three species indicate three separate lines of evolutionary divergence in *Glycaspis* (*Glycaspis*).

The sequence of round lerp-forming species continues, to include Text-fig. 102; oval lerp-forming species are illustrated in Text-figs. 103 to 118; rectangular lerp-forming species, Text-figs. 119 to 123.

Glycaspis (*Glycaspis*) *flavilabris* (Froggatt)

Aphalara flavilabris Froggatt 1903, pp. 318-9, Pl. 4, fig. 3.
Spondyliaspis flavilabris: Tuthill & Taylor 1955, p. 231.
Glycaspis flavilabris: Taylor 1960, p. 385.
Glycaspis (*Glycaspis*) *flavilabris* Moore 1961, pp. 133, 148.

General Colour: Variable amounts of pale cream, yellow, black or brown.
Claspers & Aedeagus: As in Text-fig. 45.
Length of Aedeagus: (5 specimens) 0.288 mm. to 0.320 mm.
Hindwings: Cu_1 as Group (i).
Host Plant: *Eucalyptus goniocalyx* F. Muell. ex Miq. (bundy).
Type Locality: Rylstone, New South Wales.
Types: Unique Holotype female dried specimen labelled "Rylstone, N.S.W., Sweeping, 7.2.'01, Type, *Aphalara flavalabris* n.sp., Rylstone, N.S.W., Holotype".
Other Specimens Examined: (slides) 1♂ "Tharwa Rd., A.C.T., 23 xii 1954, E. E. Lewis, *E. elaeophora*"; 1♂ "Kambah Rd., A.C.T., 14 xii 1954, E. E. Lewis, *E. elaeophora*"; 1♂ "Kambah Rd., A.C.T., 31 xii 1954, F. Wheelhouse, *E. elaeophora*"; 2♂s "Mullion Ra. S.F., N.S.W., 12 iii 1969, *E. goniocalyx*". (in alcohol) 5♂s 18♀s "Mullion Ra. S.F., N.S.W., 12 iii 1969, *E. goniocalyx*". (dried spcs.). 1♂ 1♀ "Tharwa Rd., A.C.T., 23 xii 1954, E. E. Lewis, *E. elaeophora*"; 1♀ "Kambah Rd., A.C.T., 14 xii 1954, E. E. Lewis, *E. elaeophora*"; 1♂ 2♀s

"Kambah Rd., A.C.T., 31 xii 1954, F. Wheelhouse, *E. elaeophora*"; 1♀ with same label data, but date "23 xi 1954"; 1♀ with same label data, but date 6 xii 1954; 1♀ and lerp with same label data, but date "17 iii 1955".

Notes: Lerps round. This species was designated the type-species of the genus *Glycaspis* by Taylor, 1960. The Holotype female specimen, and its associated label data, have been compared with Froggatt's original description of *G. flavilabris,* and in the opinon of the writer, there is no doubt that his description was based on this specimen. The specimen bears 3 labels, with the data given above, which distinguish it as the Holotype.

The specimen has been moved from its original bedding of gum on the card, and portions of some legs and one forewing are in the centre of the card, with the specimen towards one edge of the card. One antenna, one forewing and one hindwing are missing. The specimen has been compared with the series of 12♂s and 25♀s mentioned above, and which are considered by the writer to be specimens of *G. flavilabris.* The aedeagus and claspers of a male specimen of this series are illustrated in Text-fig. 45. This species may be separated from all other species in the subgenus *Glycaspis,* by the short stem of M+Cu, and the coloration of the forewing (Text-fig. 133), and from all other species in the subgenus *Synglycaspis* by the shape of Cu_1 of the hindwing.

Although intensive collections were made to locate this species at Rylstone, the type locality, on four different occasions, no specimens were obtained.

Glycaspis (*Glycaspis*) *eucalypti* (Dobson)

Psylla eucalypti Dobson 1851, pp. 235-239, Pl. 18, figs. 1 to 4.
Spondyliaspis eucalypti (?): Schwarz 1898, pp. 69-71, *non Dobson.*
Spondyliaspis eucalypti: Froggatt 1900, pp. 289-291, Pl. 12, figs. 1 & 12, Pl. 13, fig. 5, Pl. 14, fig. 7, *non Dobson.*
Glycaspis eucalypti: Taylor 1960, p. 385, Pl. 1, fig. 2.
Glycaspis eucalypti: Moore 1961, p. 132.

General Colour: Yellow with dark marks; abdomen bright green on living or dried specimens.
Claspers & Aedeagus: As in Text-fig. 46.
Length of Aedeagus: (20 specimens) 0.239 mm. to 0.277 mm.
Hindwings: Cu_1 as Group (i).
Host Plants: *E. viminalis* Labill. (ribbon gum); *E. rodwayi* R. T. Bak. & H. G. Sm. (black gum); *E. ?dalrympleana* Maiden (broad-leaved kindling bark); *E. ?ovata* Labill. (swamp gum).
Type: Neotype (here designated) 1 male on slide labelled "*Glycaspis* (*Glycaspis*) *eucalypti* (Dobson), Neotype, Domain, Hobart, Tas., 31 x 1959, K. L. Taylor, Bred from *E. viminalis*".
Other Specimens Examined: (slides) 4♂s "Domain, Hobart, Tas., 16 xii 1966, *E. viminalis*"; 3♂s "35 mi. W. Scottsdale, Tas., 29 xii 1966, *E. ?ovata*"; 1♂ "1 mi. E. Belchers, Tas., 12 xii 1966, *E. ?ovata*"; 1♂ "Apsley Riv., Tas., 28 xii 1966, *E. ?ovata*"; 1♂ "6 mi. N. Ellendale, Tas., 11 xii 1966, *E. viminalis*"; 3♂s "12 mi. N. Geehi, N.S.W., 8 i 1967, *E. ?viminalis*"; 2♂s "18 mi. E. Derwent Bge., Tas., 10 xii 1966, *E. rodwayi*"; 3♂s "14 mi. S. Kiandra, N.S.W., 11 i 1967, *E. ?dalrympleana*"; 1♂ "11 mi. E. Derwent Bge., Tas., 10 xii 1966, *E. ?obliqua*". (in alcohol) 2♂s 1♀ "Domain, Hobart, Tas., 16 xii 1966, *E. viminalis*"; 1♂ 1♀ "6 mi. N. Ellendale, Tas., 11 xii 1966, *E. viminalis*"; 1♀ "Apsley Riv., Tas., 28 xii 1966, *E. ?ovata*"; 1♂ 1♀ 35 mi. W. Scottsdale, Tas., 29 xii 1966, *E. ?ovata*"; 1♀ "Imi. E. Cygnet, Tas., 18 xii 1966, *E. ?ovata*"; 1♀ "5 mi. S. Cygnet, Tas., 18 xii 1966, *E. ?viminalis*"; 5♂s 17♀s "18 mi. E. Derwent Bge., Tas., 10 xii 1966, *E. rodwayi*"; 1♂ 5♀s "14 mi. S. Kiandra, N.S.W., 11 i 1967, *E. ?dalrympleana*". (dried) 2♂s 9♀s

1 lerp, with same label data as the Neotype. A series of 9 lerps on 6 pins accompanies these specimens, and bears the same label data as the specimens. The lerps were associated with the series of adults (personal communication, Taylor 1969).

Notes: Lerps round. This species, originally described and placed in the genus *Psylla* by Dobson, was collected by him in the Domain, Hobart, Tas., during or prior to 1851. After extensive enquiries, Taylor (1960, p. 385) records that Dobson's type specimens apparently do not exist. Taylor reared several specimens from round lerps occurring on *E. viminalis* in the type locality. A male specimen of this series has been selected as Neotype to represent Dobson's species *G. eucalypti*, and has been placed on a side as a whole mount, dissected to show the claspers and aedeagus. During December, 1966, the Domain (particularly the area adjacent to where the High School was once located and with which Dobson was associated) was twice visited by the writer, and many intensive collections of *Glycaspis* spp. were made. It was found that the "stunted gum bushes" referred to by Dobson, could be represented by three *Eucalyptus* spp., namely E. *globulus, E. viminalis* or *E. linearis*.

On an examination of the *Glycaspis* spp. obtained from these three hosts, the species constructing round lerps on *E. viminalis* was selected to represent Dobson's *G. eucalypti*. This choice is in accordance with that by Taylor (1960, p. 385) and as indicated on specimens in the National Insect Collection, C.S.I.R.O., Canberra, which Taylor reared from *E. viminalis* growing in the Domain, Hobart, Tasmania. As many species of *Glycaspis* construct lerps similar to that described and figured by Dobson, little assistance in the selection of a specimen to represent his *G. eucalypti* could be gained from his information concerning the shape of the lerps, apart from the general shape, which is round. On present knowledge, his description is inadequate to allow undoubted recognition of his species. However, minor indications which have guided the selection of representative specimens are given in his paper. The dark markings on the scutum of the selected species appear to be as those shown by Dobson in his Fig. 4, and the "rich emerald green" of the abdomens of those specimens constructing round lerps on *E. viminalis* appear to indicate his *G. eucalypti*. Specimens considered by Froggatt to be *G. eucalypti*, and Schwarz's *G. eucalypti*(?), are not conspecific with Dobson's *G. eucalypti*. The limitations and conditions of the I.C.Z.N. Code (1961, pp. 81, 83) are satisfied in the selection of the Neotype representing Dobson's *G. eucalypti* and are recorded categorically:-

Article 75. No holotype, lectotype or syntype exists.

(a) The Neotype is designated in a Revision, as is required, and is necessary in the interests of stability of nomenclature.

(i) This course is essential for solving a complex problem of confused and doubtful identities of closely similar species.

(b) The Neotype is not designated for its own sake, or as a matter of curatorial routine.

(c) The designation of the Neotype of *G. eucalypti* is validated by publication of the following qualifying particulars:-

(1) Characters differentiating the taxon *G. eucalypti* are:-
The morphology of the male claspers and aedeagus as represented in Text. fig. 46; the length of the latter character; the "rich emerald green" of the abdomens of live or dried specimens; the construction of round lerps by this species; the determination of its host plant, *E. viminalis*.

(2) The type locality and host association, together with the illustration of the male claspers and aedeagus, ensure recognition of the species designated.

(3) Taylor's enquiries concerning the original type material were made to The British Museum (Nat. Hist.), London; The Australian Museum, Sydney, N.S.W.; The Tasmanian Museum, Hobart, Tasmania; the Tasmanian Department of Agriculture, Hobart. No specimens recognised by the writer as possibly Dobson's species were loaned for this Revision from any of the Institutions mentioned in the "Acknowledgments" in this paper.

(4) The Neotype taxon constructs round lerps; dark markings on the scutum compare with Dobson's fig. 4; the abdomens are "rich emerald green", as recorded by Dobson.

(5) The Neotype came from the original type locality given by Dobson, i.e. The Domain, Hobart.

(6) The Neotype is lodged with the National Insect Collection, C.S.I.R.O., Canberra, A.C.T., together with all of the specimens previously enumerated under "Other Specimens Examined". Recommendation 75A. The proposed Neotype designation has been discussed with Mr. K. L. Taylor, taxonomist of the Psyllidae, and Dr. K. H. L. Key, Curator of Insects and Taxonomist, both of the C.S.I.R.O., Canberra.

Glycaspis (*Glycaspis*) *minuscula,* comb. nov.

Glycaspis (*Alloglycaspis*) *minuscula* Moore 1961, p. 153, Text-fig. 31.

General Colour: Cream to yellow; dark dorsal & ventral markings.
Claspers & Aedeagus: As in Text-fig. 47.
Length of Aedeagus: (9 specimens) 0.248 mm. to 0.272 mm.
Hindwings: Cu_1 as Group (i).
Host Plants: *E. cinerea* F. Muell. (Argyle apple); *E. rubida* Deane & Maiden (candle-bark gum); *E. cephalocarpa* Blakely (long-leaved Argyle apple): *E. ?viminalis* Labill. (ribbon gum).
Type Locality: 26 mi. N. Goulburn, N.S.W.
Specimens Examined: (slides) 2♂s 1♀ "26 mi. N. Goulburn, N.S.W., 29 iv 1964, *E. cinerea*"; 1♂ "26 mi. N. Goulburn, N.S.W., 19 i 1967, *E. cinerea*"; 4♂s "Olinda Crk., Vic., 27 xi 1966, *E. rubida*"; 1♂ "Olinda Crk., Vic., 27 xi 1966, *E. ?viminalis*"; 1♂ "1 mi. N.E. Montrose, Vic., 27 xi 1966, *E. cephalocarpa*"; 1♂ "Emerald (?Vic.), 16 v 1907". (in alcohol) 9♂s 22♀s "26 mi. N. Goulburn, N.S.W., 19 i 1967, *E. cinerea*"; 10♂s 7♀s with same label data but date "29 iv 1964"; 2♂s "Olinda Crk., Vic., 27 xi 1966, *E. ?viminalis*"; 6♂s 21♀s with same label data but host "*E. rubida*"; 3♂s 18♀s "1 mi. N.E. Montrose, Vic., 27 xi 1966, *E. cephalocarpa*".
Notes: Lerps round. Venation of the forewing approaches that of specimens in the subgenus *Synglycaspis,* but less so than that of *G. flavilabris* or *G. eucalypti.*

Glycaspis (*Glycaspis*) *egregia,* sp. nov.
(L. *egregius* = surprising)

General Colour: Pale brown lightly marked with black; white to yellow dorsal median stripe from anterior of vertex to anterior of abdomen; variable red suffusion. Dark markings on forewings of the male are illustrated in Text-fig. 134.
Claspers & Aedeagus: As in Text-fig. 48.
Length of Aedeagus: (4 specimens) 0.236 mm. to 0.254 mm.
Hindwings: Cu_1 as Group (i).
Host Plant: *E. moluccana* Roxb. (grey box).
Type Locality: 3 mi. W. Calliope, on Callide Rd., Queensland.
Types: Holotype male on slide labelled "3 mi. W. Calliope, Qld., 23 iv 1966, *E. moluccana*". Paratypes: (slides) 2♂s with same label data as the holotype; 1♂ "Brisbane, Qld., 2 x 1957, K. L. Harley". (in alcohol) 7♂s 17♀s 15 nymphs with same label data as the holotype. (dried) 2♂s and lerp "Brisbane, Qld., 2 x 1957, K. L. Harley".
Notes: Lerps round. Wing coloration of this species is similar to that of *G. flavilabris,* but the dark area extends on to the pterostigma. Specimens were reared from lerps by the writer.

Glycaspis (*Glycaspis*) *cnecosia*, sp. nov.

(Gr. *knekos* = pale yellow; *-ia* = state of being)

General Colour: Pale yellow with dark marks; abdomen suffused green.
Claspers & Aedeagus: As in Text-fig. 49.
Length of Aedeagus: (2 specimens) 0.252 mm. to 0.279 mm.
Hindwings: Cu_1 as Group (i).
Host Plant: *E. cambageana* Maiden (Coowarra box).
Type Locality: 17 mi. N. Banana, Queensland (Rannes Rd.).
Types: Holotype male on slide labelled "17 mi. N. Banana, Qld., 25 iv 1966, *E. cambageana*". Paratypes: (slide) 1♂ with same label data. (in alcohol) 3♂s 10♀s with same label data.
Notes: Lerps round, always at base of leaf and in compact groups. Some adults were reared by the writer.

Glycaspis (*Glycaspis*) *suavis*, comb. nov.

Glycaspis (*Alloglycaspis*) *suavis* Moore 1961, p. 155, Text-fig. 33.

Claspers & Aedeagus: As in Text-fig. 50.
Length of Aedeagus: (7 specimens) 0.203 mm. to 0.227 mm.
Hindwings: Cu_1 as Group (i).
Host Plants: *E. populnea* F. Muell. (bimble box); *Eucalyptus* sp. (box).
Type Locality: Strahorn State Forest, N.S.W.
Specimens Examined: (slides) 7♂s "24 mi. S.E. Gayndah, Qld., 21 iv 1966, *E. populnea*"; 5♂s "11 mi. N.W. Mt. Carbine, Qld., 16 v 1966, *Euc.* sp. (box); 1♂ "61 mi. N. Clermont, Qld., 2 v 1966, *E. ?populnea*"; 1♂ "60 mi. N. Mitchell, Qld., 7 xi 1952, A. L. Dyce, *E. populnea*". (in alcohol) several ♂s ♀s "24 mi. S.E. Gayndah, Qld., 21 iv 1966, *E. populnea*"; 1♂ 2♀s "118 mi. N. Clermont, Qld., 2 v 1966, *Euc.* sp. (box); several ♂s ♀s "61 mi. N. Clermont, Qld., 2 v 1966, *E. populnea*"; 10♂s 20♀s "11 mi. N.W. Mt. Carbine, Qld., 16 v 1966, *Euc.* sp. (box)"; 1♀ "4 mi. N.E. Hillston, N.S.W., 25 i 1967, *E. populnea*, reared ex round lerps, emgd. 26 i 1967". (dried) 5♀s "60 mi. N. Mitchell, Qld., 7 xi 1952, A. L. Dyce, *E. populnea*".
Notes: Lerps round.

Glycaspis (*Glycaspis*) *buxalis*, sp. nov.

(L. *buxus* = the box tree; *-alis* = pertaining to)

General Colour: Yellow, with variable dark markings.
Claspers & Aedeagus: As in Text-fig. 51.
Length of Aedeagus: (24 specimens) 0.193 mm. to 0.221 mm.
Hindwings: Cu_1 as Group (i).
Host Plants: *E. microtheca* F. Muell. (flooded box); *E. ?intertexta* R. T. Bak. (gum-barked coolabah); *E. ?melanophloia* F. Muell. (silver-leaved ironbark).
Type Locality: 102 mi. E. X-roads (Darwin-Mt. Isa), Northern Territory.
Types: Holotype male on slide labelled "102 mi. E. X-roads, N.T., 10 iv '66, *E. microtheca*". Paratypes: (slides) 4♂s with same label data as the holotype; 5♂s "67 mi. N.E. Pt. Hedland, W.A., 29 vii 1966, *E. microtheca*"; 4♂s "8 mi. S.W. DeGrey Riv., W.A., 30 vii 1966, *E. ?microtheca*"; 3♂s "14 mi. S.W. Pt. Hedland, W.A., 30 vii 1966, *E. ?microtheca*"; 2♂s "2 mi. E. Millstream, W.A., 3 viii 1966, *E. ?intertexta*"; 1♂ "32 mi. S. Roy Hill, W.A., 10 viii 1966, *E. ?microtheca*"; 4♂s "131 mi. N. Clermont, Qld., 2 v 1966, *E. ?melanophloia*"; 1♂ "107 mi. N. Clermont, Qld., 2 v 1966, *E. microtheca*". (in alcohol) 20♂s 20♀s "102 mi. E. X-roads, N.T., 10 iv 1966, *E. microtheca*"; 7♂s 9♀s "8 mi. S.W. DeGrey Riv., W.A., 30 vii 1966, *E. ?microtheca*"; 3♂s 9♀s "14 mi. S.W. Pt. Hedland, W.A., 30 vii 1966, *E. ?microtheca*"; 1♂ 2♀s "2 mi. E. Millstream, W.A., 3 viii 1966, *E. ?intertexta*"; 4♂s 4♀s "67 mi. N.E. Pt. Hedland, W.A., 29 vii 1966, *E. microtheca*"; 3♂s 7♀s "131 mi. N. Clermont, Qld., 2 v 1966, *E. ?melanophloia*"; 1♀ "32 mi. S. Roy Hill, W.A., 10 viii 1966, *E. ?microtheca*".

Notes: Lerps ? round. This species with short genal processes appears to come within the *occidentalis* group of species. Lerps occur on stems, leaves and twigs of the host plant. The short genal processes distinguish this species from *G. retrusa*, sp. nov.

Glycaspis (*Glycaspis*) *retrusa*, sp. nov.
(L. *retrusus* = hidden, concealed)

General Colour: Yellow with variable dark markings; some females with distinctive coloration similar to that given in Text-fig. 132. Abdomens retain green coloration in alcohol.
Claspers & Aedeagus: As in Text-fig. 52.
Length of Aedeagus: (21 specimens) 0.198 mm. to 0.250 mm.
Hindwings: Cu_1 as Group (i).
Host Plants: *E. microtheca; E. largiflorens* F. Muell. (river black box); *E. leptophleba* F. Muell. (bastard gum-leaved box); *E. ?tectifica* F. Muell. (Macarthur River Box).
Type Locality: Roper Bar, Roper River, Northern Territory.
Types: Holotype male on slide labelled "Roper Bar., N.T., 17 vi 1966, *E. microtheca* or *E. tectifica*". Paratypes: (slides) 1♂ "23 mi. W. Camooweal, N.T., 9 vi 1966, *E. ?microtheca*"; 2♂s "5 mi. S. Dunmarra, N.T., 13 vi 1966, *E. microtheca* or *E. tectifica*"; 5♂s "Roper Bar, N.T., 18 vi 1966, *E. microtheca* or *E. tectifica*"; 2♂s with same label data as the holotype; 3♂s 1♀ "Victoria Riv. X-ing, N.T., 7 vii 1966, *E. microtheca* or *E. tectifica*". (in alcohol) 6♂s 5♀s "5 mi. S. Dunmarra, N.T., 13 vi 1966, *E. microtheca* or *E. tectifica*"; 8♂s 10♀s "Roper Bar, N.T., 18 vi 1966, *E. microtheca* or *E. tectifica*"; 13♀s with same label data; 7♂s 3♀s "Victoria Riv. X-ing, N.T., 7 vii 1966, *E. microtheca* or *E. tectifica*"; *Females with distinctive coloration*: (in alcohol) 2♀s "Gunbar, N.S.W., 24 i 1967, *E. ?largiflorens*"; 1♀ "3 mi. S. Hillston, N.S.W., 25 i 1967, *E. largiflorens*"; 4♀s "2 mi. N.E. Hillston, N.S.W., 25 i 1967, *E. largiflorens*"; 2♀s "Willandra Crk., N.S.W., 26 i 1967, *E. ?largiflorens*"; 2♀s "Paroo Riv., N.S.W., 29 viii 1967, *E. ?microtheca*"; 2♀s "45 mi. W. Moree, N.S.W., 26 viii 1967, *E. microtheca*"; 1♀ "3 mi. W. Moree, N.S.W., 26 viii 1967, *E. microtheca*"; 1♀ "Tibooburra Crk., N.S.W., (Mt. Wood H.S.), 30 viii 1967, *E. microtheca*"; 1♀ "ca. 1 mi. N. Rannes, Qld., 25 iv 1966, *E. microtheca*"; 4♀s "6 mi. N. Emerald, Qld., 30 iv 1966, *E. microtheca*"; 1♀ "13 mi. N.W. Mt. Molloy, Qld., 12 v 1966, *E. leptophleba*"; 2♀s "119 mi. S. Normanton, Qld., 29 v 1966, *E. microtheca*"; 3♀s "5 mi. N.W. Mt. Isa, Qld., 8 vi 1966, *E. microtheca*"; 4♀s "23 mi. W. Camooweal, Qld., 9 vi 1966, *E. ?microtheca*"; 4♀s "5 mi. S. Dunmarra, N.T., 13 vi 1966, *E. microtheca* or *E. tectifica*"; 13♀s "Victoria Riv. X-ing, N.T., 7 vii 1966, *E. microtheca* or *E. tectifica*". (dried) 5♀s "30 mi. S. Bourke, N.S.W., 25 x 1957, I. F. B. Common"; 2♀s "27 mi. E. Cobar, N.S.W., 27 x 1957, I. F. B. Common"; 1♀ "Walgett, N.S.W., 15 x 1957, I. F. B. Common"; 1♀ "Hebel, Qld., 16 x 1957, I. F. B. Common"; 1♀ "Werna Crk., 30 mi. N.W. Winton, Qld., 6 viii 1963, T. E. Woodward", to QU.
Other Specimens Examined: (slides) (on slide with *G. anomala*) 1♂ "6 mi. N. Emerald, Qld., 30 iv 1966, *E. microtheca*".

Glycaspis (*Glycaspis*) *pervagata*, sp. nov.
(L. *pervagatus* = widespread)

General Colour: Pale yellow to orange; few dark marks with red suffusion.
Claspers & Aedeagus: As in Text-fig. 53.
Length of Aedeagus: (20 specimens) 0.230 mm. to 0.263 mm.
Hindwings: Cu_1 as Group (i).
Host Plants: *E. dumosa* A. Cunn. ex Schau. (congoo mallee); *E. incrassata* Labill. (lerp mallee); *E. gracilis* F. Muell. (yorrell); *E. ?foecunda* Schau. (slender-leaved white mallee); *E. striaticalyx* W. V. Fitzg. (Cue york gum); *E. lesouefii* Maiden (LeSouef's blackbutt); *E.*

torquata Luehm. (coral gum); *E. brachycalyx* Blakely (gilja); *E. ?griffithsii* Maiden (Griffith's grey gum); *E. ?dongarraensis* Maiden & Blakely (Dongarra mallee); *E. ?salmonophloia* F. Muell. (salmon gum); *E. ?calycogona* Turcz. (gooseberry mallee).

Type Locality: 2 mi. W. Goolgowie, New South Wales.

Types: Holotype male on slide labelled "2 mi. W. Goolgowie, N.S.W., 25 i 1967, *E. dumosa*". Paratypes: (slides) 2♂s with same label data as the holotype; 1♂ "3 mi. N. Karoonda, S.A., 13 xi 1966, *E. pileata-dumosa* complex"; 1♂ "Alawoona, S.A., 12 xi 1966, reared from *E. pileata* complex, emgd. 17 xi 1966"; 3♂s "Broad Arrow, W.A., 3 x 1966, *E. ?griffithsii*"; 1♂ "29 mi. S. Coolgardie, W.A., 8 x 1966, *E. ?griffithsii*"; 1♂ "4 mi. S. Geraldton, W.A., 20 viii 1966, *E. ?dongarraensis*"; 1♂ "4 mi. S. Nannine, W.A., 13 viii 1966, *E. striaticalyx*"; 1♂ "2.5 mi. S. Menzies, W.A., 1 x 1966, *E. lesouefii*"; 1♂ "44 mi. S. Menzies, W.A., 2 x 1966, *E. ?lesouefii*"; 1♂ "3 mi. S. Kalgoorlie, W.A., 5 x 1966, *E. ?lesouefii*"; 1♂ "Kalgoorlie, W.A., 4 x 1966, bred from *E. torquata* street trees"; 1♂ "29 mi. S. Coolgardie, W.A., 8 x 1966, *E. torquata*"; 1♂ "Paruna, S.A., 1 ii 1965, G. Howard, *E. incrassata*", to SM; 3♂s "20 mi. N. Norseman, W.A., 10 x 1966, *E. gracilis*". (in alcohol) 9♀s "4 mi. S. Nannine, W.A., 13 viii 1966, *E. striaticalyx*"; 1♀ "7 mi. along Casuarinas Rd., (45 mi. Geraldton), W.A., 18 viii 1966, *E. ?dongarraensis*"; 1♀ "4 mi. S. Geraldton, W.A., 20 viii 1966, *E. ?dongarraensis*"; 1♀ "29 mi. S. Coolgardie, W.A., 8 x 1966, *E. ?griffithsii*"; 1♀ "5 mi. N. Coolgardie, W.A., 7 x 1966, *E. torquata*"; 1♀ 9 nymphs "Kalgoorlie, W.A., *E. torquata*, bred from street trees"; 4♂s 16♀s 6 nymphs "3 mi. S. Kalgoorlie, W.A., 5 x 1966, *E. ?lesouefii*"; 19♀s "44 mi. S. Menzies, W.A., 2 x 1966, E. *?lesouefii*"; 1♀ "2.5 mi. S. Menzies, W.A., 1 x 1966, E. *lesouefii*"; 8♂s 9♀s 6 nymphs "Broad Arrow, W.A., 3 x 1966, *E. ?griffithsii*"; 1♂ 3♀s "29 mi. S. Coolgardie, W.A., 8 x 1966, *E. ?griffithsii*"; 1♀ "4 mi. S. Coolgardie, W.A., 7 x 1966, *E. ?griffithsii* or *E. salmonophloia*"; 4♀s "44 mi. S. Menzies, W.A., 2 x 1966, *E. lesouefii*"; 9♀s "3 mi. S. Kalgoorlie, W.A., 5 x 1966, *E. ?calycogona*"; 1♀ "Keith, S.A., 15 viii 1963, T. C. R. White, *E. incrassata*, Rearing No. 17E, emgd. 2 ix 63", to SM; 1♀, nymph, lerps, "Paruna, S.A., 1 ii 1965, G. Howard, *E. incrassata*", to SM; 2♂s 3♀s "2 mi. W. Goolgowie, N.S.W., 25 i 1967, *E. dumosa*"; 2♂s 8♀s "20 mi. N. Norseman, W.A., 10 x 1966, *E. gracilis*"; 2♀s "3 mi. N. Karoonda, S.A., 13 xi 1966, *E. pileata-dumosa* complex".

Other Specimens Examined: 1♀ "10 mi. N. Mannum, S.A., 11 xi 1966, *E. brachycalyx*".

Glycaspis (*Glycaspis*) *repentina*, comb. nov.

Glycaspis (*Alloglycaspis*) *repentina* Moore 1964, pp. 148-150, Text-fig. 4.

Claspers & Aedeagus: As in Text-fig. 54.

Length of Aedeagus: (20 specimens) 0.164 mm. to 0.191 mm.

Hindwings: Cu_1 as Group (i).

Host Plants: *E. oleosa* F. Muell. ex Miq. (giant mallee); *E. porosa* F. Muell. *in* Miq. (black mallee box); *E. ?foecunda; E. ?leucoxylon* F. Muell. (white ironbark).

Type Locality: Loxton, South Australia.

Specimens Examined: (slides) 2♂s "Lerps on mallee, adults 12 xii 1892", to SM; 1♂ "3 mi. S. Pt. Wakefield, S.A., 25 x 1966, *E. porosa*"; 6♂s "Lowaldie, S.A., 13 xi 1966, *E. ?foecunda*"; 4♂s "Glossop, S.A., 20 v 1966, R. H. Brewer, *Euc.* sp.", to SI. (in alcohol). 130♂s 130♀s "Lowaldie, S.A., 13 xi 1966, *E. ?foecunda*"; 30♂s 30♀s "Alawoona, S.A., 12 xi 1966, *E. ?oleosa*"; 11♂s 2♀s "6 mi. W. Mannum, S.A., 11 xi 1966, *E. ?oleosa*"; 2♂s 9♀s "6 mi. N. Mannum, S.A., 11 xi 1966, *E. ?oleosa*"; 1♂ 5♀s "Tintinara, S.A., 14 xi 1966, *E. ?leucoxylon*". (Dried) 2♀s "Glossop, S.A., 20 v 1966, R. H. Brewer, *Euc.* sp.", to SI; 1♀ 2 nymphs "Lerps on mallee, adults, 12 xii 1892", to SM.

Notes: Lerps round, on leaves and young shoots.

Glycaspis (*Glycaspis*) *collina*, sp. nov.
(L. *collinus* = hill loving)

General Colour: Yellow suffused red, with dark marks.
Claspers & Aedeagus: As in Text-fig. 55.
Length of Aedeagus: (4 specimens) 0.248 mm. to 0.256 mm.
Hindwings: Cu_1 as Group (i).
Host Plant: *E. melanophloia.*
Type Locality: 36 mi. W. Rockhampton, Queensland.
Types: Holotype male on slide labelled "36 mi. W. Rockhampton, Qld., 28 iv 1966, *E. ?melanophloia*". Paratypes: (slides) 1♂ "3 mi. N. Clermont, Qld., 1 v 1966, *E. melanophloia*"; 2♂s "24 mi. S.E. Gayndah, Qld., (Kilkivan Rd.), 21 iv 1966, *E. melanophloia*". (in alcohol) 2♀s with same label data as the holotype; 2♀s "3 mi. N. Clermont, Qld., 1 v 1966, *E. melanophloia*"; 1♀ "24 mi. S.E. Gayndah, Qld., 21 iv 1966, *E. melanophloia*".
Notes: Lerps ? oval.

Glycaspis (*Glycaspis*) *brunneincincta*, sp. nov.
(L. *brunneus* = dark brown; *incincta* = encircled)

General Colour: Male, cream to yellow; Female, as male but predominantly chocolate-brown.
Claspers & Aedeagus: As in Text-fig. 56.
Length of Aedeagus: (3 specimens) 0.230 mm. to 0.252 mm.
Hindwings: Cu_1 as Group (i).
Host Plants: *E. major* (Maiden) Blakely (bastard bangalay), or *E. propinqua* Deane & Maiden (small fruited grey gum); *?E. tessellaris* F. Muell. (carbeen).
Type Locality: 4.5 mi. N.E. Plunkett, Queensland.
Types: Holotype male on slide labelled "4.5 mi. N.E. Plunkett, Qld., 13 iv 1966, *E. major* or *E. propinqua*". Paratypes: (slides) 2♂s with same label data. (in alcohol) 5♂s 9♀s, nymphs, with same label data; 1♂ 4♀s "17 mi. N. Banana, Qld., 25 iv 1966, *E. ?cambageana*"; 1♀ "10 mi. N.E. Callide, Qld., 24 iv 1966, *?E tessellaris*".
Notes: Lerps round. Some adults were reared.

Glycaspis (*Glycaspis*) *dobsoni*, sp. nov.
(Named to honour Mr. Thomas Dobson who, during 1851, collected, and gave the earliest description of, a species in this genus).

General Colour: Yellow and orange-red, marked with black.
Claspers & Aedeagus: As in Text-fig. 57.
Length of Aedeagus: (2 specimens) 0.286 mm. and 0.309 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. viminalis.*
Type Locality: Domain, Hobart, Tasmania.
Types: Holotype male on slide labelled "Domain, Hobart, Tasmania, 17 xii 1966, *E. viminalis*". Paratypes: (slide) 1♂ "Domain, Hobart, Tas., 31 x 1959, K. L. Taylor, Bred from *E. viminalis*. (in alcohol) 3♀s with same label data as the holotype; 2♀s "5 mi. S. Cygnet, Tas., 18 xii 1966, *E. ?viminalis*". (dried) 3♀s "Domain, Hobart, Tas., 31 x 1959, K. L. Taylor, *E. viminalis*.
Notes: Lerps round to oval. Accompanying the latter 3♀s is a series of 11 lerps on 8 pins with the same label data. The lerps were associated with the series of adults (personal communication Taylor 1969).

Glycaspis (*Glycaspis*) *hadlingtoni*, sp. nov.
(Named for my colleague, Mr. P. Hadlington, who provided opportunities in the form of many projects, for the writer to express personal capabilities over many years).

General Colour: Cream to yellow, with or without dark markings.

Claspers & Aedeagus: As in Text-fig. 58.
Length of Aedeagus: (2 specimens) 0.245 mm., 0.263 mm.
Hindwings: Cu_1 as Group (i).
Host Plant: *E. intertexta.*
Type Locality: 28 mi. E. Cobar, New South Wales.
Types: Holotype male on slide labelled "28 mi. E. Cobar, N.S.W., 27 i 1967, *E. intertexta*". Paratypes: (slides) 1♂ "1.5 mi. E. Cobar, N.S.W., 6 ix 1967, *E. intertexta*"; 2♂s "Willandra Crk., N.S.W., 26 i 1967, *E. ?largiflorens*"; 3♂s "2 mi. N.E. Hillston, N.S.W., 25 i 1967, *E. ?largiflorens*". (in alcohol) 9♀s "1.5 mi. E. Cobar, N.S.W., 6 ix 1967, *E. intertexta*"; 7♀s "Willandra Crk., N.S.W., 26 i 1967, *E. ?largiflorens*".
Notes: Lerps ? round to oval. Dark markings on the scutum of adult females are similar to those of the dark phase of an adult female *G. retrusa* (Text-fig. 132) but reduced in area and intensity.

Glycaspis (*Glycaspis*) *rylstonensis*, sp. nov.

General Colour: Unrecorded.
Claspers & Aedeagus: As in Text-fig. 59.
Length of Aedeagus: (1 specimen) 0.218 mm.
Hindwings: Cu_1 as Group (i).
Host Plant: *E. blakelyi* Maiden (Blakely's red gum).
Type Locality: 2 mi. E. Rylstone, New South Wales (Olinda Rd.).
Types: Holotype male on slide labelled "2 mi. E. Rylstone, N.S.W., 6 iv 1966, *E. blakelyi*".

Glycaspis (*Glycaspis*) *grapta*, sp. nov.
(Gr. *graptos* = painted)

General Colour: Cream to orange-yellow; red suffusion; sesaonal variation in coloration.
Claspers & Aedeagus: As in Text-fig. 60.
Length of Aedeagus: (29 specimens) 0.221 mm. to 0.256 mm.
Hindwings: Cu_1 as Group (i).
Host Plants: *E. oleosa; E. ?salmonophloia.*
Type Locality: 33 mi. N. Hillston, New South Wales.
Types: Holotype male on slide labelled "33 mi. N. Hillston, N.S.W., 26 i 1967, *E. socialis* (= *oleosa*)". Paratypes: (slides) 4♂s with same label data as the holotype; 1♂ "33 mi. S. Cobar, N.S.W., 27 i 1967, *E. ?socialis*"; 1♂ "Alawoona, S.A., 12 xi 1966, *E. ?oleosa*"; 3♂s "4 mi. S. Coolgardie, W.A., 7 x 1966, *E. ?salmonophloia*"; 1♂ "3 mi. S. Kalgoorlie, W.A., 5 x 1966, *E. oleosa*"; 2♂s "2 mi. S. Kalgoorlie, W.A., 5 x 1966, *E. ?oleosa*"; 3♂s "2.5 mi. S. Menzies, W.A., 1 x 1966, *E. ?salmonophloia*"; 2♂s "99 mi. E. Geraldton, W.A., 15 viii 1966, *E. oleosa*"; 4♂s "112 mi. E. Wittenoom, W.A., 9 viii 1966, *E. oleosa glauca*". (in alcohol) 5♀s with same label data as the holotype; 2♀s "6 mi. W. Mannum, SA., 11 xi 1966, *E. ?oleosa*"; 2♀s "6 mi. N Mannum, S.A., 11 xi 1966, *E. ?oleosa*"; 1♀ "Alawoona, S.A., 12 xi 1966, *E. ?oleosa*"; 1♀ "62 mi. E. Ivy Tank, S.A., 16 x 1966, *E. ?oleosa*"; 2♂s 22♀s "4 mi. S. Coolgardie, W.A., 7 x 1966, *E. ?salmonophloia*"; 1♀ "2 mi. S. Kalgoorlie, W.A., 5 x 1966, *E. ?oleosa*"; 11♀s "2 mi. S. Kalgoorlie, W.A., 5 x 1966, *E. ?calycogona, E. ?oleosa*"; 4♂s 15♀s "2.5 mi. S. Menzies, W.A., 1 x 1966, *E. ?salmonophloia*"; 7♂s 7♀s "99 mi. E. Geraldton, W.A., 15 viii 1966, *E. oleosa*"; 19♂s 26♀s "112 mi. E. Wittenoom, W.A., 9 viii 1966, *E. oleosa glauca*".
Notes: Lerps round to oval.

Glycaspis (*Glycaspis*) *wanbiensis*, comb. nov.

Glycaspis (*Alloglycaspis*) *wanbiensis* Moore 1964, p. 148, Text-figs. 1-3.

Claspers & Aedeagus: As in Text-fig. 61.
Length of Aedeagus: (22 specimens) 0.180 mm. to 0.209 mm.
Hindwings: Cu_1 as Group (i).

Host Plants: *E. oleosa; E. ?foecunda; E. ?leucoxylon.*
Type Locality: Loxton, South Australia.
Specimens Examined: (slides) 1♂ "Tintinara, S.A., 14 xi 1966, *E. ?leucoxylon*"; 6♂s "Alawoona, S.A., 12 xi 1966, *E. ?oleosa*"; 3♂s "Lowaldie, S.A., 13 xi 1966, *E. ?foecunda*". (in alcohol) 2♀s "Tintinara, S.A., 14 xi 1966, *E. ?leucoxylon*"; 14♂s 24♀s "Alawoona, S.A., 12 xi 1966, *E. ?oleosa*"; 11♂s 13♀s "Lowaldie, S.A., 13 xi 1966, *E. ?foecunda*".
Notes: Lerps round; on leaves, stems, leaf-petioles and bud peduncles.

Glycaspis (*Glycaspis*) *notialis*, sp. nov.
(L. *notialis* = southern)

General Colour: Similar to *G. wanbiensis* and *G. repentina*, but dark markings black rather than brown; abdomen and other areas red.
Claspers & Aedeagus: As in Text-fig. 62.
Length of Aedeagus: (3 specimens) 0.191 mm. to 0.196 mm.
Hindwings: Cu_1 as Group (i).
Host Plants: *E. gracilis; E. pileata-dumosa* complex; *?E porosa; E. ?oleosa.*
Type Locality: 28 mi. S. Ceduna, South Australia.
Types: Holotype male on slide labelled "28 mi. S. Ceduna, S A., 17 x 1966, *E. pileata-dumosa* complex". Paratypes: (slides) 1♂ "20 mi. N. Norseman, W.A., 10 x 1966, *E. gracilis*"; 1♂ "2 mi. N. Bow Hill, S.A., 11 xi 1966, *E. ?oleosa*". (in alcohol) 1♀ "28 mi. S. Ceduna, S.A., 17 x 1966, *E. pileata-dumosa* complex"; 1♀ "2 mi. N. Bow Hill, S.A., 11 xi 1966, *E. ?oleosa*"; 1♀ "6 mi. W. Mannum, S.A., 11 xi 1966, *E. ?oleosa*".
Other Specimens Examined: 2♀s "3 mi. S. Pt. Wakefield, S.A., 25 xi 1966, *E. porosa*".
Notes: Lerps round.

Glycaspis (*Glycaspis*) *occidentalis* (Solomon), comb. nov.

Spondyliaspis occidentalis Solomon 1936, pp. 41-48, 2 Pls. of 12 figs.
Glycaspis occidentalis: Taylor 1960, p. 385.
Glycaspis (*Alloglycaspis*) *occidentalis*: Moore 1964, p. 150, Text-fig. 5.

General Colour: Brown to dark brown.
Claspers & Aedeagus: As in Text-fig. 63 (of Lectotype).
Length of Aedeagus: (12 specimens) 0.203 mm. to 0.221 mm.
Hindwings: Cu_1 as Group (i).
Host Plants: *E. gomphocephala* A.DC. (tuart); *E. redunca elata; E. oleosa; ?E. calycogona.*
Type Locality: Perth, Western Australia.
Specimens Examined: (slides) 3♂s "Wembley Golf Course, W.A., 4 v 1954, K. L. Taylor, Twigs of *E. gomphocephala*"; 4♂s "Wooroloo, W.A., 2 ix 1966, *E. redunca elata*"; 4♂s "Kalgoorlie, W.A., on gum trees", to WA; 4♂s 5♀s "Perth, W.A., 4 iii 1959, V.F.E., 7361, B.M. 1960-144", to BM; 3♂s "Bullsbrook, W.A., 18 iii 1969, S. J. Curry, *E. redunca elata*", to WA; 3♂s "Psyllid from eucalypt, young secrete sugary covering, Perth, 16 ii 1931, B.A.O'C", to WA. (in alcohol) ca. 50♂s & ♀s, "Kalgoorlie, W.A., on gum trees", to WA; 1♀ "Crawley, Perth, W.A., 6 ix 1966, *E. gomphocephala*"; 3♂s 4♀s "Wooroloo, W.A., 2 ix 1966, *E. redunca elata*"; 1♀ "99 mi. E. Geraldton, W.A , 15 viii 1966, *E. oleosa*"; 1♀ "44 mi. S. Menzies, W.A., 2 x 1966, *E. ?calycogona*"; 2♀s nymphs, lerps, "Bullsbrook, W.A., 18 iii 1969, S. J. Curry, *E. redunca elata*"; nymphs, lerps, "Rockingham, W.A., 23 i 1969, S. J. Curry, *E. gomphocephala*", to WA. (dried) 4♂s 3♀s "Wembley Golf Course, W.A., 4 v 1954, K. L. Taylor, Twigs of *E. gomphocephala*".

Notes on the *occidentalis* group of species

The type slides, and 24 additional slides of male aedeagi and claspers have been examined and compared, with the following indications:-

G. repentina is a separate species.

The shape of the aedeagus of the *G. occidentalis* Lectotype is apparently atypical of the species, and specimens approach *G. wanbiensis* in the general shape of that character.

The length-ranges of the male aedeagi overlap in the specimens from the two widely separated areas, with the average length for the Western Australian specimens exceeding that for the South Australian specimens.

From the known distribution of these two groups, and the intervening natural barriers to the intermingling of the species, it seems unlikely that there is any overlap of populations.

The claspers of the W.A. group specimens are consistently wider than those of the S.A. group, although the width for one W.A. specimen corresponds with the maximum width for the S.A. specimens.

In this paper, the two species *G. occidentalis* and *G. wanbiensis* are retained, as it is considered that more extensive investigations to determine their taxonomic status, are required.

Glycaspis (*Glycaspis*) *yilgarniensis*, sp. nov.

(Yilgarnia is the name given to an area, which includes the type locality, believed to be the oldest land surface in Australia).

General Colour: Cream suffused red, with extensive dark markings.
Claspers & Aedeagus: As in Text-fig. 64.
Length of Aedeagus: (1 specimen) 0.207 mm.
Hindwings: Cu_1 as Group (i).
Host Plants: *E. gamophylla* F. Muell. (twin-leaved gum); *E. ?lesouefii.*
Type Locality: 66 mi. S. Mundiwindi, Western Australia.
Types: Holotype male on slide labelled "66 mi. S. Mundiwindi, W.A., 11 viii 1966, *E. gamophylla*". Paratype: (slide) 1♂ "44 mi. S. Menzies, W.A., 2 x 1966, *E. ?lesouefii*".

Glycaspis (*Glycaspis*) *infucata*, sp. nov.
(L. *infucatus* = painted)

General Colour: Cream suffused brown, black and red; there is a dark coloured band on the forewings of the females, contiguous to stem of M+Cu and branch of Cu_2, and a paler brownish suffusion on posterior half of forewings.
Claspers & Aedeagus: As in Text-fig. 65.
Length of Aedeagus: (1 specimen) 0.254 mm.
Hindwings: Cu_1 as Group (i).
Host Plant: *E. leptopoda* Benth. (tammin mallee).
Type Locality: 90 mi. E. Geraldton, Western Australia.
Types: Holotype male on slide labelled "90 mi. E. Geraldton, W.A., 15 viii 1966, *E. leptopoda*". (in alcohol) 3♀s and anterior half of 1 specimen, with same label data.

Glycaspis (*Glycaspis*) *felicitaris*, sp. nov.
(L. *felicitas* = good fortune; *-aris* = pertaining to)

General Colour: Brown, black and white or cream; ♂ forewing with grey suffused band as in Text-fig. 135.
Claspers & Aedeagus: As in Text-fig. 66.
Length of Aedeagus: (1 specimen) 0.304 mm.
Hindwings: Cu_1 as Group (i), and the shortest of any spp. in the Group.
Host Plant: *E. tetraptera* Turcz. (square fruited mallee).
Type Locality: 13 mi. N. Esperance, Western Australia.
Types: Holotype male and nymph on slide labelled "13 mi. N. Esperance, W.A., 29 ix 1966, *E. tetraptera*".
Notes: Lerps round; small lerps very granular, with few short filaments.

Glycaspis (*Glycaspis*) *subita*, sp. nov.
(L. *subitus* = unexpected)

General Colour: Unrecorded.
Claspers & Aedeagus: As in Text-fig. 67.

Length of Aedeagus: (1 specimen) 0.322 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. cornuta* Labill. (yate).
Type Locality: Stirling Range, Western Australia.
Types: Holotype male on slide labelled "Stirling Ra., W.A., 23 ix 1966, *E. cornuta*".
Notes: The aedeagus of this species suggests affinities with *G. pervagata*.

Glycaspis (*Glycaspis*) *rivalis*, comb. nov.

Glycaspis (*Alloglycaspis*) *rivalis* Moore 1961, pp. 155-6, Text-fig. 34.

Claspers & Aedeagus: As in Text-fig. 68.
Length of Aedeagus: (19 specimens) 0.216 mm. to 0.248 mm.
Hindwings: Cu_1 as Group (i).
Host Plants: *E. paniculata* Sm. (grey ironbark); *E. ?ovata*.
Type Locality: Ourimbah State Forest, New South Wales.
Specimens Examined: (slides) 4♂s "5 mi. W. Lakes Entrance, Vic., 6 i 1967, *E. ?ovata*". (in alcohol) 25♂s 35♀s with same label data. (Dried) 1♂ "Ourimbah S.F., N.S.W., 14 xii 1956, K. L. Taylor, *E. acmenioides*".
Notes: Lerps round.

Glycaspis (*Glycaspis*) *pilata*, comb. nov.

Glycaspis (*Alloglycaspis*) *pilata* Moore 1961, pp. 156-7, Text-fig. 35.

Claspers & Aedeagus: As in Text-fig. 69.
Length of Aedeagus: (6 specimens) 0.236 mm. to 0.263 mm.
Hindwings: Cu_1 as Group (i).
Host Plant: *E. paniculata*.
Type Locality: Kurrajong, New South Wales.
Notes: Lerps round.

Glycaspis (*Glycaspis*) *whitei*, sp. nov.

(Named for Dr. T. C. R. White, of the University of Adelaide, S.A., whose helpful information concerning this and other *Glycaspis* spp., together with the provision of many reared specimens, contributed much to this Revision).

General Colour: Lemon yellow lightly marked with black; very variable.
Claspers & Aedeagus: As in Text-fig. 70.
Length of Aedeagus: (16 specimens) 0.236 mm. to 0.267 mm.
Hindwings: Cu_1 as Group (ii).
Host Plants: *E. polyanthemos* Schau. (red box); *E. fasciculosa* F. Muell. (pink gum).
Type Locality: 1 mi. W. Rylstone, New South Wales.
Types: Holotype male on slide labelled "1 mi. W. Rylstone, N.S.W., 1 ii 1967, *E. polyanthemos*". Paratypes: (slides) 1♂ with same label data as the holotype; 4♂s "8.5 mi. E. Tumut, N.S.W., 12 i 1967, *E. polyanthemos*"; 2♂s "Tintinara, S.A., 25 v 1967, T. C. R. White, *E. fasciculosa*", (1♂ to SM); 2♂s "Brecon, S.A., 25 v 1967 (eggs), T. C. R. White, Reared in lab. 15.5°-21°C., 24 L.O.D., *E. fasciculosa*", (1♂ to SM); 2♂s "Keith, S.A., 25 v 1963, T. C. R. White, Hatched 1 vi 63, emgd. 22-23 vi 63, *E. fasciculosa*", (1♂ to SM). (in alcohol) 4♂s 23♀s "8.5 mi. E. Tumut, N.S.W., 12 i 1967, *E. polyanthemos*"; 8♂s 12♀s "1 mi. W. Rylstone, N.S.W., 1 ii 1967, *E. polyanthemos*"; 3 nymphs 1 lerp "Keith, S.A., 29 v 1963, T. C. R. White, *E. fasciculosa*, (eggs), pres. 1 vii 63"; 11♀s "Tintinara, S.A., 25 v 1967, T. C. R. White, *E. fasciculosa*"; 1♀ 1 lerp, "National Park, S.A., 17 vi 1963, T. C. R. White, emgd. 28 vi 63, *E. fasciculosa*"; 1♀, 1 lerp, with same label data, but "emgd. 27 vi 63"; 6 nymphs, 9 lerps, "Keith, S.A., 25 v 1963, T. C. R. White, *E. fasciculosa*"; 3 nymphs, 6 lerps "Keith, S.A., 25 v 1963, T. C. R. White, Hatched 1 vi 63, em. 22-23 vi 63, eggs short, yellow, *E. fasciculosa*"; 4♂s 9♀s, nymphs, lerps, "Brecon, S.A., 25 v 1967, coll. & reared T. C. R. White, 15.5°-21°C., 24 L.O.D., *E. fasciculosa*"; 1♀ "23 mi. S. Keith, S.A., 15 xi 1966, *E. fasciculosa*"; 2♀s "7 mi. E. Tumut, N.S.W., 25 ii 1969, *E. polyanthemos*".

Other Specimens Examined: (slide) 1♂ "Heywood Park, S.A., 7 x 1940, R. V. Southcott, ACA, 714 DA". (in alcohol) 2♀s "Tintinara, S.A., 14 xi 1966, *E. ?fasciculosa*".

Notes: Lerps round. This species appears near to *G. fuscovena* but is readily separable on the shape of the male aedeagus.

Glycaspis (*Glycaspis*) *fuscovena*, sp. nov.

(L. *fuscus* = brown, dark; *vena* = a vein)

General Colour: Cream to yellow, with dark marks and red suffusion.

Claspers & Aedeagus: As in Text-fig. 71.

Length of Aedeagus: (7 specimens) 0.241 mm. to 0.284 mm.

Hindwings: Cu_1 as Group (ii).

Host Plants: *E. woollsiana* R. T. Bak. (mallee box) or *E. microcarpa* Maiden (green-leaved box); *E. ?fasciculosa; E. odorata* Behn. & Schlect. (peppermint box).

Type Locality: Gillenbah State Forest, Narrandera, New South Wales.

Types: Holotype male on slide labelled "Gillenbah S.F., N.S.W., 1 xi 1967, *E. woollsiana* or *E. microcarpa*". Paratypes: (slides) 2♂s with same label data as the holotype; 2♂s "Australia, Koebele, *E. leucoxylon*", to UM; 2♂s "4 mi. ESE Struan, S.A., 16 xi 1966, *E. ?fasciculosa*"; 6♂s "Blackwood, S.A., 7 i 1950, T. O. Browning, *Euc.* sp.", to SI; 2♂s "Waite Institute, S.A., 1 x 1963, T. C. R. White, *E. odorata*". (in alcohol) 2♂s 2♀s with same label data as the holotype; 1♂ 5♀s "4 mi. ESE. Struan, S.A., 16 xi 1966, *E. ?fasciculosa*"; 5♂s 1♀ "Blackwood, S.A., 7 i 1950, T. O. Browning, *Euc.* sp.", to SI; 4♀s nymphs, lerps, "Waite Institute, S.A., 1 x 1963, T. C. R. White, *E. odorata*". (dried) 4♂s 7♀s "Australia, Koebele", to UM.

Other Specimens Examined: (slides) 2♂s "Belair, S.A., 10 x 1952, G. F. Gross", to SM; 1♂ "Lyndoch, S.A., 29 iii 1891, Tepper, from thickets *E. odorata*", to SM; 4♂s "Lyndoch scrub, S.A., 30 iii 1891, Tepper, on leaves *E. odorata*, to Maskell 5 iv 91", to SM; 1♂ "Black Mtn., A.C.T., 1 xi 1954, I. F. B. Common, light trap". (in alcohol) 1♀ "3 mi. S. Wilmington, S.A., 24 x 1966, *E. ?odorata*". (dried) 2♀s "Belair, S.A., 10 x 1952, G. F. Gross", to SM; 6?♂s, nymphs, lerps, parasites, "Lyndoch scrub, S.A., 30 iii 1891, on leaves *E. odorata*, to Maskell 5 iv 91", to SM; 1♀ "Mt. Lofty, S.A., N. B. Tindale", to SM; 2♀s "Lyndoch, S.A., 29 iii 1891, *Psylla* sp. from shields, on *E. odorata*", to SM.

Glycaspis (*Glycaspis*) *wagaitjae*, sp. nov.

(= of the Aboriginal tribe of Wagaitj, which inhabited the type locality)

General Colour: Pale yellow, with few dark marks on females only, eyes red.

Claspers & Aedeagus: As in Text-fig. 72.

Length of Aedeagus: (4 specimens) 0.158 mm. to 0.169 mm.

Hindwings: Cu_1 as Group (ii).

Host Plant: *E. ?tetrodonta* F. Muell. (Darwin stringybark).

Type Locality: 35 mi. S. Darwin, Northern Territory.

Types: Holotype male on slide labelled "35 mi. S. Darwin, N.T., 4 vii 1966, *E. ?tetrodonta*". Paratypes: (slides) 2♂s with same label data as the holotype; 1♂ "5.5 mi. S. Darwin, N.T., 3 vii 1966, *E. ?tetrodonta*". (in alcohol) 12♂s 13♀s with same label data as the holotype.

Notes: Lerps round; eggs in circles and arcs; large numbers of lerps on leaves and twigs. Vein Cu_1 of the hindwing and the shape of the claspers, suggest that this species is more recent in phylogeny than other species in the *occidentalis* group, to which it apparently belongs because of the short genal processes, the disposition of feeding nymphs, and the general biology of the species.

The species is readily separable from other species of similar coloration by the short genal processes and the unusual characteristic for spp. in this genus, of red eyes.

Glycaspis (*Glycaspis*) *caurina*, sp. nov.
(L. *caurinus* = north-western)

General Colour: Deep lemon-yellow; no dark marks; bases of antennae and anterior projections of vertex sometimes lightly suffused red; genal processes suffused grey on internal edges.
Claspers & Aedeagus: As in Text-fig. 73.
Length of Aedeagus: (3 specimens) 0.187 mm. to 0.203 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. jensenii* Maiden (wandi ironbark).
Type Locality: 88 mi. W. Timber Creek, Northern Territory.
Types: Holotype male on slide labelled "88 mi. W. Timber Creek, N.T., 9 vii 1966, *E. jensenii*". Paratypes: (slides) 2♂s with same label data. (in alcohol) 14♂s 30♀s 1 nymph, with same label data.
Notes: Lerps round.

Glycaspis (*Glycaspis*) *lucrosa*, sp. nov.
(L. *lucrosa* = advantageous)

General Colour: Yellow; variable dark marks on female dorsal abdominal segments.
Claspers & Aedeagus: As in Text-fig. 74.
Length of Aedeagus: (5 specimens) 0.218 mm. to 0.232 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. tetrodonta*.
Type Locality: 28 mi. S. Normanton, Queensland.
Types: Holotype male on slide labelled "28 mi. S. Normanton, Qld., 27 v 1966, *E. tetrodonta*". Paratypes: (slides) 1♂ "2 mi. N. Larrimah, N.T., 14 vi 1966, *E. tetrodonta*"; 1♂ "5 mi. N. Larrimah, N.T., 15 vi 1966, *E. tetrodonta*"; 2♂s "5.5 mi. S. Darwin, N.T., 3 vii 1966, *E. tetrodonta*". (in alcohol) 3♀s "3.5 mi. S. Normanton, Qld., 27 v 1966, *E. tetrodonta*"; 2♀s "27 mi. N. Larrimah, N.T. ,15 vi 1966, *E. tetrodonta*"; 6♀s "5 mi. N. Larrimah, N.T., 15 vi 1966, *E. tetrodonta*"; 1♀ "13 mi. N.W. Katherine, N.T., 22 vi 1966, *E. tetrodonta*"; 1♀ "6 mi. S.W. East Alligator Riv., N.T., 24 vi 1966, *E. tetrodonta*"; 7♀s "5.5 mi. S. Darwin, N.T., 3 vii 1966, *E. ?tetrodonta*"; 1♂ 1♀ "128 mi. W. Timber Crk., W.A., 10 vii 1966, *E. tetrodonta*".
Notes: Lerps round.

Glycaspis (*Glycaspis*) *anota*, sp. nov.
(L. *a-* = without; *nota* = a mark)

General Colour: Yellow; a black spot each side of the anal aperture on female specimens only.
Claspers & Aedeagus: As in Text-fig. 75.
Length of Aedeagus: (11 specimens) 0.203 mm. to 0.227 mm.
Hindwings: Cu_1 as Group (ii).
Host Plants: *E. phoenicea* F. Muell. (ngainggar or scarlet gum); *E. miniata* A. Cunn. ex Schau. (Melaleuca gum).
Type Locality: 63 mi. W. Georgetown, Queensland.
Types: Holotype male on slide labelled "63 mi. W. Georgetown, Qld., 24 v 1966, *E. miniata*". Paratypes: (slides) 3♂s with same label data as the holotype; 2♂s "Roper Valley H.S., N.T., 16 vi 1966, *E. phoenicea*"; 2♂s "5.5 mi. S. Darwin, N.T., 3 vii 1966, *E. ?miniata*"; 1♂ "Edith Riv., N.T., 22 vi 1966, *E. miniata*"; 1♂ "King Leopold Ra., W.A., 19 vii 1966, *E. miniata*"; 1♂ "14 mi. S. Derby, W.A., 17 vii 1966, *E. miniata*". (in alcohol) 4♂s 5♀s with same label data as the holotype; 3♂s 4♀s, 1 nymph, "40 mi. W. Georgetown, Qld., 23 v 1966, *E. miniata*"; 3♀s "13 mi. NW. Katherine, N.T., 22 vi 1966, *E. miniata*"; 1♂ 6♀s "Edith Riv., N.T., 22 vi 1966, *E. miniata*"; 4♀s "14 mi. S. Derby, W.A., 17 vii 1966, *E. miniata*"; 2♀s "King Leopold Ra., W.A., 19 vii 1966, *E. miniata*"; 6♂s 27♀s "Roper Valley H.S., N.T., 16 vi 1966, *E. phoenicea*"; 2♀s "5.5 mi. S. Darwin, N.T., 3 vii 1966, *E. ?miniata*".
Notes: Lerps round.

Glycaspis (*Glycaspis*) *wondjinae*, sp. nov.

(The Aboriginal Cult, Wondjina, was practised in the area of the type locality).

General Colour: Cream to yellow, with variable dark markings; females with red suffusion, and sometimes with darker medio-dorsal area.

Claspers & Aedeagus: As in Text-fig. 76.

Length of Aedeagus: (13 specimens) 0.203 mm. to 0.243 mm.

Hindwings: Cu_1 as Group (ii).

Host Plants: *E. houseana* W. V. Fitzgerald ex Maiden (tropical white gum); *E. alba* Reinw. ex Blume (Timor white gum); *E. bigalerita* F. Muell. (Adelaide River white gum).

Type Locality: King Leopold Range, Kimberleys, Western Australia (nr. summit, in creek bed).

Types: Holotype male on slide labelled "King Leopold Ra., W.A., 19 vii 1966, *E. houseana*". Paratypes: (slides) 1♂ with same label data as the holotype; 2♂s "35 mi. S. Townsville, Qld., 4 v 1966, *E. alba*"; 3♂s "11 mi. S. Cooktown, Qld., 15 v 1966, *E. ?alba*"; 2♂s "17 mi. S. Larrimah, N.T., 14 vi 1966, *E. bigalerita*"; 2♂s "27 mi. N. Katherine, N.T., 22 vi 1966, *E. ?bigalerita*"; 1♂ "42 mi. SW. Katherine, N.T., 6 vii 1966, *E. ?bigalerita*"; 2♂s "24 mi. W. Kununurra, W.A., 10 vii 1966, *E. ?bigalerita*". (in alcohol) 5♀s with same label data as the holotype; 5♀s "35 mi. S. Townsville, Qld., 4 v 1966, *E. alba*"; 7♀s "11 mi. S. Cooktown, Qld., 15 v 1966, *E. ?alba*"; 1♂ 6♀s "17 mi. S. Larrimah, N.T., 14 vi 1966, *E. bigalerita*"; 1♂ 4♀s "27 mi. NW. Katherine, N.T., 22 vi 1966, *E. ?bigalerita*"; 2♀s "63 mi. S. Darwin, N.T., 5 vii 1966, *E. ?alba*"; 1♂ 2♀s "24 mi. W. Kununurra, W.A., 10 vii 1966, *E. ?bigalerita*".

Notes: Lerps round. Three female dried specimens from Papua, one of which bears label data indicating that its host plant is *E. alba*, have been examined. Until male specimens are studied, the identification of the species must remain in doubt. Label data are "Saraga, Port Moresby, Papua, v 1968, T. L. Fenner, *E. alba*"; same locality, "4 ii 1969, T. L. Fenner, at house light"; "Port Moresby, Boroko, N.G., 6-7 xi 1960, J. L. Gressitt, Malaise Trap, Bishop Museum", to BP.

Glycaspis (*Glycaspis*) *quornensis*, sp. nov.

General Colour: Yellow suffused red, with variable dark markings.

Claspers & Aedeagus: As in Text-fig. 77.

Length of Aedeagus: (2 specimens) 0.250 mm, 0.261 mm.

Hindwings: Cu_1 as Group (ii).

Host Plants: *E. albens* Benth. (white box); *E. microcarpa; ?E. leucoxylon.*

Type Locality: 6 mi. S. Quorn, South Australia.

Types: Holotype male on slide labelled "6 mi. S. Quorn, S.A., 23 x 1966, *?E. albens*". Paratypes: (slide) 1♂ 1♀ "26 mi. S. Omeo, Vic., 7 i 1967, *E. albens*". (in alcohol) 3♀s with same label data as the holotype; 7♀s "18 mi. S. Wilmington, S.A., 24 x 1966, *E. albens*"; 6♀s "6 mi. S. Quorn, S.A., 23 x 1966, *?E. leucoxylon*".

Other Specimens Examined: (in alcohol) 2♀s "Lah Arum, Vic., 17 xi 1966, *E. microcarpa*"; 7♀s "6 mi. N. Merriwa, N.S.W., 25 ix 1967, *E. albens*".

Glycaspis (*Glycaspis*) *anomala*, sp. nov.
(Gr. *anomalos* = irregular)

General Colour: Seasonal variation; lemon yellow to orange, sometimes suffused red; sometimes with dark marks.

Claspers & Aedeagus: As in Text-fig. 78.

Length of Aedeagus: (12 specimens) 0.203 mm. to 0.256 mm.

Hindwings: Cu_1 as Group (ii).

Host Plants: *E. microtheca; E. largiflorens; E. ?populnea; E. cambageana; E. thozetiana* F. Muell. ex R. T. Bak. (yapunyah); *E. microcarpa* or *E. woollsiana.*

Type Locality: Warrego Riv., New South Wales.

Types: Holotype male on slide labelled "Warrego Riv., N.S.W., 29 viii 1967, *E. ?microtheca*". Paratypes: (slides) 2♂ "Paroo Riv., N.S.W.,

29 viii 1967, *E. ?microtheca"*; 1♂ "23 mi. W. Camooweal, N.T., 9 vi 1966, *E. ?microtheca"*; 2♂s "10 mi. E. Brewarrina, N.S.W., 28 viii 1967, *E. largiflorens"*; 5♂s "2 mi. NE. Hillston, N.S.W., 25 i 1967, *E. ?largiflorens"*; 1♂ "Gunbar, N.S.W., 24 i 1967, *E. ?largiflorens"*. (in alcohol) 2♂s 8♀s "Warrego Riv., N.S.W., 29 viii 1967, *E. ?microtheca"*; 2♀s "Paroo Riv., N.S.W., 29 viii 1967, *E. ?largiflorens"*; 3♀s "45 mi. W. Moree, N.S.W., 26 viii 1967, *E. microtheca"*; 2♀s "3 mi. W. Moree, N.S.W., 26 viii 1967, *E.? microtheca"*; 8♀s "3.5 mi. N. Walgett, N.S.W., 28 viii 1967, *E. ?microtheca"*; 1♂ 1♀ "10 mi. E. Brewarrina, N.S.W., 28 viii 1967, *E. largiflorens"*; 5♀s "44 mi. W. Wanaaring, N.S.W., 29 viii 1967, *E. ?populnea"*; 1♀ "5 mi. N. Tibooburra, N.S.W., 31 viii 1967, *E. ?microtheca"*; 1♀ "48 mi. S. Kayrunnera, N.S.W., 3 ix 1967, *E. ?largiflorens"*; 4♀s "2 mi. W. Hermidale, N.S.W., 6 ix 1967, *E. ?populnea"*; 4♀s "14 mi. E. Cobar, N.S.W., 27 i 1967, *Euc.* sp."; 11♀s "4 mi. NE. Hillston, N.S.W., 25 i 1967, *E. ?populnea"*; 9♂s 11♀s "2 mi. NE. Hillston, N.S.W., 25 i 1967, *E. ?largiflorens"*; 1♂ 3♀s "3 mi. S. Hillston, N.S.W., 25 i 1967, *Euc.* sp."; 3♀s "7 mi. S. Jerilderie, N.S.W., 23 i 1967, *E. ?largiflorens"*; 2♂s 8♀s "Deniliquin, N.S.W., 24 i 1967, *E. ?largiflorens"*; 3♂s 9♀s "Gunbar, N.S.W., 24 i 1967, *E. ?largiflorens"*; 1♂ 1♀ "23 mi. W. Camooweal, N.T., 9 vi 1966, *E. ?microtheca"*; 2♀s "17 mi. N. Banana, Qld., 25 vi 1966, *E. ?cambageana"*; 2♀s "21 mi. N. Clermont, Qld., 1 v 1966, *E. cambageana"*; 1♀ "29 mi. N. Clermont, Qld., 1 v 1966, *E. thozetiana"*; 1♀ "Narrandera,, N.S.W., 1 xi 1967, *E. microcarpa* or *E. woollsiana"*.

Other Specimens Examined: (in alcohol) 1♀ "60 mi. S. Cooktown, Qld., 15 v 1966, *Euc.* sp."; 2♀s "6 mi. N. Emerald, Qld., 30 iv 1966, *E. microtheca"*.

Glycaspis (*Glycaspis*) *johnsoni*, sp. nov.

(Named for Mr. L. A. S. Johnson, of the Royal Botanic Gardens, Sydney, whose helpful identifications of a large number of host plants over many years have been of inestimable value).

General Colour: Yellow, with or without dark marks; paler in coloration than *G. brimblecombei* when occurring together on the same host.

Claspers & Aedeagus: As in Text-fig. 79.

Length of Aedeagus: (17 specimens) 0.182 mm. to 0.214 mm.

Hindwings: Cu_1 as Group (ii).

Host Plants: *E. dealbata* A. Cunn. ex Schau. (tumble-down gum); *E. blakelyi; E. dwyeri* Maiden & Blakely (Dwyer's mallee gum); *E. ?largiflorens.*

Type Locality: 10 mi. S. Narrabri, New South Wales.

Types: Holotype male on slide labelled "10 mi. S. Narrabri, N.S.W., 25 viii 1967, *E. dealbata"*. Paratypes (slides) 3♂s with same label data as the holotype; 1♂ "Kandos, N.S.W., 30 viii 1964"; 4♂s "36 mi. E. Rylstone, N.S.W., 7 iv 1966, *E. blakelyi"*; 2♂s "6 mi. NW. Goolma, N.S.W., 31 i 1967, *E. blakelyi"*; 8♂s 2♀s "Corringle S.F., N.S.W., 3 v 1964, *E. dwyeri"*; 7♂s "Capitol Hill, A.C.T., 13 i 1953, E. Lewis, *E. blakelyi"*; 1♂ "Black Mtn., A.C.T., 29 i 1953, E. Lewis, *E. blakelyi"*; 2♂s "Deakin, A.C.T., 24 vii 1953, F. Wheelhouse, *E. blakelyi"*. (in alcohol) 1♂ 10♀s with same label data as the holotype; 20♂s 20♀s "Corringle S.F., N.S.W. ,3 v 1964, *E. dwyeri"*. (dried) 12♂s 17♀s "Capitol Hill, A.C.T., 13 i 1953, E. Lewis, *E. blakelyi"*.

Other Specimens Examined: (slide) 1♂ (with *G. ?gradata*) "2 mi. NE. Hillston, N.S.W., 25 i 1967, *E. ?largiflorens"*. (in alcohol) in 3 tubes with *G. brimblecombei*, labelled "2 mi. E. Rylstone, N.S.W., 6 iv 1966, *E. blakelyi"*; "36 mi. E. Rylstone, N.S.W., 7 iv 1966, *E. blakelyi"*; and "6 mi. N. Goolma, N.S.W., 31 i 1967, *E. blakelyi"*. (dried) 1♀ "Deakin, A.C.T., 24 vii 1953, F. Wheelhouse, *E. blakelyi"*; 2♀s "Black Mtn., A.C.T., 29 i 1953, E. Lewis, *E. blakelyi"*.

Notes: Specimens from Corringle S.F. constructed their lerps on twigs and petioles, indicating biological affinities of this species with the *occidentalis* group of species, but apparently of more recent phylogeny.

Glycaspis (*Glycaspis*) *violae*, sp. nov.

(Named for my project companion who contributed substantially to the successful conclusion of this project).

General Colour: Pale yellow, lightly marked with black.
Claspers & Aedeagus: As in Text-fig. 80.
Length of Aedeagus: (3 specimens) 0.180 mm. to 0.191 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. ?melanophloia.*
Type Locality: 131 mi. N. Clermont, Queensland.
Types: Holotype male on slide labelled "131 mi. N. Clermont, Qld., 2 v 1966, *E. ?melanophloia*". Paratypes: (slides) 2♂ with same label data as the holotype. (In alcohol) 1♂ 3♀s with same label data.
Notes: Lerps ? oval.

Glycaspis (*Glycaspis*) *onychis*, sp. nov.

(L. *onychis* = of onyx)

General Colour: Deep lemon-yellow, sometimes with red suffusion, rarely with dark markings except on seg. 10 of antennae.
Claspers & Aedeagus: As in Text-fig. 81.
Length of Aedeagus: (16 specimens) 0.216 mm. to 0.243 mm.
Hindwings: Cu_1 as Group (ii).
Host Plants: *E. brevifolia* F. Muell. (mountain white gum); *E. gamophylla.*
Type Locality: 5 mi. E. Mt. Isa, Queensland.
Types: Holotype male on slide labelled "5 mi. E. Mt. Isa, Qld., 31 v 1966, *E. brevifolia*". Paratypes: (slides) 2♂s with same label data as the holotype; 4♂s "65 mi. N.X-roads, N.T., 12 vi 1966, *E. brevifolia*"; 4♂s "Hall's Crk., W.A., 14 vii 1966, *E. brevifolia*"; 4♂s "Mt Herbert, W.A., 2 viii 1966, *E. brevifolia*"; 1♂ "Joffre Falls, W.A., 5 viii 1966, *E. brevifolia*"; 1♂ "5 mi. E. Joffre Falls, W.A., 6 viii 1966, *E. gamophylla*". (In alcohol) 26♂s 11♀s "70 mi. S. Normanton, Qld., 29 v 1966, *E. brevifolia*"; 29♂s 9♀s "5 mi. E. Mt. Isa, Qld., 31 v 1966, *E. brevifolia*"; 10♂s 2♀s "25 mi. NW. Mt. Isa, Qld., 8 vi 1966, *E. brevifolia*"; 8♀s "65 mi. N.X-roads, N.T., 12 vi 1966, *E. brevifolia*"; 2♂s 3♀s "63 mi. E. on Roper Riv. Rd., N.T., 16 vi 1966, *E. brevifolia*"; 7♂s 24♀s "13 mi. NW. Top Springs, N.T., 7 vii 1966, *E. brevifolia*"; 9♀s "Mt. Herbert, W.A., 2 viii 1966, *E. brevifolia*"; 2♂s 2♀s "Joffre Falls, W.A., 5 viii 1966, *E. brevifolia*"; 3♂s 7♀s "5 mi. S. Dunham Riv. H.S., W.A., 13 vii 1966, *E. brevifolia*"; 9♂s 9♀s "Hall's Crk., W.A., 14 vii 1966, *E. brevifolia*".
Notes: Lerps round. At Mt. Herbert, some lerps tended to ovality.

Glycaspis (*Glycaspis*) *lactea*, comb. nov.

Glycaspis (*Alloglycaspis*) *lactea* Moore 1961, pp. 151-3, Text-fig. 29.

Claspers & Aedeagus: As in Text-fig. 82.
Length of Aedeagus: (1 specimen) 0.193 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. blakelyi* or *E. dealbata.*
Type Locality: Strahorn S.F., New South Wales.
Notes: Lerps round.

Glycaspis (*Glycaspis*) *hackeri*, comb. nov.

Glycaspis (*Alloglycaspis*) *hackeri* Moore 1964a, p. 165, Text-fig. 7.

Claspers & Aedeagus: As in Text-fig. 83.
Length of Aedeagus: (3 specimens) 0.198 mm. to 0.203 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: Not known.
Type Locality: Brisbane, Queensland.
Notes: Lerps not known.

Glycaspis (*Glycaspis*) *rubritincta*, sp. nov.
(L. *ruber* = red; *tinctus* = dyed or tinged)

General Colour: Yellow with some red suffusion.
Claspers & Aedeagus: As in Text-fig. 84.
Length of Aedeagus: (3 specimens) 0.207 mm. to 0.218 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. confluens* W. V. Fitzg. ex Maiden (Kimberley gum).
Type Locality: King Leopold Ranges, Kimberleys, Western Australia.
Types: Holotype male on slide labelled "King Leopold Ra., W.A., 19 vii 1966, *E. confluens*". Paratypes: (slides) 2♂s with same label data as the holotype. (in alcohol) 5♂s 13♀s with same label data.
Notes: Lerps round.

Glycaspis (*Glycaspis*) *exsertae*, sp. nov.
(L. = of *Eucalyptus exserta*)

General Colour: Yellow, lightly marked with black.
Claspers & Aedeagus: As in Text-fig. 85.
Length of Aedeagus: (1 specimen) 0.198 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. exserta* F. Muell. (bendo).
Type Locality: 34 mi. N. Clermont, Queensland.
Types: Holotype male on slide labelled "34 mi. N. Clermont, Qld., 1 v 1966, *E. exserta*".

Glycaspis (*Glycaspis*) *froggatti*, sp. nov.
(Named for the late W. W. Froggatt, a pioneer of Australian Entomology)

General Colour: Lemon-yellow; thorax often completely suffused red.
Claspers & Aedeagus: As in Text-fig. 86.
Length of Aedeagus: (48 specimens) 0.200 mm. to 0.243 mm.
Hindwings: As Group (ii).
Host Plants: *E. microneura* Maiden & Blakely (Gilbert River box); *E. oligantha* Schau. (broad-leaved box); *E. argillacea* W. V. Fitzg. *in* Maiden (Kimberley grey box); *E. normantonensis* Maiden & Cambage (box); *E. leptophleba; E. ?intertexta; E. striaticalyx; E. tectifica; E. microtheca.*
Type Locality: 3 mi. S. Normanton, Queensland.
Types: Holotype male on slide labelled "3 mi. S. Normanton, Qld., 27 v 1966, *E. normantonensis*". Paratypes: (slides) 3♂s with same label data as the holotype; 2♂s "119 mi. S. Normanton, Qld., 29 v 1966, *E. microtheca*"; 1♂ "55 mi. W. Croydon, Qld., 25 v 1966, *E. microtheca*"; 1♂ "Flinders Riv. Qld., 28 v 1966, *E. microtheca*"; 3♂s "19 mi. W. Mt. Surprise, Qld., 22 v 1966, *E. microneura*"; 2♂s "107 mi. N. Clermont, Qld., 2 v 1966, *E. microtheca*"; 5♂s "1 mi. S. Batchelor turnoff, N.T., 5 vii 1966, *E. oligantha*"; 2♂s "102 mi. E. X-roads, N.T., 10 vi 1966, *E. microtheca*"; 1♂ "Katherine Gorge, N.T., 21 vi 1966, *E. ?tectifica*"; 2♂s "26 mi. N.W. Katherine, N.T., 22 vi 1966, *E. ?tectifica*"; 1♂ 1♀ "Mary Riv., N.T., 25 vi 1966, *E. ?tectifica*"; 1♂ "88 mi. W. Timber Crk., N.T., 9 vii 1966, *E. tectifica*"; 4♂s "23 mi. SW. Hall's Crk., W.A., 14 vii 1966, *E. argillacea*"; 1♂ 1♀ "Laura Riv., W.A., 14 vii 1966, *E. ?microtheca*"; 3♂s Geikie Gorge, W.A., 16 vii 1966, *E. ?microtheca*"; 1♂ "85 mi. E. Derby, W.A., 19 vii 1966, *E. tectifica*"; 1♂ King Leopold Ra., W.A., 19 vii 1966, *E. ?tectifica*"; 5♂s "67 mi. NE. Pt. Hedland, W.A., 29 vii 1966, *E. microtheca*"; 1♂ "14 mi. SW. Pt. Hedland, W.A., 30 vii 1966, *E. ?microtheca*"; 1♂ "35 mi. S. Roebourne, W.A., 31 vii 1966, *E. ?microtheca*"; 2♂s "2 mi. E. Millstream, W.A., 3 viii 1966, *E. ?intertexta*"; 1♂ 1♀ "92 mi. E. Wittenoom, W.A., 9 viii 1966, *E. ?microtheca*"; 1♂ "68 mi. S. Roy Hill, W.A., 10 viii 1966, *E. ?microtheca*"; 4♂s "2 mi. S. Mundiwindi, W.A., 11 viii 1966, *E. ?intertexta*"; 1♂ "4 mi. S. Nannine, W.A., 13 viii 1966, *E. striaticalyx*". (In alcohol) 2♀s "55 mi. W. Croydon, Qld., 25 v 1966, *E. microtheca*"; 13♂s 21♀s "3 mi. S. Normanton, Qld., 27 v 1966,

E. normantonensis"; 2♀s "119 mi. S. Normanton, Qld., 29 v 1966, *E. microtheca"*; 3♀s "19 mi. W. Mt. Surprise, Qld., 22 v 1966, *Euc.* sp."; 2♀s "Flinders Riv., Qld., 28 v 1966, *E. microtheca"*; 5♀s "107 mi. N. Clermont, Qld., 2 v 1966, *E. microtheca"*; 9♀s "88 mi. W. Timber Crk., N.T., 9 vii 1966, *E. ?tectifica"*; 1♂ 2♀s "26 mi. NW. Katherine, N.T., 22 vi 1966, *E. ?tectifica"*; 3♀s "Katherine Gorge, N.T., 21 vi 1966, *E. tectifica"*; 3♀s "1 mi. S. Batchelor turnoff, N.T., 5 vii 1966, *E. oligantha"*; 1♂ 1♀ "102 mi. E. X-roads, N.T., 10 vi 1966, *E. microtheca"*; 6♀s "2 mi. S. Mundiwindi, W.A., 11 viii 1966, *E. ?intertexta"*; 1♂ 1♀ "2 mi. E. Millstream, W.A., 3 viii 1966, *E. ?intertexta"*; 1♂ 2♀s "85 mi. E. Derby, W.A., (Mt. House Rd.) 19 vii 1966, *E. ?tectifica"*; 2♀s "2 mi. E. Millstream, W.A., 3 viii 1966, *E. ?intertexta"*; 1♂ 1♀ "35 mi. E. Roebourne, W.A., 31 vii 1966, *E. ?microtheca"*; 9♀s "King Leopold Ra., W.A., 19 vii 1966, *Euc.* sp."; 3♂s 4♀s "Geikie Gorge, W.A., 16 vii 1966, *E. ?microtheca"*; 3♂s 2♀s "67 mi. NE. Pt. Hedland, W.A., 29 vii 1966, *E. microtheca"*; 6♀s with same label data; 2♀s "35 mi. S. Roebourne, W.A., 1 viii 1966, *E. ?microtheca"*; 2♂s 25♀s "23 mi. SW. Hall's Crk., W.A., 14 vii 1966, *E. argillacea"*; 1♀ "19 mi. E. Mt. Surprise, Qld., 21 v 1966, *E. leptophleba"*.

Other Specimens Examined: 1♀ "55 mi. W. Mt. Isa, Qld., 8 vi 1966, *E. microtheca"*; 2♀s "Roper Bar, N.T., 17 vi 1966, *E. ?microtheca"*; 2♀s "Roper Bar, N.T., 18 vi 1966, *E. ?tectifica"*; 1♀ "8 mi. SW. DeGrey Riv., W.A., 30 vii 1966, *E. ?microtheca"*.

Notes: On *E. argillacea, E. microneura,* and *E. microtheca* in some areas, lerps were of a distinctive shape, being "rounded rectangular". Specimens from the north-west of Western Australia tend to have longer claspers with the median area wider.

Glycaspis (*Glycaspis*) *blakei*, sp. nov.

(Named for Dr. S. T. Blake, of the Botanic Museum and Herbarium, Brisbane, Queensland, who gave much assistance in the identifications of numerous host plants from the northern areas of Australia).

General Colour: Yellow; sometimes whole of thorax suffused red; with or without extensive black and/or brown marks; seasonal variation in coloration.

Claspers & Aedeagus: As in Text-fig. 87.

Length of Aedeagus: (20 specimens) 0.221 mm. to 0.265 mm.

Hindwings: Cu_1 as Group (ii).

Host Plant: *Eucalyptus* sp. (gum type, similar in general appearance to *E. camaldulensis* or *E. tereticornis*).

Type Locality: 107 mi. N. Clermont, Queensland.

Types: Holotype male on slide labelled "107 mi. N. Clermont, Qld., 2 v 1966, *Euc.* sp.". Paratypes: (slides) 2♂s with same label data as the holotype; 2♂s 1♀ "Reedy St. George Riv., Qld., 13 v 1966, *Euc.* sp."; 1♂ "3.5 mi. N. Quamby, Qld., 30 v 1966, *Euc.* sp."; 1♂ "25 mi. S. Turkey Crk., W.A., 13 vii 1966, *Euc.* sp."; 1♂ "Geikie Gorge, W.A., 16 vii 1966, *Euc.* sp."; 2♂s "Lennard Riv., W.A., 20 vii 1966, *Euc.* sp."; 1♂ "DeGrey Riv., W.A., 30 vii 1966, *Euc.* sp."; 6♂s "32 mi. S. Roy Hill, W.A., 10 viii 1966, *Euc.* sp."; 4♂s "11 mi. S. Meekatharra, W.A., 13 viii 1966, *Euc.* sp.". (In alcohol) 1♂ 13♀s "107 mi. N. Clermont, Qld., 2 v 1966, *Euc.* sp."; 1♀ "Roper Bar, N.T., 17 vi 1966, *Euc.* sp."; 7♀s "Roper Bar, N.T., 18 vi 1966, *Euc.* sp."; 2♀s "25 mi. S. Turkey Crk., W.A., 13 vii 1966, *Euc.* sp."; 1♂ 5♀s "Geikie Gorge, W.A., 16 vii 1966, *Euc.* sp."; 1♂ 15♀s "Lennard Riv., W.A., 20 vii 1966, *Euc.* sp."; 2♀s "DeGrey Riv., W.A., 30 vii 1966, *Euc.* sp."; 11♂s 18♀s "32 mi. S. Roy Hill, W.A., 10 viii 1966, *Euc.* sp."; 2♂s 4♀s "68 mi. S. Roy Hill, W.A., 10 viii 1966, *Euc.* sp."; 4♀s "3 mi. S. Kumarina, W.A., 12 viii 1966, *Euc.* sp."; 30♂s 40♀s "11 mi. S. Meekatharra, W.A., 13 viii 1966, *Euc.* sp.".

Notes: Lerps ? round.

Glycaspis (*Glycaspis*) *eremica*, sp. nov.
(L. *eremicus* = of the desert, lonely)

General Colour: Yellow suffused red, with dark marks.
Claspers & Aedeagus: As in Text-fig. 88.
Length of Aedeagus: (2 specimens) 0.243 mm., 0.254 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. ?camaldulensis* Dehn. (Murray red gum).
Type Locality: 45 mi. W. White Cliffs, New South Wales.
Types: Holotype male on slide labelled "45 mi. W. White cliffs, N.S.W., 2 ix 1967, *E. ?camaldulensis*". Paratypes: (slides) 1♂ "8 mi. S. Quorn, S.A., *E. ?camaldulensis*"; 1♂ "Amadeus Basin, N.T., 3 vii 1962, P. Ranford". (In alcohol) 1♂ 3♀s with same label data as the holotype; 2♀s "8 mi. S. Quorn, S.A., 23 x 1966, *E. ?camaldulensis*".
Other Specimens Examined: The following specimens, which may be this species, are not included wih the paratypes, because of uncertain identification, although they were collected in the same general area as the type material:- (in alcohol) 3♀s "Pulgamurtie, 62 mi. SE. Milparinka, N.S.W., 2 ix 1967, *E. ?camaldulensis*"; 1♀ "Bendigo Crk., 5 mi. N. Milparinka, N.S.W., 1 ix 1967, *E. ?camaldulensis*"; 1♀ "Sturt's Depot Glen, 9 mi. W. Milparinka, N.S.W., 1 ix 1967, *E. ?camaldulensis*".

Glycaspis (*Glycaspis*) *taylori*, sp. nov.

(Named for Mr. K. L. Taylor who erected the genus, and gave much advice concerning the Psyllidae).

General Colour: Cream to yellow suffused red, with variable dark marks.
Claspers & Aedeagus: As in Text-fig. 89.
Length of Aedeagus: (9 specimens) 0.236 mm. to 0.254 mm.
Hindwings: Cu_1 as Group (iii).
Host Plants: *E. globulus* Labill. (Tasmanian blue gum); *E. ovata*.
Type Locality: Domain, Hobart, Tasmania.
Types: Holotype male on slide labelled "Domain, Hobart, Tas., 17 xii 1966, *E. globulus*". Paratypes: (slides) 3♂s with same label data as the holotype; 1♂ "1 mi. E. Belchers, Tas., 12 xii 1966, *E. ?ovata*"; 1♂ "1 mi. E. Cygnet, Tas., 18 xii 1966, *E. ovata*"; 1♂ "Apsley Riv., Tas., 28 xii 1966, *E. ?ovata*"; 2♂s "35 mi. W. Scottsdale, Tas., 29 xii 1966, *E. ?ovata*"; 3♂s "8 mi. W. Peterborough, Vic., 20 xi 1966, *E. ovata*" 1♂ "Mt York, N.S.W., 1 ii 1967, *Euc.* sp.". (In alcohol) 4♂s 9♀s with same label data as the holotype; 2♀s "1 mi. E. Belchers, Tas., 12 xii 1966, *E. ?ovata*"; 2♀s "1 mi. E. Cygnet, Tas., 18 xii 1966, *E. ovata*"; 2♀s "Apsley Riv., Tas., 28 xii 1966, *E. ?ovata*"; 8♀s "35 mi. W. Scottsdale, Tas., 29 xii 1966, *E. ?ovata*"; 3♀s "8 mi. W. Peterborough, Vic., 20 xi 1966, *E. ovata*"; 1♀ "15 mi. SE. Tarraleah, Tas., 11 xii 1966, *E. ovata*".
Notes: Lerps round.

Glycaspis (*Glycaspis*) *gradata*, sp. nov.
(L. *gradatus* = step by step; referring to the phylogeny of the species)

General Colour: Lemon-yellow.
Claspers & Aedeagus: As in Text-fig. 90.
Length of Aedeagus: (2 specimens) 0.241 mm., 0.243 mm.
Hindwings: Cu_1 as Group (ii).
Host Plants: *E. ?camaldulensis; E. ?largiflorens.*
Type Locality: Hay, New South Wales.
Types: Holotype male on slide labelled "Hay, N.S.W., 24 i 1967, *E. ?camaldulensis*". Paratypes: (slides) 1♂ "24 mi. N. Hillston, N.S.W., 26 i 1967, *E. ?camaldulensis*". (In alcohol) 1♀ with same label data as the holotype.
Other Specimens Examined: (slides) 1♂ "Gunbar, N.S.W., 24 i 1967, *E. ?largiflorens*"; 1♂ "Willandra Crk., N.S.W., 26 i 1967, *E. ?largiflorens*"; 2♂s "2 mi. NE. Hillston, N.S.W., 25 i 1967, *E. ?largiflorens;* 1♂ "Bendigo, Vic., 10 vi 1892, W. W. Froggatt, S. lerp scale", to NA;

1♂ "Near Tempe Downs, N.T., 24 vi 1963, P. Ranford". (In alcohol) 5♀s "Urana, N.S.W., 23 i 1967, *E. ?camaldulensis*. (Dried) 2♀s "Near Tempe Downs, N.T., 24 vi 1963, P. Ranford".

Glycaspis (*Glycaspis*) *confinis*, sp. nov.

(L. *confinis* = related. Referring to the relationship of this species to the eastern and northern species occurring on "gum" type eucalypts).

General Colour: Yellow, with few dark marks.
Claspers & Aedeagus: As in Text-fig. 91.
Length of Aedeagus: (8 specimens) 0.212 mm. to 0.227 mm.
Hindwings: Cu_1 as Group (ii).
Host Plants: *E. rudis* Endl. (moitch); *E. ?cornuta*.
Type Locality: Middle Swan, Perth, Western Australia.
Types: Holotype male on slide labelled "Middle Swan, Perth, W.A., 2 ix 1966, *E. rudis*". Paratypes: (slides) 4♂s with same label data as the holotype; 1♂ "2 mi. E. Cape Naturaliste, W.A., 18 ix 1966, *E. ?cornuta*"; 1♂ "12 mi. W. Baker's Hill, W.A., 9 ix 1960, M.M.H. Wallace, *E. rudis*"; 2♂s "Perth, W.A., Compere, collector, on *Euc.* sp.", to UM; 3♂s "Beckenham, W.A., 5 iii 1969, K. T. Richards, *E. rudis*", to WA. (In alcohol) 6♂s 14♀s with same label data as the holotype; 3♀s "Irwin Riv., W.A., 23 viii 1966, *E. rudis*"; 12♂s 9♀s, nymphs, "Beckenham, W.A., 5 iii 1969, K. T. Richards, *E. rudis*", to WA.
Other Specimens Examined: (slide) 1♂ 1♀ "Perth, W.A., 15 xi 1950, B. W. Logan, on *E. rudis*", to WA. (Dried) 3♀s "Perth, W.A., Compere, collector, on *Euc.* sp.", to UM; 3♀s "12 mi. W. Baker's Hill, W.A., 9 ix 1960, M.M.H. Wallace, *E. rudis*".
Notes: Lerps round; this species has affinities with *G. blakei* and *G. brimblecombei*.

Glycaspis (*Glycaspis*) *wakelburae*, sp. nov.

(The Aboriginal tribe of Wakelbura once occupied the area of the type locality)

General Colour: Pale to deep yellow, to orange; variable red suffusion; with or without dark marks.
Claspers & Aedeagus: As in Text-fig. 92.
Length of Aedeagus: (17 specimens) 0.198 mm. to 0.225 mm.
Hindwings: Cu_1 as Group (ii).
Host Plants: *E. thozetiana; Eucalyptus* sp. (box); *E. microtheca*.
Type Locality: 118 mi. N. Clermont, Queensland.
Types: Holotype male on slide labelled "118 mi. N. Clermont, Qld., 2 v 1966, *Eucalyptus* sp." (box type). Paratypes: (slides) 7♂s with same label data as the holotype; 8♂s "11 mi. NW. Mt. Carbine, Qld., 16 v 1966, *Euc.* sp."; 1♂ "6 mi. N. Emerald, Qld., 30 iv 1966, *E. microtheca*"; 1♂ "40-48 mi. S. Cooktown, Qld., 15 v 1966, *Euc.* sp."; 3♂s "29 mi. N. Clermont, Qld., 1 v 1966, *E. thozetiana*". (In alcohol) 24♂s 54♀s with same label data as the holotype; 26♀s "11 mi. NW. Mt. Carbine, Qld., 16 v 1966, *Euc.* sp."; 3♀s "40-48 mi. S. Cooktown, Qld., 15 v 1966, *Euc.* sp."; 11♂s 13♀s "29 mi. N. Clermont, Qld., 1 v 1966, *E. thozetiana*"; 1♀ "11 mi. NW. Mt. Carbine, Qld., 16 v 1966, *Euc.* sp.".
Notes: Lerps round, some tending to ovality. Eggs in compact groups near lerps. This is the first record of the occurrence of lerps on blossoms, and they also occurred in large numbers on leaves and stems of young twigs. Some adults were reared. It appears that this species is at an intermediate stage of evolutionary progression from round to oval lerp-forming, as indicated by Cu_1 of the hindwing, and the shape of the lerps and the claspers.
This species may be separated from *G. froggatti* by the shape of the claspers and the sclerotised rounded area of the inner clasper surface protruding into the clasper "foot", as illustrated.

Glycaspis (*Glycaspis*) *brimblecombei*, comb. nov.

Glycaspis (*Alloglycaspis*) *brimblecombei* Moore 1964a, pp. 163-165, Text-fig. 5.

General Colour: A large series of adults of this species collected in the Botanic Park, Adelaide, from *E. camaldulensis*, by Dr. T. C. R. White, provided the first evidence of seasonal variation in coloration in the genus *Glycaspis*.

Claspers & Aedeagus: As in Text-fig. 93.

Length of Aedeagus: (48 specimens) 0.205 mm. to 0.232 mm.

Hindwings: Cu_1 as Group (ii).

Host Plants: *E. camaldulensis; E. blakelyi; E. ?nitens* Maiden (silver top); *E. tereticornis* Sm. (forest red gum); *E. dealbata; E. bridgesiana* R. T. Bak. (but but, or apple); *Eucalyptus* sp. (gum type).

Type Locality: Brisbane, Queensland.

Other Specimens Examined: (slides) 1♂ "Moree, N.S.W., 20 iii 1918, W. W. Froggatt Collection"; 10♂s "Adelaide, S.A., vi-vii 1967, 3 i 1968, T. C. R. White, *E. camaldulensis*"; 4♂s "Adelaide, S.A., 26 ix 1967, T. C. R. White, *E. camaldulensis*"; 2♂s "Pt. Lookout, Armidale, N.S.W., 9 iv 1966, *E. ?nitens*"; 3♂s "107 mi. N. Clermont, Qld., 2 v 1966, *Euc.* sp."; 5♂s "10 mi. S. Narrabri, N.S.W., 25 viii 1967, *E. dealbata*"; 1♂ "2 mi. E. Rylstone, N.S.W., 6 iv 1966, *E. bridgesiana*"; 3♂s "2 mi. E. Rylstone, N.S.W., 6 iv 1966, *E. blakelyi*"; 4♂s "36 mi. E. Rylstone, N.S.W., 7 iv 1966, *E. blakelyi*"; 8♂s "10 mi. E. Callide, Qld., 24 iv 1966, *E. tereticornis*"; 3♂s "Narrandera S.F., N.S.W., 1 xi 1967, *E. camaldulensis*"; 1♂ "20 mi. W. Urana, N.S.W., 23 i 1967, *E. ?camaldulensis*"; 1♂ "Mt. Jerrabomberra, A.C.T., 30 v 1967, E.b.34, E.L., *E. blakelyi*"; 1♂ "24 mi. N. Hillston, N.S.W., 26 i 1967, *E. ?camaldulensis*"; 1♂ "6 mi. NW. Goolma, N.S.W., 31 i 1967, *Angophora floribunda*". (In alcohol) A large series of ♂s and ♀s "Adelaide, S.A., vi-vii, 1967, 10 vi 1967, 26 iv 1967 3 i 1968, T. C. R. White, *E. camaldulensis*"; 1♂ 4♀s "Pt. Lookout, Armidale, N.S.W., 9 iv 1966, *E. ?nitens*"; 21♂s 11♀s "10 mi. S Narrabri, N.S.W., 25 viii 1967, *E. dealbata*"; 2♀s "2 mi. E. Rylstone, N.S.W., 6 iv 1966, *E. bridgesiana*"; "5 mi. E. Cudgegong, N.S.W., 29 ix 1967, *E. bridgesiana*" (with *G. amydra*); 1♂ 5♀s "2 mi. E. Rylstone, N.S W., 6 iv 1966, *E. blakelyi*"; 21♂s 29♀s "36 mi. E. Rylstone, N.S.W., 7 iv 1966, *E. blakelyi*"; 2♂s 6♀s "6 mi. NW. Goolma, N.S.W., 31 i 1967, *E. blakelyi*"; 4♂s 8♀s "Narrandera S.F., N.S.W., 1 xi 1967, *E. camaldulensis*"; 1♂ 2♀s "20 mi. W. Urana, N.S.W., 23 i 1967, *E. ?camaldulensis*"; 9♂s 18♀s "10 mi. NE. Callide, Qld., 24 iv 1966, *E. tereticornis*"; 16♀s "107 mi. N. Clermont, Qld., 2 v 1966, *Euc.* sp."; 2♀s "24 mi. N. Hillston, N.S.W., 26 i 1967, *E. ?camaldulensis*"; 1♀ "Marden Rd., Torrens Valley, S.A., 13 iv 1967, T. C. R. White, *E. camaldulensis*". (Dried) 4♂s 10♀s "Mt Jerrabomberra, A.C.T., 30 v 1967, E. Lewis, *E. blakelyi*"; 1♀ "Moree, N.S.W., 20 iii 1918, W. W. Froggatt Collection"; 2♀s "Brisbane, 21 x 1935, Host blue gum", to NA.

Notes: Lerps round. This species is associated with *G. prepta* on *E. blakelyi* at A.C.T.; with *G. amydra* on *E. bridgesiana* at Rylstone, N.S.W.; with *G. blakei* on *Euc.* sp. at 107 mi. N. Clermont, Qld.; with *G. johnsoni* on *E. dealbata* at 10 mi. S. Narrabri, N.S.W.; with *G. johnsoni* at Rylstone, N.S.W., and with *G. amnicola* at Moree, N.S.W.

Glycaspis (*Glycaspis*) *mannifera* (Froggatt), comb. nov.

Spondyliaspsis mannifera Froggatt 1900, pp. 291-3, Pl. 12, figs. 2 & 10, Pl. 14, fig. 6.

Spondyliaspis mannifera: Tuthill & Taylor 1955, p. 231.

Glycaspis mannifera: Taylor 1960, p. 385.

Glycaspis (*Alloglycaspis*) *mannifera*: Moore 1961, p. 157, Text-fig. 36.

Glycaspis (*Alloglycaspis*) *vellerosa*: Moore 1961, pp. 153-5, Text-fig. 32. *syn. nov.*

General Colour: Cream to yellow, suffused red, with few dark marks.

Claspers & Aedeagus: As in Text-fig. 94.
Length of Aedeagus: (7 specimens) 0.223 mm. to 0.256 mm.
Hindwings: Cu_1 as Group (iii).
Host Plants: *E. moluccana; ?E. polyanthemos.*
Type Locality: Tumut, New South Wales.
Types: Lectotype (here designated) 1♂ genitalia on slide labelled "Tumut, N.S.W., 18 x 1899, large sugar lerp, Type, N.S.W., *Spondyliasp. mannifera* (on back of label), (♂ genitalia only, remainder on card) *Eucalyptus; Glycaspis* (*Glycaspis*) *mannifera* (Frogg.) Lectotype". The remainder of this specimen is mounted on a card point, the pin bearing label data "Large sugar lerp, *Eucalyptus,* Tumut, 18 x 1899, Genitalia on side; Lectotype". Paralectotypes (here designated) 1♀ whole mount on slide labelled "Tumut, N.S.W., 18 x 1899, Large sugar lerp, *Eucalyptus, Glycaspis* (*Glycaspis*) *mannifera* (Frogg.) ♀, Paralectotype". 2♀s (dried specimens on cards on separate pins) each pin bearing label data "Large sugar lerp, *Eucalyptus,* Tumut, 18 x 99, Paralectotype".
There is no doubt that these four specimens are Froggatt's syntypes of *G. mannifera.*
The only male specimen (now the Lectotype) was originally placed by Froggatt on a card with a female specimen. The pin bore an additional label with the data "Type. N.S.W. *Spondyliasp. mannifera*", apparently in Froggatt's handwriting.
The wholemount female specimen on a slide, was originally placed by Froggatt on a second card with another female specimen. Consequently, designation of a Lectotype was necessary.
Other Specimens Examined: (slides) 2♂s "Prospect, N.S.W., 7 viii 1968, *E. moluccana*". (in alcohol) 12♀s "Prospect, N.S.W., 7 viii 1968, *E. moluccana*".
Notes: Lerps round. Froggatt records the habitat of *G. mannifera* as Tumut, N.S.W., and the host species as *E. polyanthemos, E. moluccana* (= *E. hemiphloia*) and *E. gracilis.* The two latter hosts do not naturally occur in the Tumut area, so that there remains some doubt as to the host associations of this species. According to Froggatt, the lerps of *G. mannifera* are round.
The possibility of seasonal variation in coloration eliminates the identification of *G. mannifera* on colour alone. Froggatt's fig. 10, Pl. 12, of the male claspers, obviously does not correspond with the figure of the claspers of the Lectotype (Text-fig. 94) of *G. mannifera.* Froggatt therefore appears to have had more than one species before him when describing and figuring his *G. mannifera.*
A series of specimens of *G. whitei* which constructs round lerps on *E. polyanthemos,* was collected 7 mi. E. Tumut on 12 i 1967. The aedeagus, and claspers which are scimitar-shaped are given in Text-fig. 70. These claspers compare favourably with Froggatt's fig. 10, Pl. 12, but not with those of the Lectotype. Specimens of *G. amnicola* which constructs oval lerps on *E. polyanthemos* were also collected at the same site on 25 ii 1969. It therefore seems unlikely that *G. mannifera* occurs on *E. polyanthemos,* and that the Lectotype was not collected at Tumut.
Glycaspis vellerosa Moore 1961 was described on specimens from *E. moluccana* from Prospect, N.S.W., but on re-examination of the type material, a correction to the drawings of the claspers was found to be necessary.
It is now determined that *G. vellerosa* Moore is a synonym of *G. mannifera* (Froggatt). Additional material from the type locality of *G. vellerosa* was obtained and examined.
Froggatt appears to have described this species from *E. moluccana* and figured the male genitalia of *G. whitei* from round lerps on *E. polyanthemos.*
The species *G. pervagata* which constructs round lerps on *E. gracilis,* is illustrated in Text-fig. 53.

Glycaspis (*Glycaspis*) *xanthopepla*, sp. nov.
(Gr. *xanthos* = yellow; *peplos* = robe or coat)

General Colour: Cream to yellow or pale orange, with few dark marks.
Claspers & Aedeagus: As in Text-fig. 95.
Length of Aedeagus: (2 specimens) both 0.212 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. seeana* Maiden (narrow-leaved cabbage gum).
Type Locality: 1 to 2 mi. E. Plunkett, Queensland.
Types: Holotype male on slide labelled "1 to 2 mi. E. Plunkett, Qld., 13 iv 1966, *E. seeana*". Paratypes: (slide) 1♂ with same label data. (In alcohol) 6♀s, 2 nymphs, with same label data.
Notes: Lerps round. Specimens were reared.

Glycaspis (*Glycaspis*) *pratensis*, comb. nov.

Glycaspis (*Alloglycaspis*) *pratensis* Moore 1961, p. 151, Text-fig. 28.

Claspers & Aedeagus: As in Text-fig. 96.
Length of Aedeagus: (3 specimens) 0.223 mm. to 0.234 mm.
Hindwings: Cu_1 as Group (ii).
Host Plants: *E. amplifolia* Naudin (cumbora or cabbage gum); *E. tereticornis*.
Type Locality: Jilliby, New South Wales.
Specimens Examined: (slides) 1♂ "Mt. Archer, (Rockhampton) Qld., 1400', 28 iv 1966, *E. tereticornis*"; 2♂s "Prospect, N.S.W., 7 viii 1968, *E. ?tereticornis*"; 1♂ "12 mi. S. Coff's Hbr., N.S.W., 14 i 1958, I. F. B. Common". (In alcohol) 1♀ "Mt Archer, Qld., 1400', 28 iv 1966, *E. tereticornis*"; 2♀s "Bonnell's Bay, Lake Macquarie, N.S.W., 26 xii 1967, *E. ?tereticornis*".
Notes: Lerps round. A correction to the drawing of the claspers as previously given (Moore 1961), now shows the correct shape, on the left hand side in Text-fig. 96.

Glycaspis (*Glycaspis*) *australoraria*, comb. nov.

Glycaspis (*Alloglycaspis*) *australoraria* Moore 1961, p. 150, Text-fig. 26.

Claspers & Aedeagus: As in Text-fig. 97.
Length of Aedeagus: (1 specimen) 0.234 mm.
Hindwings: Cu_1 as Group (iii).
Host Plants: *E. longifolia* Link & Otto (Woolly butt); *E. amplifolia; E. tereticornis; E. punctata* DC. (grey gum).
Type Locality: Corrimal, New South Wales.
Specimens Examined: (slides) 3♂s "5 mi. S. Picton, N.S.W., 10 v 1969, *E. punctata*"; 2♂s "10 mi. N. Clouds Creek, N.S.W., 10 iv 1966, *E. amplifolia*"; 1♂ "Goodna, Qld., 19 vi 1967, R. A. Yule, *E. tereticornis*", to QF; 1♂ "Cooper's Plains, Brisbane, Qld., 10 ix 1914, H. Tryon, *Euc.* sp., 5440, C.I.E. Coll. 18123", to BM; 1♂ "Mt Lofty, S.A., A. M. Lea", to SM. (In alcohol) 1♂ 2♀s "10 mi. N. Clouds Crk., N.S.W., 10 iv 1966, *E. amplifolia*"; 10♂s 30♀s (with *G. ignea*) "5 mi. S. Picton, N.S.W.,10 v 1969, *E. punctata*"; 10♀s "Goodna, Qld., 19 vi 1967, *E. tereticornis*", to QF.
Notes: Lerps ? round.

Glycaspis (*Glycaspis*) *struicis*, comb. nov.

Glycaspis (*Alloglycaspis*) *struicis* Moore 1961, pp. 150-151, Text-fig. 27.

Claspers & Aedeagus: As in Text-fig. 98.
Length of Aedeagus: (19 specimens) 0.193 mm. to 0.218 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. tereticornis*.
Type Locality: Merrylands, New South Wales.
Notes: Lerps round.

Glycaspis (*Glycaspis*) *montana*, comb. nov.

Glycaspis (*Alloglycaspis*) *montana* Moore 1961, p. 153, Text-fig. 30.

Claspers & Aedeagus: As in Text-fig. 99.
Length of Aedeagus: (8 specimens) 0.227 mm. to 0.248 mm.

Hindwings: Cu_1 as Group (ii).
Host Plant: *E. dunnii* Maiden (Dunn's white gum).
Type Locality: Clouds Crk., New South Wales.
Notes: Lerps round.

Glycaspis (*Glycaspis*) *baileyi*, comb. nov.

Glycaspis (*Alloglycaspis*) *baileyi* Moore 1961, pp. 148-9, Text-fig. 24.
Claspers & Aedeagus: As in Text-fig. 100.
Length of Aedeagus: (150 specimens) 0.203 mm. to 0.250 mm.
Hindwings: Cu_1 as Group (ii).
Host Plants: *E. saligna* Sm. (Sydney blue gum); *E. robusta* Sm. (swamp mahogany); *E. resinifera* Sm. (red mahogany).
Type Locality: Lisarow, New South Wales.
Specimens Examined: (in alcohol) 4♂s 5♀s "Ourimbah S.F., N.S.W., 16 v 1967, *E. saligna*". (Dried) 3♂s 12♀s "Lisarow, N.S.W., 30 v 1954, *E. saligna*"; 4♀s "Myall Riv. S. F., N.S.W., 10 ix 1953, W. Wells, *E. saligna*"; 1♂ "Clouds Crk. S.F., N.S.W., 12 ix 1952, O. Powloff, *E. saligna*"; 1♂ 1♀ "Bulga S.F., N.S.W., 13 ii 1953, O. Powloff, *E. saligna*"; 3♂s 3♀s "Craven Plateau, N.S.W., 13 xi 1952, O. Powloff, *E. saligna*".
Notes: Lerps round.

Glycaspis (*Glycaspis*) *imponens*, comb. nov.

Glycaspis (*Alloglycaspis*) *imponens* Moore 1961, p. 150, Text-fig. 25.
Claspers & Aedeagus: As in Text-fig. 101.
Length of Aedeagus: (44 specimens) 0.252 mm. to 0.286 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. propinqua* Deane & Maiden (small-fruited grey gum).
Type Locality: Kincumber, New South Wales.
Notes: Lerps round.

Glycaspis (*Glycaspis*) *campbelli*, sp. nov.

(Named for my former colleague, Mr. K. G. Campbell, who willingly gave much valuable assistance with many of the writer's projects).
General Colour: Similar to *G. baileyi* and *G. imponens*.
Claspers & Aedeagus: As in Text-fig. 102.
Length of Aedeagus: (10 specimens) 0.256 mm. to 0.279 mm.
Hindwings: Cu_1 as Group (iii).
Host Plants: *E. cypellocarpa* L. Johnson (spotted mountain gum); *?E. cephalocarpa; ?E. ovata.*
Type Locality: Jigamy Crk., Eden, New South Wales.
Types: Holotype male on slide labelled "Jigamy Crk., Eden, N.S.W., 19 xi 1965, *E. cypellocarpa*". Paratypes: (slides) 2♂s with same label data as the holotype; 3♂s "Greig's Flat, Eden, N.S.W., 19 xi 1965, Reared from *E. cypellocarpa*"; 4♂s "1 mi. NE. Montrose, Vic., 27 xi 1966, *E. ovata* or *E. cephalocarpa*". (In alcohol) 4♂s 6♀s "Jigamy Crk., Eden, N.S.W., 19 xi 1965, *E. cypellocarpa*"; 15♂s 18♀s "Greig's Flat, Eden, N.S.W., 19 xi 1965, Reared from *E. cypellocarpa*"; 1♂ 6♀s "Greig's Flat, Eden, N.S.W., 19 xi 1965, *E. cypellocarpa*"; 37♂s 26♀s "1 mi. NE. Montrose, Vic., 27 xi 1966, *E. ovata* or *E. cephalocarpa*"; 34♂s 18♀s 2 nymphs, "1 mi. NE. Montrose, Vic., 27 xi 1966, *E. cephalocarpa*".
Notes: Lerps round.

Glycaspis (*Glycaspis*) *locaridensis*, comb. nov.

Glycaspis (*Alloglycaspis*) *locaridensis* Moore 1961, p. 161, Text-fig. 41.
Glycaspis (*Alloglycaspis*) *convallaria*: Moore 1961, p. 159, Text-fig. 39. *syn. nov.*
Claspers & Aedeagus: As in Text-fig. 103.
Length of Aedeagus: (5 specimens) 0.243 mm. to 0.267 mm.
Hindwings: As Group (iii).
Host Plants: *E. populnea; E. blakelyi* or *E. melliodora* A. Cunn. ex Schau. (yellow box).

Type Locality: Strahorn State Forest, New South Wales.
Specimens Examined: (slides) 2♂s "61 mi. N. Clermont, Qld., 2 v 1966, *E. ?populnea*"; 4♂s "4 mi. NE. Hillston, N.S.W., 25 i 1967, *E. ?populnea*"; 2♂s "27 mi. E. Cobar, N.S.W., 27 x 1957, I. F. B. Common"; 2♂s "3 mi. S. Hillston, N.S.W., 25 i 1967, *E. ?populnea*"; 2♂s "14 m. E. Cobar, N.S.W., 27 i 1967, *E. ?populnea*". (In alcohol) 4♀s "61 mi. N. Clermont, Qld., 2 v 1966, *E. ?populnea*". (Dried) 1♀ "27 mi. E. Cobar, N.S.W., 27 x 1957, I. F. B. Common".
Notes: Lerps oval. On re-examination of the type specimens, it is apparent that *G. locaridensis* and *G. convallaria* are synonymous. The latter is synonymised with the former because of the definite host record and some known biology of reared specimens of the former.

Glycaspis (*Glycaspis*) *amnicola*, comb. nov.

Glycaspis (*Alloglycaspis*) *amnicola* Moore 1961, pp. 159, 161, Text-fig. 40.
Claspers & Aedeagus: As in Text-fig. 104.
Length of Aedeagus: (6 specimens) 0.221 mm. to 0.248 mm.
Hindwings: Cu_1 as Group (ii).
Host Plants: *E. camaldulensis; E. ?tereticornis; E. polyanthemos.*
Type Locality: Tocumwal, New South Wales.
Specimens Examined: (slides) 1♂ "8 mi. S. Quorn, S.A., 23 x 1966, *E. ?camaldulensis*"; 1♂ "9 mi. W. Dubbo, N.S.W., 6 ix 1967, *E. camaldulensis*"; 2♂s "Gumeracha Weir, S.A., 23 v 1964, T. C. R. White; as eggs, emgd. 6-7 vi 1964, R.N. 64/1/10, *E. camaldulensis*"; 1♂ "2 mi. N. Sale, Vic., 6 i 1967, *E. ?tereticornis*"; 1♂ "North Balwyn, Vic., viii 1967, *E. camaldulensis*", to VM; 1♂ "Wellington, N.S.W., 28 x 1957, I. F. B. Common"; 1♂ "7 mi. E. Tumut, N.S.W., 25 ii 1969, *E. polyanthemos*"; 1♂ "2 mi. W. Loxton, S.A., 13 x 1957, R. V. Southcott, *?E. oleosa*"; 1♂ "Moree, N.S.W., 20 iii 1918, W.W.F., W. W. Froggatt Collection"; 1♂ "26 mi. S. Singleton, N.S.W., 23 iii 1957, E. F. Riek". (In alcohol) nymphs, lerps, "Gumeracha Weir, S.A., 23 v 1964, T. C. R. White, *E. camaldulensis*"; 8♀s "9 mi. W. Dubbo, N.S.W., 6 ix 1967, *E. camaldulensis*"; 6♀s "2 mi. N. Sale, Vic., 6 i 1967, *E. ?tereticornis*"; 1♀ "7 mi. E. Tumut, N.S.W., 25 ii 1969, *E. polyanthemos*"; 1♀ with same label data but date "12 i 1967". (Dried) 2♂s 9♀s "North Balwyn, Vic., viii 1967, *E. camaldulensis*", to VM; 1♀ "Moree, N.S.W., 20 iii 1918, W.W.F., W. W. Froggatt Collection"; 2♀s "Wellington, N.S.W., 28 x 1957, I. F. B. Common"; 1♀ "26 mi. S. Singleton, N.S.W., 23 iii 1957, E. F. Riek".
Notes: Lerps oval.

Glycaspis (*Glycaspis*) *prepta*, sp. nov.
(Gr. *preptos* = distinguished)

General Colour: Lemon-yellow to orange, sometimes with dark markings.
Claspers & Aedeagus: As in Text-fig. 105.
Length of Aedeagus: (7 specimens) 0.225 mm. to 0.254 mm.
Hindwings: Cu_1 as Group (ii).
Host Plants: *E. melliodora; E. blakelyi; E. ?longifolia; E. ?tereticornis; E. ?camaldulensis.*
Type Locality: 4 mi. NE. Goulburn, New South Wales.
Types: Holotype male on slide labelled "4 mi. N. Goulburn, N.S.W., 18 i 1967, *E. melliodora*". Paratypes: (slides) 5♂s "Mt. Jerrabomberra, A.C.T., 30 v 1967, E.b., E.L., *E. blakelyi*"; 1♂ "Prospect, N.S.W., 7 viii 1968, *E. ?tereticornis*"; 1♂ "6 mi. NE. Corryong, Vic., 8 i 1967, *E. ?camaldulensis*"; 6♂s 3♀s "Jigamy Crk., Eden, N.S.W., 30 x 1962, K. G. Campbell, *E. longifolia*"; 1♂ "Jigamy Crk., Eden, 19 xi 1965, *E. longifolia*"; 1♂ "Weetangera Rd., A.C.T., 9 iii 1954, F. Wheelhouse"; 1♂ "Capitol Hill, A.C.T., 13 iv 1951, K. L. Taylor, *E. blakelyi*". (In alcohol) 13♀s 4 nymphs "Jigamy Crk., Eden, N.S.W., 30 x 1962, K. G. Campbell, *E. longifolia*"; 2♂s 4♀s with same label data as the holotype; 4♀s "6 mi. NE. Corryong, Vic., 8 i 1967, *E. ?camaldulensis*"; 4♀s "Prospect, N.S.W., 7 viii 1968, *E. ?tereticornis*".

Other Specimens Examined: (Dried) 1♀ "Weetangera Rd., A.C.T., 9 iii 1954, F. Wheelhouse"; 1♀ "Capitol Hill, A.C.T., 13 iv 1951, K. L. Taylor, *E. blakelyi*".
Notes: Lerps oval.

Glycaspis (*Glycaspis*) *wiradjurae*, sp. nov.

(Of the Aboriginal tribe Wiradjuri who inhabited the type locality).

General Colour: Yellow lightly suffused red.
Claspers & Aedeagus: As in Text-fig. 106.
Length of Aedeagus: (1 specimen) 0.218 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. oleosa* or *E. intertexta*.
Type Locality: 33 mi. N. Hillston, New South Wales.
Types: Holotype male on slide labelled "33 mi. N. Hillston, N.S.W., 26 i 1967, *E. oleosa* or *E. intertexta*". Paratypes: (in alcohol) 5♀s with same label data.

Glycaspis (*Glycaspis*) *permista*, comb. nov.

Glycaspis (*Alloglycaspis*) *permista* Moore 1961, p. 162, Text-fig. 43.

Claspers & Aedeagus: As in Text-fig. 107.
Length of Aedeagus: (5 specimens) 0.214 mm. to 0.225 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. paniculata*.
Type Locality: Wamberal, New South Wales.
Specimen Examined: 1♂ "Gordon, N.S.W., 3 ix 1936, D. F. Waterhouse".
Notes: Lerps oval.

Glycaspis (*Glycaspis*) *schwarzi*, sp. nov.

(Named for Mr. E. A. Schwarz who studied these specimens from South Australia).

Spondyliaspis eucalypti Dobson (?): Schwarz 1898, pp. 69-71 (*non* Dobson).
Claspers & Aedeagus: As in Text-fig. 108.
Length of Aedeagus: (18 specimens) 0.239 mm. to 0.279 mm.
Hindwings: Cu_1 as Group (ii).
Host Plants: *E. leucoxylon; E. odorata; E. porosa*.
Type Locality: Tintinara, South Australia.
Types: Holotype male on slide labelled "Tintinara, S.A., 14 xi 1966, *E. leucoxylon*". Paratypes (slides) 1♂ with same label data as the holotype; 2♂s "Keith, S.A., 5 vi 1963, T. C. R. White, (eggs), emgd. 11 vi, adults 27-28 vi 63, *E. leucoxylon*", 1♂ to SM; 2♂s "Keith S.A., 1 viii 1963, T. C. R. White, (eggs), emgd. 2-5 viii, adults 20-27 viii 63, 20°C., 10 hr. light; *E. leucoxylon*", 1♂ to SM; 1♂ "Australia, Koebele, Type! *S. eucalypti* Schwarz, U.S.N.M. No. 3793, *E. leucoxylon*", to UM; 1♂ "Australia, Koebele, *E. leucoxylon*", to UM; 1♂ "Heywood Park, S.A., 5 ii 1956, R. V. Southcott, *E. leucoxylon*"; 1♂ "Second Crk., S.A., 9 x 1886, Tepper, *Eucalyptus* shrubs", to SM; 1♂ "Mt. Lofty, S.A., 5 vi 1884, Teinus", to SM; 1♂ "Mt. Lofty, S.A., 14 vii 1884, Tepper", to SM; 1♂ "Burnside, S.A., 5 vii 1884, Tepper", to SM.; 4♂s "5 mi. S. Quorn, S.A., 23 x 1966, *E. odorata*"; 2♂s "10 mi. E. Cleve, S.A., 20 x 1966, *E. odorata*"; 3♂s "41 mi. E. Elliston, S.A., 19 x 1966, *E. porosa*". (In alcohol) 1♀, nymphs, lerps "Keith, S.A., 1 viii 1963, T. C. R. White, *E. leucoxylon*, hatched 2-5 viii, emgd. 20-27 viii, 20°C., 10 hr. light. Rearing Nos. 6E, 12E, 14E, 15E"; 1♀ "Tintinara, S.A., 14 xi 1966, *E. ?leucoxylon*"; 1♂ 3♀s "10 mi. E. Cleve, S.A., 20 x 1966, *E. odorata*"; 2♂s 7♀s "5 mi. S. Quorn, S.A., 23 x 1966, *E. odorata*"; 10♂s 12♀s "41 mi. E. Elliston, S.A., 19 x 1966, *E. porosa*"; 1♂ 10♀s "3 mi. S. Wilmington, S.A., 24 x 1966, *E. ?odorata*". (Dried) 1♀ "Australia, Koebele, Type, No. 3793, U.S.N.M., *Spondyliaspis eucalypti* Schwarz, Type! *E. leucoxylon*", to UM.
Other Specimens Examined: (in alcohol) 2♀s "2 mi. E. Stokes Bay, Kangaroo Id., S.A., 4 xi 1966, *E. ?leucoxylon*"; 1♀ "42 mi. E. Elliston, S.A.,

19 x 1966, *Euc.* sp.". (Dried) 2♀s "Keith, S.A., 21 v 1966, T. C. R. White, *E. leucoxylon*", to SI; 1♂ with same label data but date "21 v 1963", to SI.; 2♀s "Burnside, S.A., 5 vii 1884, Tepper", to SM.

Notes: Eggs usually in groups of 2 or 3 to 12 or so (personal communication, T. C. R. White); lerps oval. From an examination of the series of Schwarz's specimens of *Spondyliaspis eucalypti* Dobson (?), it is quite clear that two species are involved.

The single mount of 1♂ and 1♀ on separate pins on the same piece of pith, labelled "*Eucalyptus leucoxylon*, Australia, Koebele, Type No. 3793, U.S.N.M., *Spondyliaspis eucalypti* Schwarz, Type!", are certainly *G. schwarzi*, while 4♂s and 4♀s paired on separate pins, together with 3♀s mounted singly on pith, are *G. fuscovena*. All specimens but the first two are labelled "Australia, Koebele" only. The specimens constituting the two species are separable on the vein Cu_1 of the hindwing, and usually on the fuscous basal venation of the forewing. Males are readily separable on the shape of the claspers, those of *G. fuscovena* being scimitar-shaped and dark in colour.

The confusing intergradation of coloration in this series is evident in Schwarz's description (pp. 69-70). His remarks (p. 71) that "The synonymy of these lerp psyllids will remain in an unsettled condition as long as the life history of each species is not properly known", is certainly relevant to some species of the genus today.

Glycaspis (*Glycaspis*) *sudicola*, sp. nov.

(L. *sudus* = cloudless, dry, clear; *-icola* = an inhabitant. Referring to the general weather pattern of the type locality).

General Colour: Lemon yellow to orange, marked with black.
Claspers & Aedeagus: As in Text-fig. 109.
Length of Aedeagus: (4 specimens) 0.236 mm. to 0.254 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. sideroxylon* A. Cunn. ex Woolls. (mugga).
Type Locality: 4 mi. N. West Wyalong, New South Wales.
Types: Holotype male on slide labelled "4 mi. N. West Wyalong, N.S.W., 3 v 1964, *E. sideroxylon*". Paratypes: (slides) 3♂s 1♀ with same label data as the holotype; 3♂s "Deniliquin, N.S.W., gum scrub, 14 x 1905", ?(Froggatt), to NA. (In alcohol) 1♂ 9♀s lerps, with same label data as the holotype.
Other Specimens Examined: (slides) 3♂s "Deniliquin, N.S.W., 14 x 1905", ?(Froggatt), to NA; 1♂ "12 mi. E. Springsure, Qld., 3 iv 1957, I. F. B. Common". (Dried) 5♂s 1♀ "Deniliquin, N.S.W., 14 x 1905, ?(Froggatt), gum scrub", to NA; 8♀s with same label data; 2♀s with same label data, to BM; 1♀ "12 mi. E. Springsure, Qld., 3 iv 1957, I. F. B. Common".
Notes: Lerps oval; attached to leaf by bases of long axis sides only.

Glycaspis (*Glycaspis*) *ignea*, comb. nov.

Glycaspis (*Alloglycaspis*) *ignea* Moore 1961, p. 157, Text-fig. 37.

Claspers & Aedeagus: As in Text-fig. 110.
Length of Aedeagus: (16 specimens) 0.223 mm. to 0.239 mm.
Hindwings: Cu_1 as Group (ii).
Host Plants: *E. deanei* Maiden (Deane's gum); *E. punctata; E. ?longifolia.*
Type Locality: Ourimbah State Forest, New South Wales.
Specimens Examined: (slides) 1♂ "5 mi. S. Picton, N.S.W., 10 v 1969, *E. punctata*" (with *G. australoraria*); 1♂ "Mangrove Crk., N.S.W., 27 iv 1969, *E. deanei*". (In alcohol) 10♂s 30♀s (with *G. australoraria*) "5 mi. S. Picton, N.S.W., 10 v 1969, *E. punctata*".
Notes: Lerps oval to round.

Glycaspis (*Glycaspis*) *kurrajongensis*, comb. nov.

Glycaspis (*Alloglycaspis*) *kurrajongensis* Moore 1961, pp. 161-2, Text-fig. 42.

Claspers & Aedeagus: As in Text-fig. 111.

Length of Aedeagus: (17 specimens) 0.200 mm. to 0.216 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. paniculata.*
Type Locality: Kurrajong, New South Wales.
Notes: Lerps oval.

Glycaspis (*Glycaspis*) *mellialata,* comb. nov.

Glycaspis (*Alloglycaspis*) *mellialata* Moore 1961, pp. 162-4, Text-fig. 44.

Claspers & Aedeagus: As in Text-fig. 112.
Length of Aedeagus: (7 specimens) 0.203 mm. to 0.225 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. paniculata.*
Type Locality: Wyong State Forest, New South Wales.
Notes: Lerps oval.

Glycaspis (*Glycaspis*) *neureta,* sp. nov.
(Gr. *euretos* = easy to tell; *ne-* = not)

General Colour: Yellow to orange, sometimes with dark marks; seasonal variation.
Claspers & Aedeagus: As in Text-fig. 113.
Length of Aedeagus: (16 specimens) 0.236 mm. to 0.259 mm.
Hindwings: Cu_1 as Group (iii).
Host Plant: *E. melliodora.*
Type Locality: 10 mi. S. Breeza, New South Wales.
Types: Holotype male on slide labelled "10 mi. S. Breeza, N.S.W., 25 viii 1967, *E. melliodora*". Paratypes: (slides) 2♂s with same label data as the holotype; 1♂ "9 mi. N. Quirindi, N.S.W., 25 viii 1967, *E. melliodora*"; 1♂ "7 mi. N. Quirindi, N.S.W., 25 viii 1967, *E. melliodora*"; 1♂ "19 mi. N. Molong, N.S.W., 8 ix 1967, *E. melliodora*"; 1♂ "Tharwa Rd., A.C.T., 23 ix 1953, K. L. Taylor, *E. melliodora*"; 1♂ "5 mi. E. Cudgegong, N.S.W., 29 ix 1967, *E. melliodora*"; 1♂ "15 mi. E. Rylstone, N.S.W., 6 iv 1966, *E. melliodora*"; 1♂ "Rylstone, N.S.W., 1963, *Euc.* sp."; 2♂s "4 mi. NE. Goulburn, N.S.W., 18 i 1967, *E. melliodora*"; 2♂s "Black Mtn., A.C.T., 8 ix 1953, & 19 viii 1953, F. Wheelhouse, *E. melliodora*"; 2♂s "7 mi. NE. Goulburn, N.S.W., 18 i 1967, *E. ?melliodora*"; 1♂ "You Yangs, Vic., 24 xi 1966, *E. ?melliodora*"; 6♂s "Mt. Jerrabomberra, A.C.T., 30 v 1967, E m, E.L., *E. melliodora*". (In alcohol) 7♂s 23♀s "10 mi. S. Breeza, N.S.W., 25 viii 1967, *E. melliodora*"; 1♂ 5♀s "9 mi. N. Quirindi, N.S.W., 25 viii 1967, *E. melliodora*"; 6♂s 5♀s "7 mi. N. Quirindi, N.S.W., 25 viii 1967, *E. melliodora*"; 3♀s "15 mi. E. Rylstone, N.S.W., 6 iv 1966, *E. melliodora*"; 13♂s 10♀s "19 mi. N. Molong, N.S.W., 8 ix 1967, *E. melliodora*"; 2♂s 9♀s "5 mi. E. Cudgegong, N.S.W., 29 x 1967, *E. melliodora*"; 4♀s "7 mi. NE. Goulburn, N.S.W., 18 i 1967, *E. ?melliodora*"; 3♀s "You Yangs, Vic., 24 xi 1966, *E. ?melliodora*". (dried) 3♂s 10♀s "Mt. Jerrabomberra, A.C.T., 30 v 1967, E.m., 34, E.L., *E. melliodora*"; 1♂ with same label data but date "3 iv 1967".
Other Specimens Examined: (slides) 2♂s "Bendigo, Vic., 10 vi 1892, Froggatt, S. lerp scale", to NA. (dried) 1♀ "Tharwa Rd., A.C.T., 23 ix 1953, K. L. Taylor, *E. melliodora*"; 1♀ "Canberra, A.C.T., 11 iv 1951, K. L. Taylor, *E. melliodora*"; 3♀s "Bendigo, Vic., 10 vi 1892, Froggatt, S. lerp scale", to NA; 1♀ "Capitol Hill, A.C.T., 28 vii 1953, F. Wheelhouse, *E. melliodora*"; 1♀ "Yarralumla, A.C.T., 21 vii 1953, F. Wheelhouse, *E. melliodora*".
Notes: Lerps oval.

Glycaspis (*Glycaspis*) *oraria,* comb. nov.

Glycaspis (*Alloglycaspis*) *oraria* Moore 1961, p. 159, Text-fig. 38.

Claspers & Aedeagus: As in Text-fig. 114.
Length of Aedeagus: (5 specimens) 0.232 mm. to 0.248 mm.
Hindwings: Cu_1 as Group (ii).

Host Plant: Probably hybrid *E. robusta* X *E. resinifera*.
Type Locality: Mona Vale, New South Wales.
Notes: Lerps oval.

Glycaspis (*Glycaspis*) *amydra*, sp. nov.
(Gr. *amydros* = distinctly marked)

General Colour: Seasonal variation; lemon yellow with few dark marks, and red suffusion.
Claspers & Aedeagus: As in Text-fig. 115.
Length of Aedeagus: (12 specimens) 0.245 mm. to 0.270 mm.
Hindwings: Cu_1 as Group (iii).
Host Plants: *E. bridgesiana; E. goniocalyx; E. ?melliodora; E. mannifera* Mudie subspecies *maculosa* (R. T. Bak.) L. Johnson (red spotted gum).
Type Locality: 4 mi. E. Cudgegong, New South Wales.
Types: Holotype male on slide labelled "4 mi. E. Cudgegong, N.S.W,. 29 ix 1967, *E. bridgesiana*". Paratypes: (slides) 4♂s with same label data as the holotype; 3♂s "5 mi. E. Molong, N.S.W., 8 ix 1967, *E. bridgesiana*"; 2♂s "2 mi. E. Rylstone, N.S.W., 6 iv 1966, *E. bridgesiana*"; 1♂ "11 mi. SE. Mudgee, N.S.W., 31 i 1967, *E. bridgesiana*"; 1♂ "Mullion Ra. S.F., N.S.W., 12 iii 1969, *E. goniocalyx*"; 1♂ "Capitol Hill, A.C.T., 13 iv 1951, K. L. Taylor, *E. melliodora*"; 1♂ "Majura Lane, A.C.T., 25 viii 1953, F. Wheelhouse, *E. bridgesiana*"; 2♂s "Turner, A.C.T., 1 iv 1967, K. L. Taylor, *E. mannifera* ss. *maculosa*"; 1♂ "Black Mtn., A.C.T., 24 iii 1966, M. Upton, Light trap"; 2♂s "Black Mtn., A.C.T., 20 i 1966, M. Upton, Light trap". (In alcohol) 1♂ 6♀s "11 mi. SE. Mudgee, N.S.W., 31 i 1967, *E. bridgesiana*"; several ♂s ♀s with same label data as the holotype; 1♂ 1♀ "2 mi. E. Rylstone, N.S.W., 6 iv 1966, *E. bridgesiana*"; 10♀s "5 mi. E. Molong, N.S.W., 8 ix 1967, *E. bridgesiana*"; 3♀s "Mullion Ra. S.F., N.S.W., 12 iii 1969, *E. goniocalyx*".
Other Specimens Examined: (in alcohol) 2♂s 4♀s "5 mi. E. Cudgegong, N.S.W., 29 ix 1967, *E. ?bridgesiana*" (with *G. brimblecombei*); 1♂ "1 mi. W. Rylstone, N.S.W., 7 iv 1966, *Euc.* sp.". (Dried) 1♀ "Long Gully Lane, A.C.T., 17 iii 1955, F. Wheelhouse, *E. goniocalyx*"; 1♀ "Capitol Hill, A.C.T., 13 iv 1951, K. L. Taylor, *E. melliodora*"; 3♀s "Northbourne Ave., Turner, A.C.T., 1 iv 1967, K. L. Taylor, *E. mannifera* ss. *maculosa*".

Glycaspis (*Glycaspis*) *monita*, sp. nov.
(L. *monitus* = put in mind of. Referring to the similarity of the shape of the aedeagus with that of *G. brimblecombei* and *G. confinis*).

General Colour: Not recorded.
Claspers & Aedeagus: As in Text-fig. 116.
Length of Aedeagus: (1 specimen) 0.232 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. fasciculosa*.
Type Locality: Keith, South Australia.
Types: Holotype male on slide labelled "Keith, S.A., 1 viii 1963, T. C. R. White, Bred, emgd. 19 viii 1963. Reared from *E. fasciculosa*".
Notes: Lerps round.

Glycaspis (*Glycaspis*) *lacustris*, sp. nov.
(L. *lacustris* = pertaining to a lake)

General Colour: Yellow to orange; lightly marked black; suffused red.
Claspers & Aedeagus: As in Text-fig. 117.
Length of Aedeagus: (4 specimens) 0.227 mm. to 0.239 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. ovata*.
Type Locality: 5 mi. W. Lakes Entrance, Victoria.
Types: Holotype male on slide labelled "5 mi. W. Lakes Entrance, Vic., 6 i 1967, *E. ovata*". Paratypes: (slides) 3♂s with same label data. (In alcohol) 4♂s 7♀s with same label data.
Notes: Lerps oval.

Glycaspis (*Glycaspis*) *mesicola*, comb. nov.

Glycaspis (*Alloglycaspis*) *mesicola* Moore 1964a, p. 166, Text-fig. 8.
Glycaspis (*Alloglycaspis*) *ochros*: Moore, 1964a, p. 165, Text-fig. 6. *syn. nov.*
Claspers & Aedeagus: As in Text-fig. 118.
Length of Aedeagus: (7 specimens) 0.230 mm. to 0.248 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. drepanophylla* F. Muell. ex Benth. (Bowen ironbark).
Type Locality: Brisbane, Queensland.
Specimens Examined: (slides) 1♂ "Goodna, Qld., 19 vi 1967, R. A. Yule, *E. drepanophylla*", to QF; 1♂ "Carnarvon Ra., Qld., 29 iii 1957, I. F. B. Common". (Dried) 7♀s "Carnarvon Ra., Qld., 29 iii 1957, I. F. B. Common".
Notes: Lerps are not known.

Glycaspis (*Glycaspis*) *deirada*, sp. nov.

(Gr. *deirados* = a summit. Referring to the type locality).

Claspers & Aedeagus: As in Text-fig. 119.
Length of Aedeagus: (4 specimens) 0.254 mm. to 0.265 mm.
Hindwings: Cu_1 as Group (i).
Host Plant: *E. dundasii* Maiden (Dundas blackbutt).
Type Locality: Fraser Range, SE. Western Australia.
Types: Holotype male on slide labelled "Fraser Ra., W.A., 11 x 1966, *E. dundasii*". Paratypes: (slides) 3♂s with same label data as the holotype. (In alcohol) 9♂s 6♀s with same label data.
Other Specimens Examined: 1♂ "10 mi. N. Norseman, W.A., 25 x 1958, I. F. B. Common".
Notes: Lerps rectangular.

There is apparently a complex of species throughout southern Western Australia, with close similarities in the morphology of the male aedeagi and claspers. Until a more intensive and extensive study of these species is made, known morphological characteristics are inadequate for the separation of the species.

The material at present classified as "the *deirada* complex", consists of the following specimens:- (slides) 1♂ "24 mi. E. Cocklebiddy, W.A., 13 x 1966, *E. salmonophloia*"; 1♂ "33 mi. E. Norseman, W.A., 10 x 1966, *E. ?campaspe*"; 4♂s "24 mi. S. Coolgardie, W.A., 8 x 1966, *Euc.* sp."; 3♂s "16 mi. S. Coolgardie, W.A., 7 x 1966, *E. salubris*"; 1♂ "4 mi. S. Coolgardie, W.A., 7 x 1966, *E. ?salmonophloia*"; 2♂s "2 mi. S. Coolgardie, W.A., 7 x 1966, *E. campaspe*"; 1♂ "3 mi. S. Kalgoorlie, W.A., 5 x 1966, *E. ?calycogona*"; 3♂s "2 mi. S. Kalgoorlie, W.A., 5 x 1966, *E. ?oleosa*"; 1♂ "44 mi. S. Menzies, W.A., 2 x 1966, *E. calycogona*"; 1♂ "Broad Arrow, W.A., 3 x 1966, *E. ?redunca*"; 1♂ "7 mi. E. Ravensthorpe, W.A., 28 ix 1966, *E. ?annulata*"; 2♂s "4 mi. S. Ravensthorpe, W.A., 28 ix 1966, *E. ?occidentalis*"; 5♂s "100 mi. N. Esperance, W.A., 30 ix 1966, *E. ?comitae-vallis*"; 3♂s "66 mi. N. Albany, W.A., 25 ix 1966, *E. cylindriflora*"; 2♂s "63 mi. N. Albany, W.A., 25 ix 1966, *E. ? annulata*"; 1♂ "21 mi. N. Albany, W.A., 23 ix 1966, *E. ?occidentalis*"; 2♂s "2 mi. E. Cape Naturaliste, W.A., 18 ix 1966, *E. cornuta*"; 2♂s "Crawley, Perth, W.A., 6 ix 1966, *E. gomphocephala*"; 2♂s "3.8 mi. N. Tuart Hill, W.A., 1 ix 1966, *E. gomphocephala*"; 2♂s "35 mi. E. Ceduna, S.A., 28 xi 1958, I. F. B. Common"; 2♂s "Lowaldie, S.A., 13 xi 1966, *E. ?foecunda*"; 1♂ "43 mi. E. Elliston, S.A., 19 x 1966, *E. foecunda*"; 1♂ "18 mi. S. Caiguna, W.A., 13 x 1966, *Euc.* sp."; 1♂ "Fraser Ra., W.A., 11 x 1966, *Euc.* sp."; 1♂ "20 mi. N. Norseman, W.A., 10 x 1966, *E. gracilis*"; 1♂ "Mingenew, W.A., 23 viii 1966, *E. ?rudis*"; 2♂s "28 mi. S. Coorow, W.A., 25 viii 1966, *E. leptophleba*"; 2♂s "Walebing, W.A., 2 v 1954, K. L. Taylor, *Euc.* sp."; 1♂ "Eba, S.A., 17 v 1953, G. F. Gross". (in alcohol) 1♀ "12 mi. E. Ivy Tank, S.A., 16 x 1966, *E. ?oleosa*"; 1♀ "Fraser Ra., W.A., 11 x 1966, *Euc.* sp."; 2♀s "33 mi. E. Norseman, W.A., 10 x 1966, *E. ?campaspe*"; 1♂ 13♀s "24

mi. S. Coolgardie, W.A., 8 x 1966, *Euc.* sp"; 1♂ 5♀s "16 mi. S. Coolgardie, W.A., 7 x 1966, *E. salubris*"; 8♀s "4 mi. S. Coolgardie, W.A., 7 x 1966, *E. ?salmonophloia*"; 1♂ 8♀s "2 mi. S. Coolgardie, W.A., 7 x 1966, *E. campaspe*"; 1♀ "3 mi. S. Kalgoorlie, W.A., 5 x 1966, *E. ?calycogona*"; 6♀s "3 mi. S. Kalgoorlie, W.A,. 5 x 1966, *E. ?calycogona* or *E. ?oleosa*"; 9♀s "2 mi. S. Kalgoorlie, W.A., 5 x 1966, *E. ?oleosa*"; 1♀ "44 mi. S. Menzies, W.A., 2 x 1966, *E. ?lesouefii*"; 2♀s "44 mi. S. Menzies, W.A., 2 x 1966, *E. ?lesouefii, E. ?calycogona*"; 6♀s "Broad Arrow, W.A., 3 x 1966, *E. ?redunca*"; 4♀s "4 mi. S. Ravensthorpe, W.A., 28 ix 1966, *E. ?occidentalis*"; 2♀s "7 mi. E. Ravensthorpe, W.A. 28 ix 1966, *E. ?annulata*"; 2♀s "11 mi. S. Ravensthorpe, W.A., 27 ix 1966, *E. platypus*"; 3♂s 18♀s "100 mi. N. Esperance, W.A., 30 ix 1966, *E. ?comitaevallis*"; 3♀s "2.5 mi. NW. Deep Riv., W.A., 20 ix 1966, *E. diversicolor*"; 3♀s "66 mi. N. Albany, W.A., 25 ix 1966, *E. cylindriflora*"; 4♀s "63 mi. N. Albany, W.A., 25 ix 1966, *E. ?annulata*"; 1♀ "21 mi. N. Albany, W.A., 23 ix 1966, *E. ?occidentalis*"; 1♀ "2 mi. E. Cape Naturaliste, W.A., 18 ix 1966, *E. cornuta*"; 2♀s "King's Park, Perth, W.A., 3 ix 1966, *E. gomphocephala*"; 4♀s Crawley, Perth, W.A., 6 ix 1966, *E. gomphocephala*"; 5♀s "3.8 mi. N. Tuart Hill, W.A., 1 ix 1966, *E. gomphocephala*"; 1♂ 12♀s "4.5 mi. N. Tuart Hill, W.A., 15 ix 1966, *E. gomphocephala*"; 2♀s "1 mi. N. Scarborough Beach, W.A., 8 ix 1966, *E. gomphocephala*"; 3♀s "3 mi. N. Scarborough Beach, W.A., 14 ix 1966, *E. gomphocephala*"; 2♀s "43 mi. E. Elliston, S.A., 19 x 1966, *E. foecunda*"; 2♀s "Fraser Ra., W.A., 11 x 1966, *Euc.* sp."; 1♀ "18 mi. S. Caiguna, W.A., 13 x 1966, *Euc.* sp."; 1♀ "28 mi. S. Coorow, W.A., 25 viii 1966, *E. loxophleba*". (dried) 2♀s "Walebing, W.A., 2 v 1954, K. L. Taylor, *Euc.* sp."; 1♀ "10 mi. N. Norseman, W.A., 25 xi 1958, I. F. B. Common"; 1♀ "35 mi. E. Ceduna, S.A., 28 xi 1958, I. F. B. Common".

Glycaspis (*Glycaspis*) *aurosala*, sp. nov.
(L. *aurosus* = golden; *ala* = a wing)

General Colour: Yellow to orange; few dark marks; sometimes suffused red; a broad whitish medio-dorsal area from base of genal processes to metascutellum.
Claspers & Aedeagus: As in Text-fig. 120.
Length of Aedeagus: (13 specimens) 0.220 mm. to 0.272 mm.
Hindwings: Cu_1 as Group (i).
Host Plant: *E. thozetiana*.
Type Locality: 29-31 mi. N. Clermont, Queensland.
Types: Holotype male on slide labelled "29 mi. N. Clermont, Qld., 1 v 1966, *E. thozetiana*". Paratypes: (slides) 5♂s with same label data as the holotype; 5♂s "60 mi. N. Thargomindah, Qld., 22 x 1957, I. F. B. Common"; 4♂s "16 mi. W. Charleville, Qld., 21 x 1957, I. F. B. Common". (in alcohol) 4♂s 20♀s with same label data as the holotype.
Other Specimens Examined: (dried) 5♀s "60 mi. N. Thargomindah, Qld., 22 x 1957, I. F. B. Common"; 3♀s "16 mi. W. Charleville, Qld., 21 x 1957, I. F. B. Common".
Notes: Lerps rectangular.

Glycaspis (*Glycaspis*) *emphanes*, sp. nov.
(Gr. *emphanes* = conspicuous)

General Colour: Creamy yellow to brown, with black markings and red suffusion. Dark markings on forewing as in Text-fig. 136.
Claspers & Aedeagus: As in Text-fig. 121.
Length of Aedeagus: (4 specimens) 0.248 mm. to 0.256 mm.
Hindwings: Cu_1 as Group (i).
Host Plant: *E. cambageana*.
Type Locality: 17 mi. N. Banana, Queensland.
Types: Holotype male on slide labelled "17 mi. N. Banana, Qld., 25 iv 1966,

E. cambageana". Paratypes: (slides) 1♂ with same label data as the holotype; 2♂s "21 mi. N. Clermont, Qld., 1 v 1966, *E. cambageana*". (in alcohol) 2♂s 10♀s nymphs, with same label data as the holotype; 3♂s 6♀s 12 nymphs, "21 mi. N. Clermont, Qld., 1 v 1966, *E. cambageana*". (dried) 1♂ '10 mi. N. Emerald, Qld., 4 iv 1957, I. F. B. Common".

Notes: Lerps rectangular. On any part of a leaf, and mostly singly. Some adults of this species were reared by the writer.

Glycaspis (*Glycaspis*) *siliciflava*, comb. nov.

Glycaspis (*Alloglycaspis*) *siliciflava* Moore 1961, pp. 165-6, Text-fig. 48.

Claspers & Aedeagus: As in Text-fig. 122.
Length of Aedeagus: (9 specimens) 0.216 mm. to 0.236 mm.
Hindwings: Cu_1 as Group (ii).
Host Plant: *E. robusta*.
Type Locality: Wamberal, New South Wales.
Notes: Lerps rectangular.

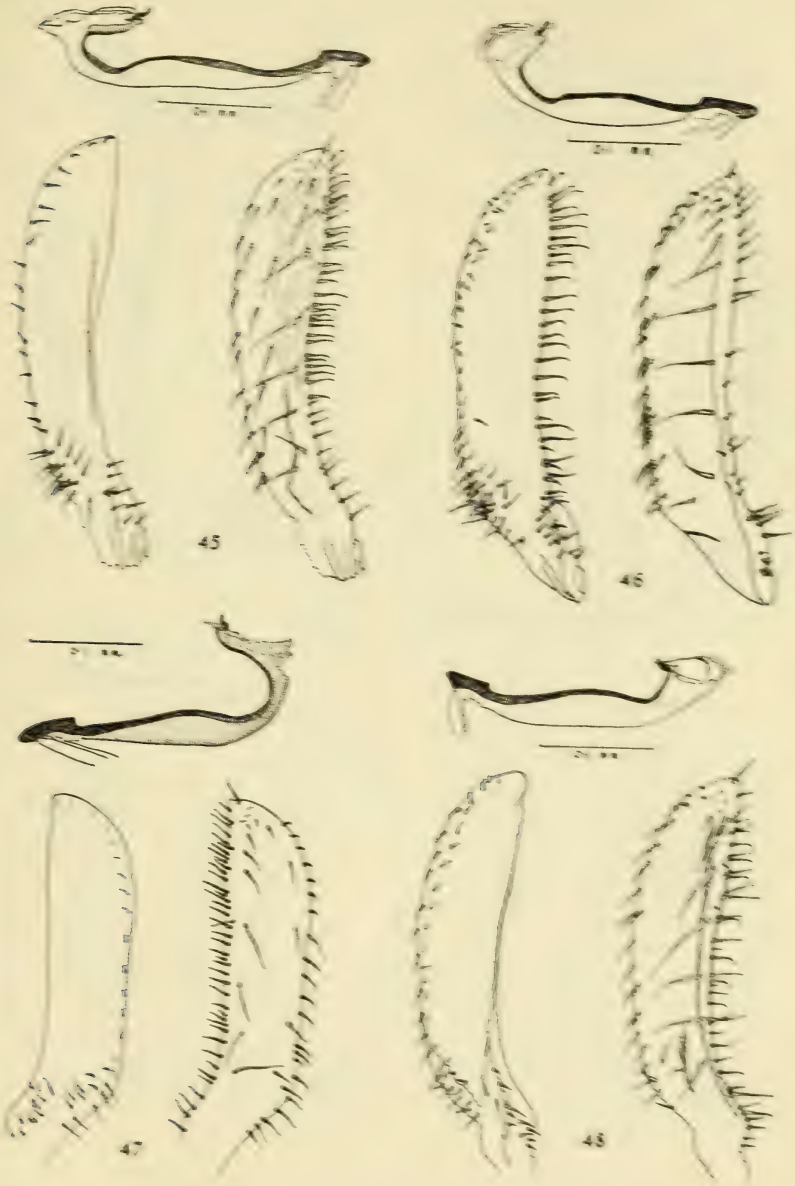
Glycaspis (*Glycaspis*) *granulata* (Froggatt), comb. nov.

Spondyliaspis granulata Froggatt 1901, pp. 293-4, Pl. 16, fig. 25.
Spondyliaspis granulata: Tuthill & Taylor 1955, p. 231.
Glycaspis granulata: Taylor 1960, p. 385.
Glycaspis (*Alloglycaspis*) *granulata*: Moore 1961, pp. 164-5, Text-figs. 46, 47.
Glycaspis (*Alloglycaspis*) *mirabilis*: Moore 1961, p. 164, Text-fig. 45. *syn. nov.*

Claspers & Aedeagus: As in Text-fig. 123 (of Lectotype).
Length of Aedeagus: (8 specimens) 0.252 mm. to 0.299 mm.
Hindwings: Cu_1 as Group (ii).
Host Plants: *E. botryoides* Sm. (bangalay); *E. grandis* Hill & Maiden (toolur); *?E. robusta; E. saligna.*
Type Locality: Botany, Sydney, New South Wales.
Types: Lectotype (here designated) 1♂ on slide labelled "*E. robusta*, Botany, N.S.W., Angle Sugar, 14.3.01, W.W.F., Type (♀) *S. granulata*, W.W.F., 1901, *Glycaspis* (*Glycaspis*) *granulata* (Froggatt), Lectotype". Paralectotype (here designated) 1♂ on slide labelled "*E. robusta*, Botany, N.S.W., Angle Sugar, 14.3.01, W.W.F., *Glycaspis* (*Glycaspis*) *granulata* (Froggatt), Paralectotype".
Other Specimens Examined: (slides) 1♂ "Boambee S.F., N.S.W., 5 iii 1962, K. G. Campbell, *E. grandis*"; 2♂s "Upper Allyn Riv., N.S.W., 1500', 9 ii 1961, I. F. B. Common & M. S. Upton"; 1♂ "Mt. Spec, Qld., 2900', 22 iv 1955, Norris & Common"; 3♂s "Sussex Inlet, N.S.W., 13 v 1969, *E. botryoides*". (in alcohol) 10♂s 27♀s 'Sussex Inlet, N.S.W., 13 v 1969, *E. botryoides*". (dried) 1♀ "Upper Allyn Riv., N.S.W., 9 ii 1961, I. F. B. Common & M. S. Upton"; 1♀ "Goodna, Qld., 1 viii 1967, R. A. Yule", to QF.
Notes: The paralectotype is the specimen illustrated in Text-fig. 46 (Moore 1961). The claspers and aedeagus of the Lectotype are now figured in Text-fig. 123 in this paper. The type label apparently written by Froggatt, and which was attached to the pin bearing a single card with 2 male specimens, bears the data "Type ♀". No female specimen has been found, so that the only syntypes available are the two male specimens. These two syntypes are now on separate slides as whole mounts, and labelled as indicated above. Lerps are rectangular.

Fig. 45. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *flavilabris* (Froggatt).
Fig. 46. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *eucalypti* (Dobson).
Fig. 47. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *minuscula*, comb. nov.
Fig. 48. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *egregia*, sp. nov.
Fig. 49. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *cnecosia*, sp. nov.
Fig. 50. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *suavis*, comb. nov.
Fig. 51. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *buxalis*, sp. nov.
Fig. 52. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *retrusa*, sp. nov.
Fig. 53. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *pervagata*, sp. nov.
Fig. 54. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *repentina*, comb. nov.
Fig. 55. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *collina*, sp. nov.
Fig. 56. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *brunneincincta*, sp. nov.
Fig. 57. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *dobsoni*, sp. nov.
Fig. 58. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *hadlingtoni*, sp. nov.
Fig. 59. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *rylstonensis*, sp. nov.
Fig. 60. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *grapta*, sp. nov.
Fig. 61. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *wanbiensis*, comb. nov.
Fig. 62. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *notialis*, sp. nov.
Fig. 63. Claspers & aedeagus of lectotype of *Glycaspis* (*Glycaspis*) *occidentalis*, comb. nov.
Fig. 64. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *yilgarniensis*, sp. nov.
Fig. 65. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *infucata*, sp. nov.
Fig. 66. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *felicitaris*, sp. nov.
Fig. 67. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *subita*, sp. nov.
Fig. 68. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *rivalis*, comb. nov.
Fig. 69. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *pilata*, comb. nov.
Fig. 70. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *whitei*, sp. nov.
Fig. 71. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *fuscovena*, sp. nov.
Fig. 72. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *wagaitjae*, sp. nov.
Fig. 73. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *caurina*, sp. nov.
Fig. 74. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *lucrosa*, sp. nov.
Fig. 75. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *anota*, sp. nov.
Fig. 76. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *wondjinae*, sp. nov.
Fig. 77. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *quornensis*, sp. nov.
Fig. 78. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *anomala*, sp. nov.
Fig. 79. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *johnsoni*, sp. nov.
Fig. 80. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *violae*, sp. nov.
Fig. 81. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *onychis*, sp. nov.
Fig. 82. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *lactea*, comb. nov.
Fig. 83. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *hackeri*, comb. nov.
Fig. 84. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *rubritincta*, sp. nov.
Fig. 85. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *exsertae*, sp. nov.
Fig. 86. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *froggatti*, sp. nov.
Fig. 87. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *blakei*, sp. nov.
Fig. 88. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *eremica*, sp. nov.
Fig. 89. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *taylori*, sp. nov.
Fig. 90. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *gradata*, sp. nov.
Fig. 91. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *confinis*, sp. nov.
Fig. 92. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *wakelburae*, sp. nov.
Fig. 93. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *brimblecombei*, comb. nov.
Fig. 94. Claspers & aedeagus of lectotype of *Glycaspis* (*Glycaspis*) *mannifera*, comb. nov.
Fig. 95. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *xanthopepla*, sp. nov.
Fig. 96. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *pratensis*, comb. nov.
Fig. 97. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *australoraria*, comb. nov.
Fig. 98. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *struicis*, comb. nov.
Fig. 99. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *montana*, comb. nov.
Fig. 100. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *baileyi*, comb. nov.
Fig. 101. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *imponens*, comb. nov.

Fig. 102. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *campbelli*, sp. nov.
Fig. 103. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *lucaridensis*, comb. nov.
Fig. 104. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *amnicola*, comb. nov.
Fig. 105. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *prepta*, sp. nov.
Fig. 106. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *wirradjuraae*, sp. nov.
Fig. 107. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *permista*, comb. nov.
Fig. 108. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *schwarzi*, sp. nov.
Fig. 109. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *sudicola*, sp. nov.
Fig. 110. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *ignea*, comb. nov.
Fig. 111. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *kurnajongensis*, comb. nov.
Fig. 112. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *mellialata*, comb. nov.
Fig. 113. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *neureta*, sp. nov.
Fig. 114. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *ovaria*, comb. nov.
Fig. 115. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *amydra*, sp. nov.
Fig. 116. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *mimita*, sp. nov.
Fig. 117. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *lacustris*, sp. nov.
Fig. 118. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *mesicola*, comb. nov.
Fig. 119. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *deirada*, sp. nov.
Fig. 120. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *aurosala*, sp. nov.
Fig. 121. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *emphanes*, sp. nov.
Fig. 122. Claspers & aedeagus of *Glycaspis* (*Glycaspis*) *siliciflava*, comb. nov.
Fig. 123. Claspers & aedeagus of lectotype of *Glycaspis* (*Glycaspis*) *granulata*, comb. nov.



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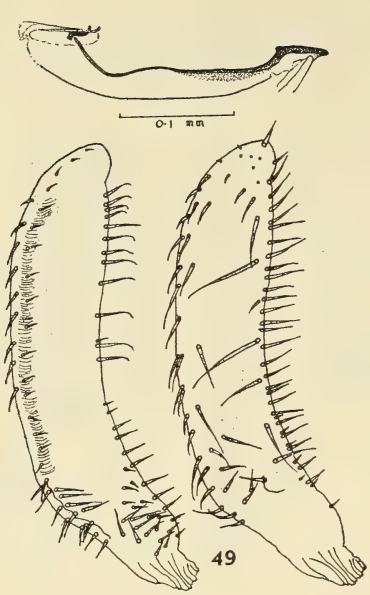

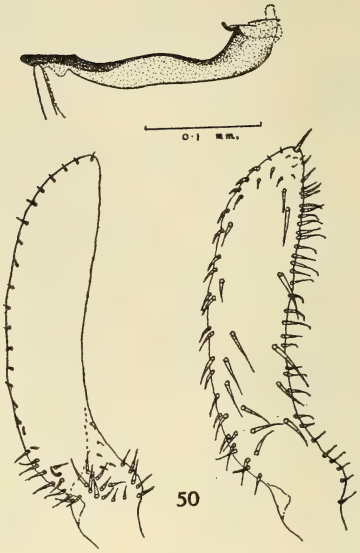

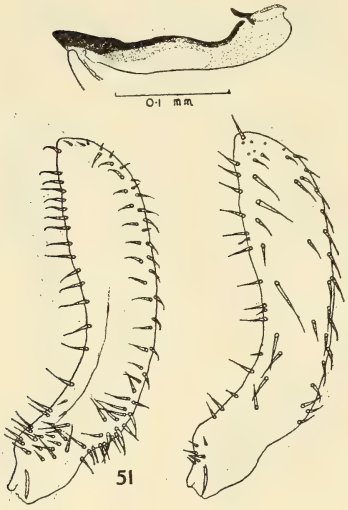

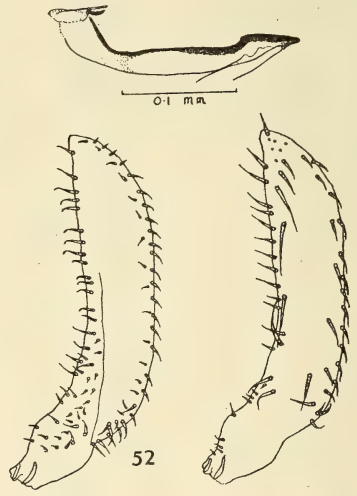

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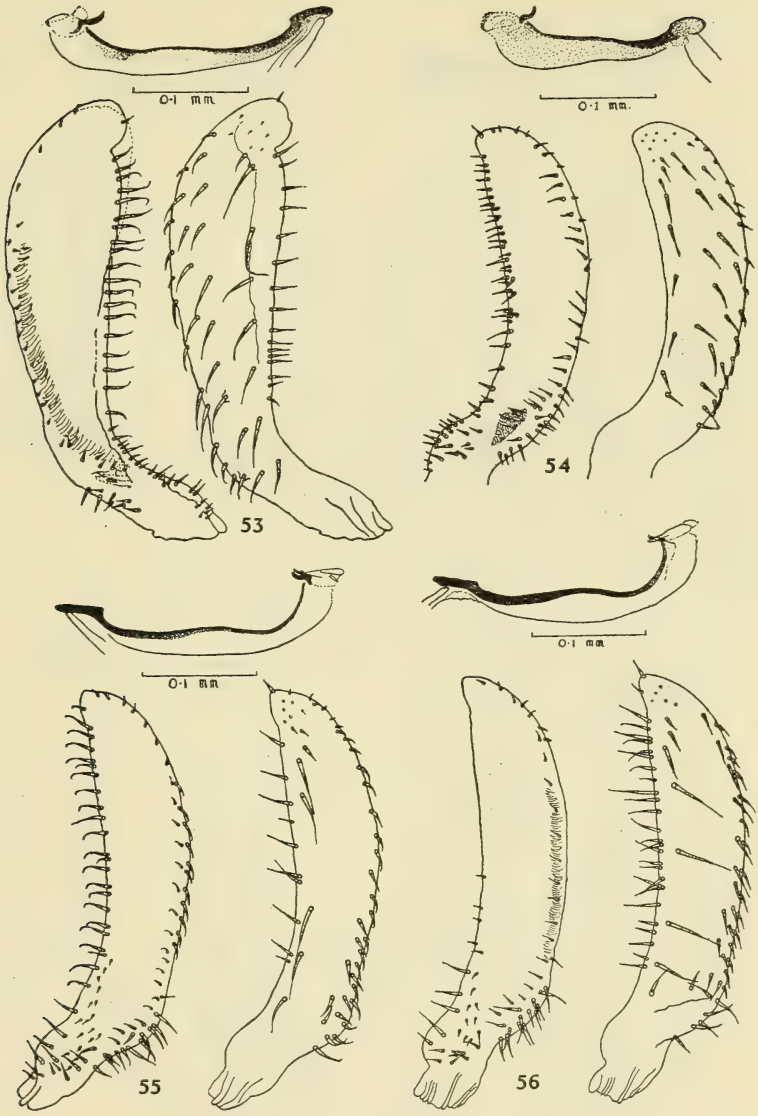

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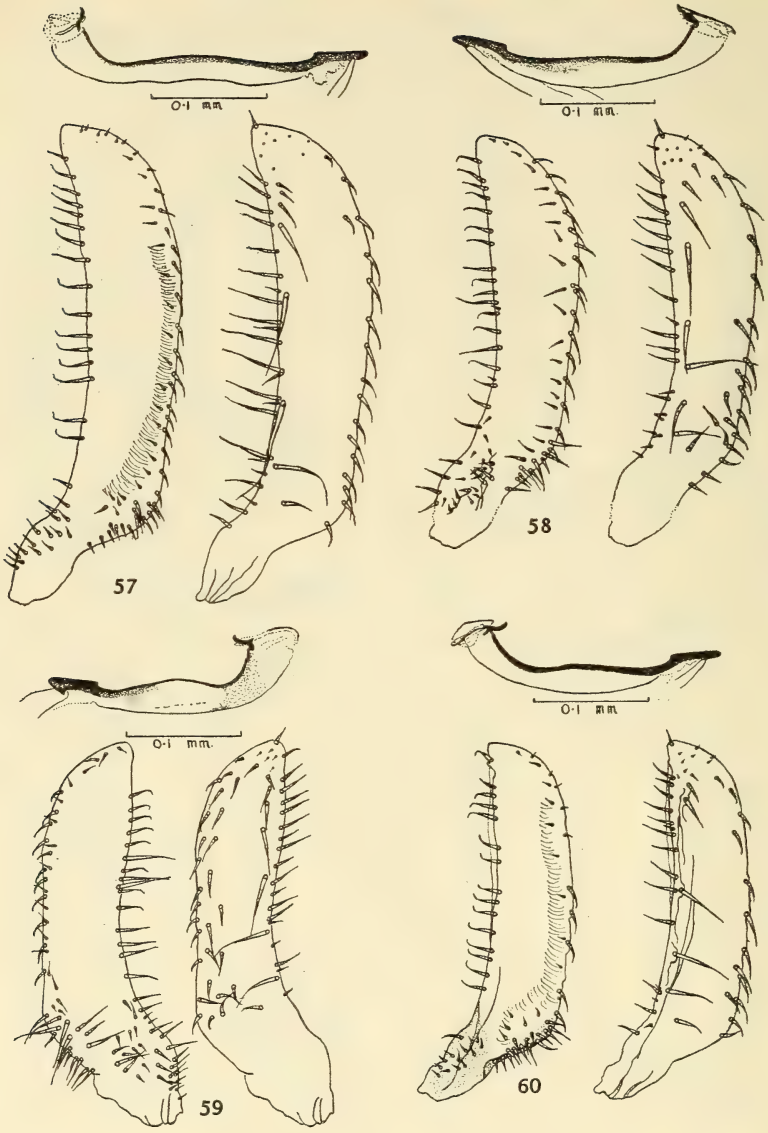

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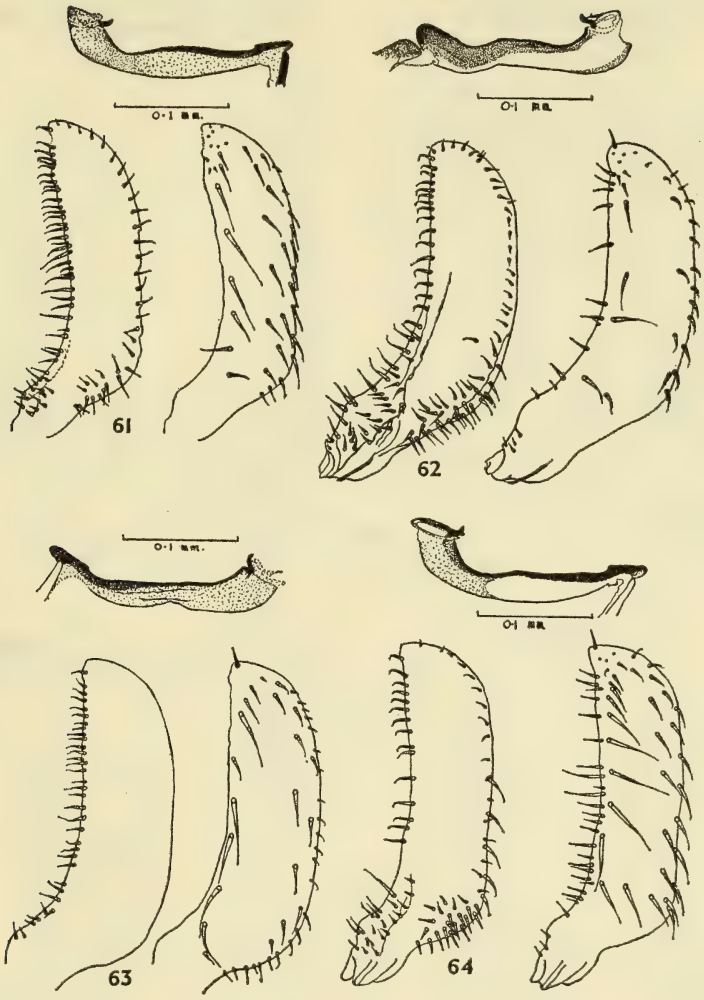

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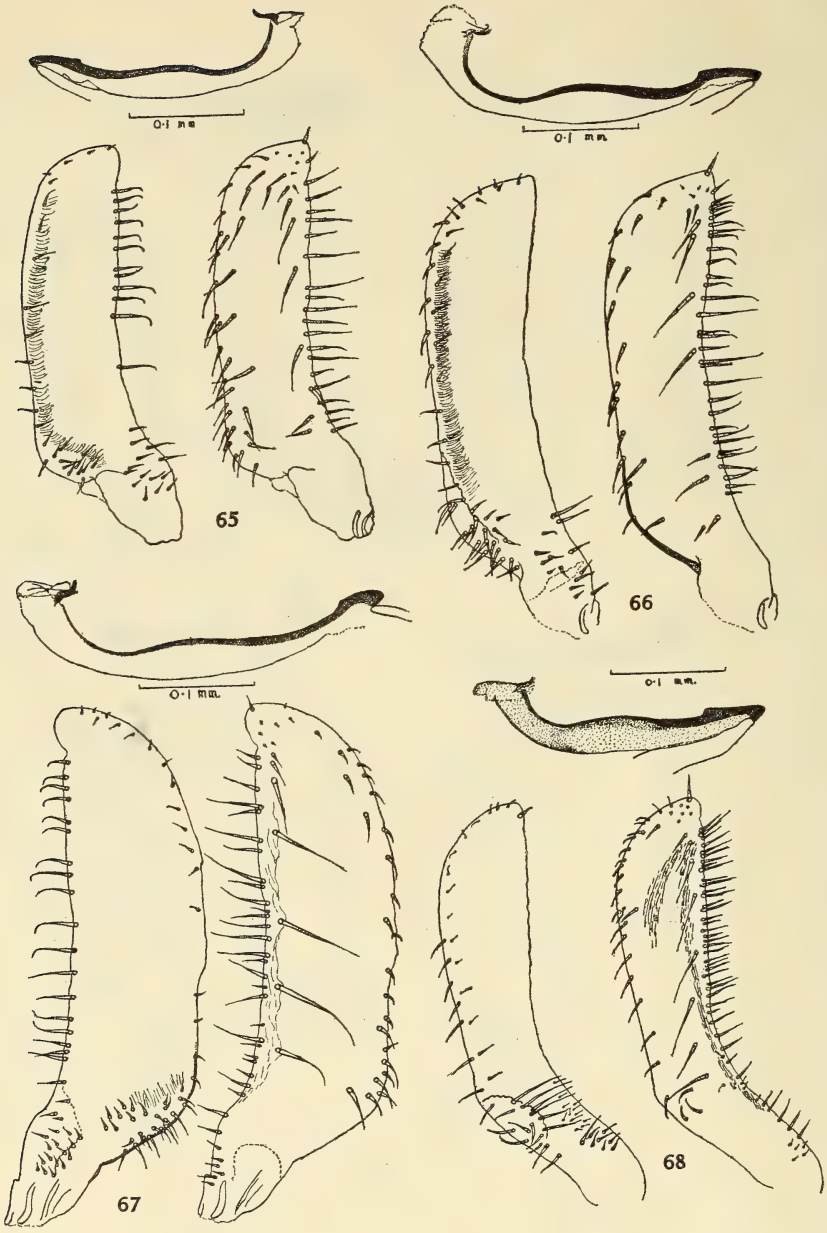

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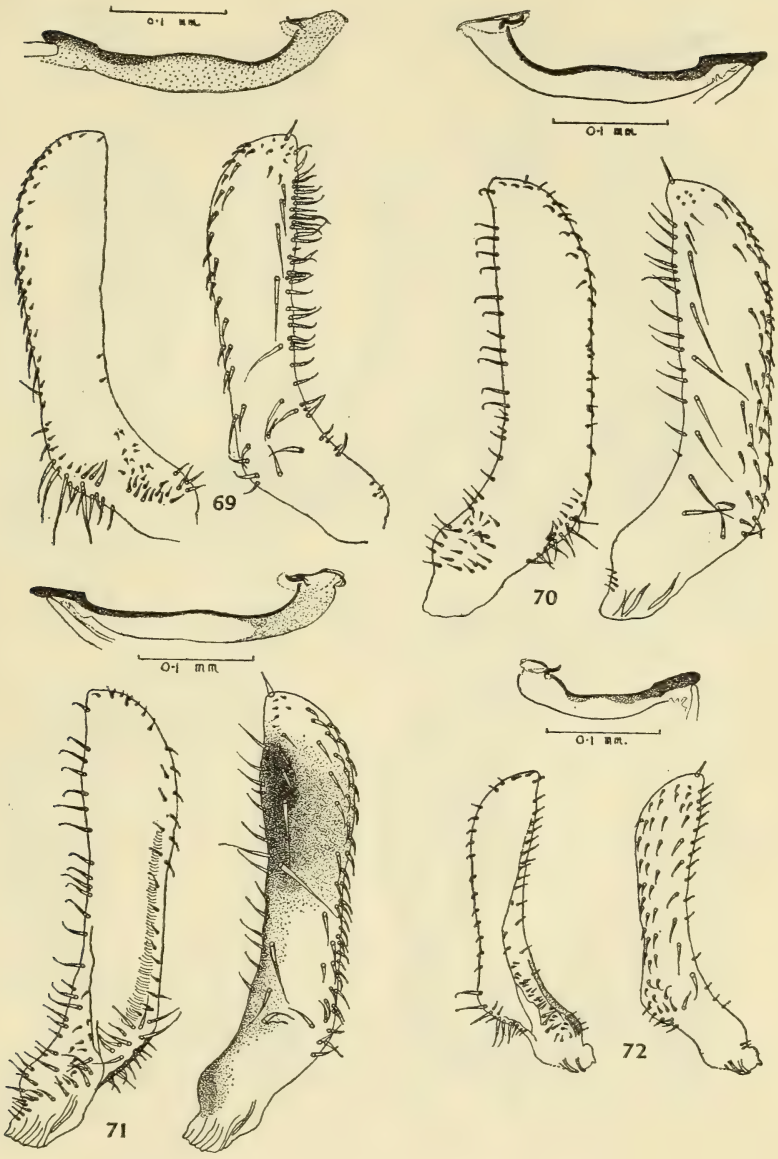

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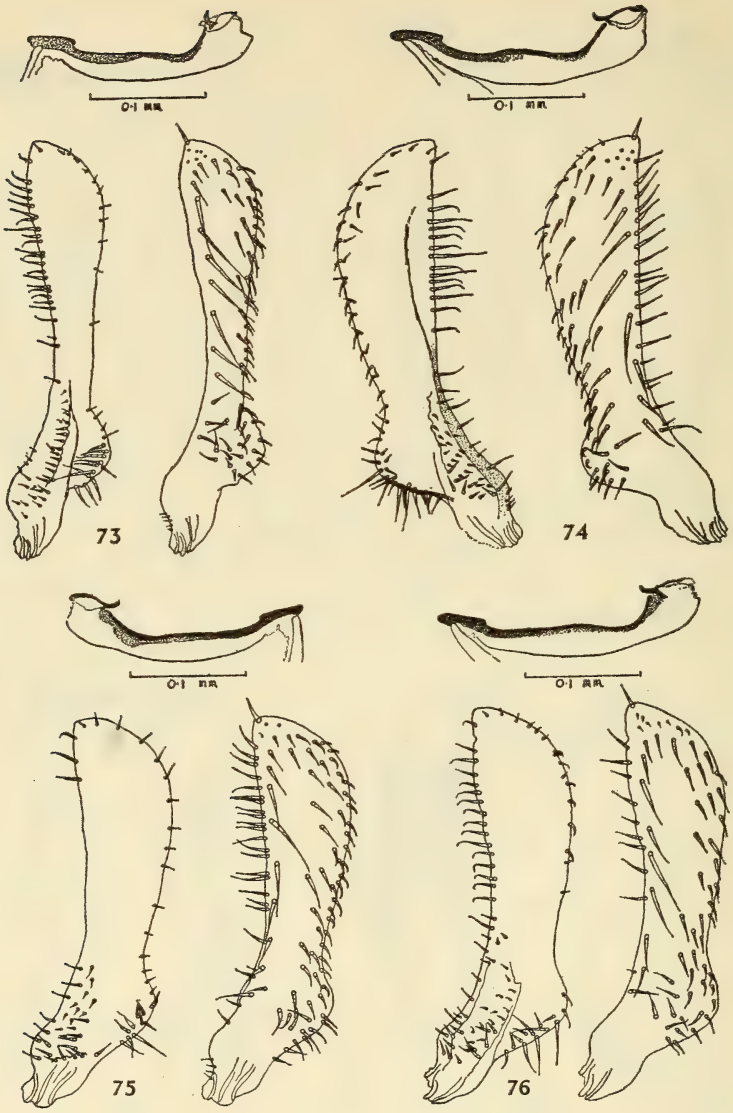

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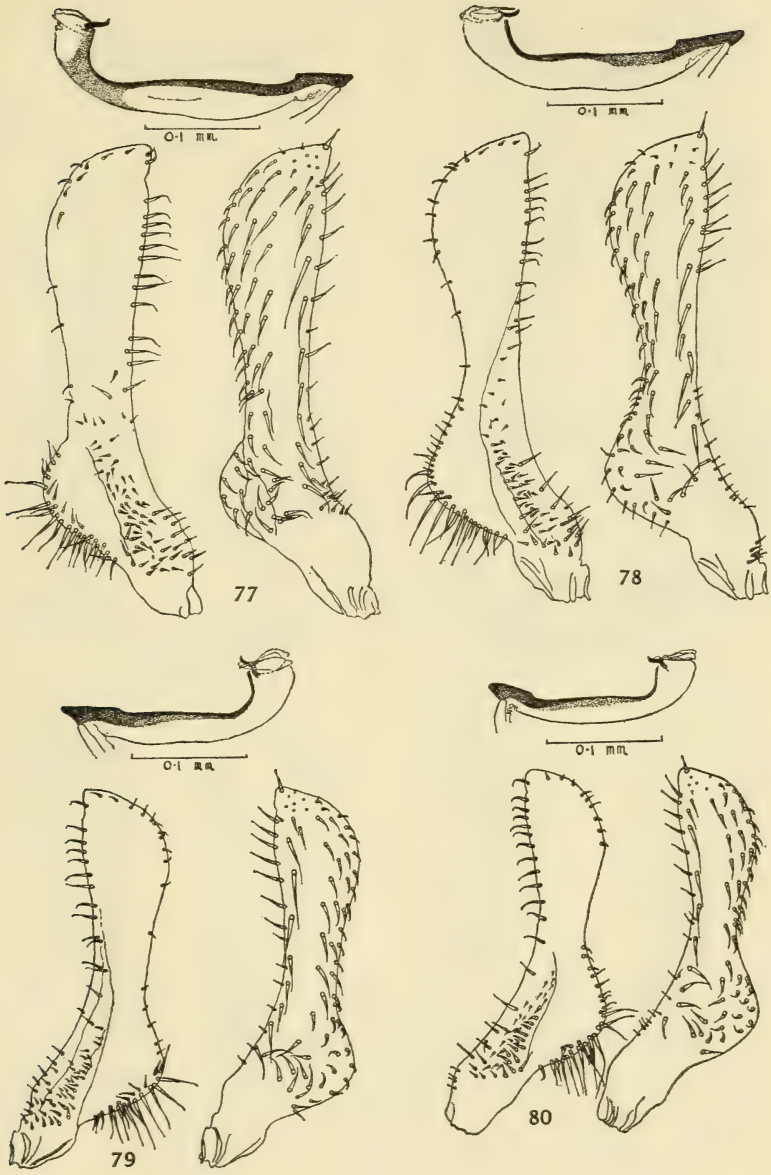

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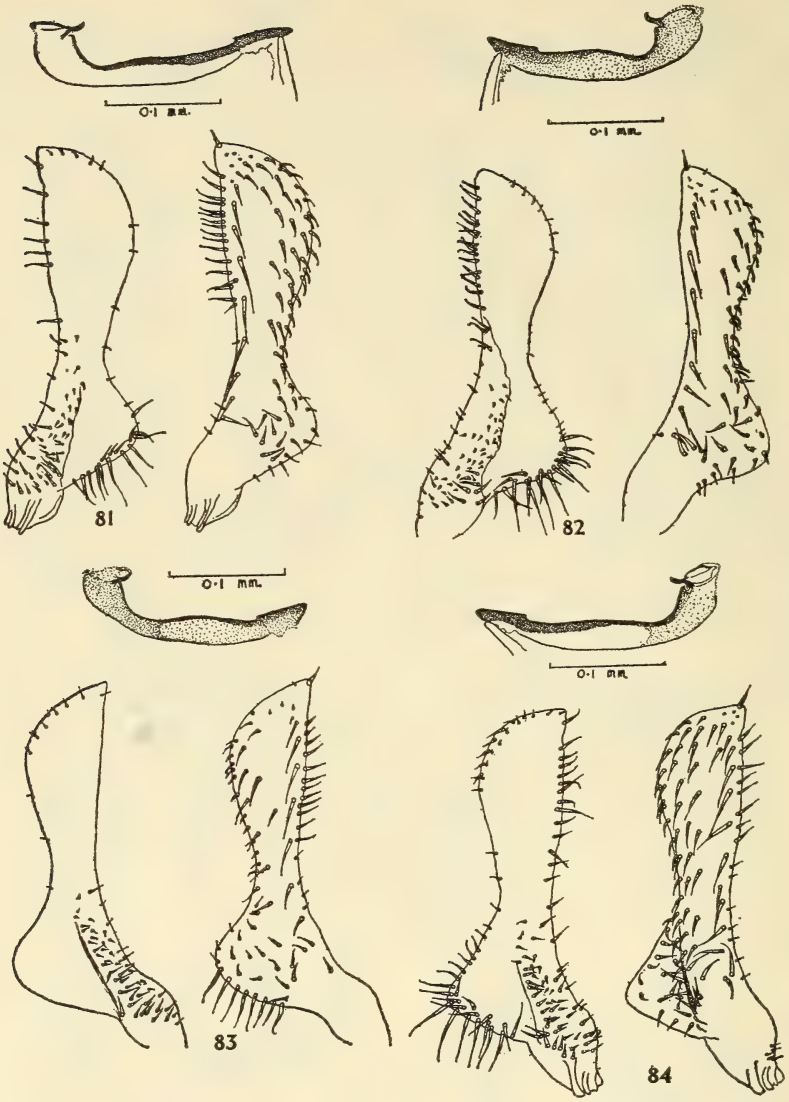

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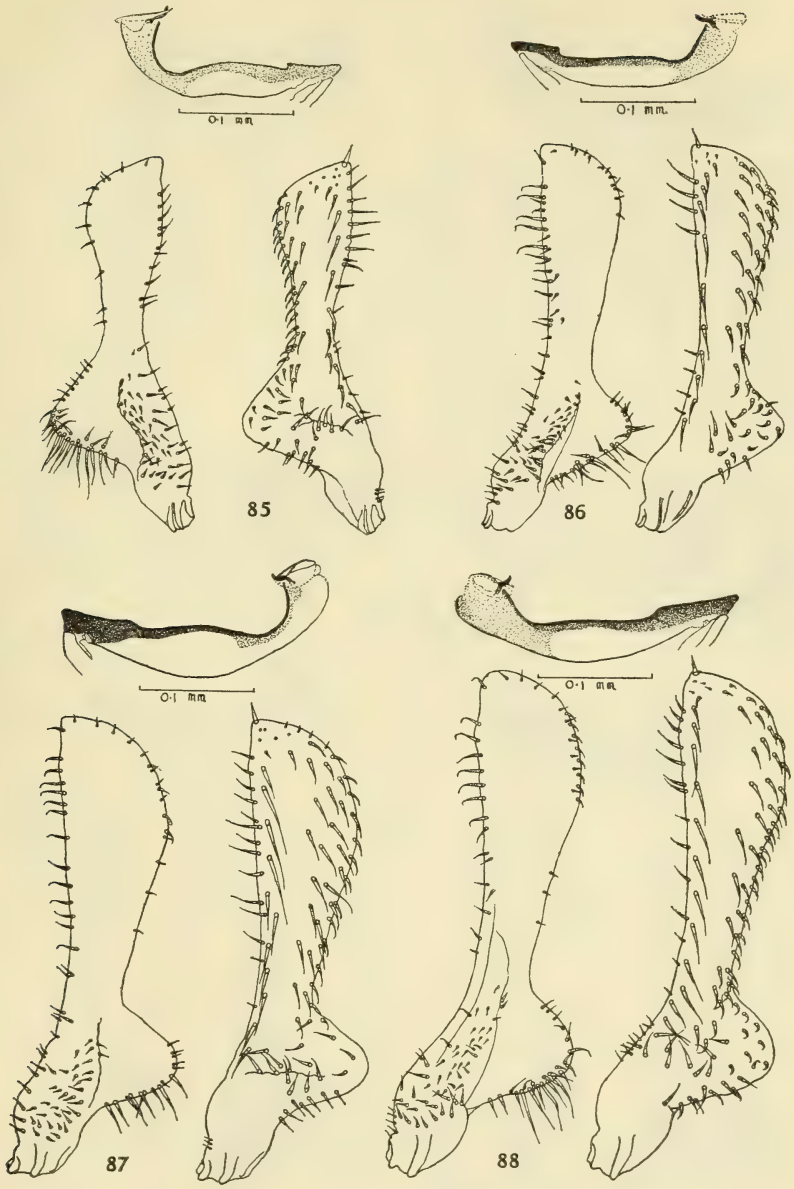

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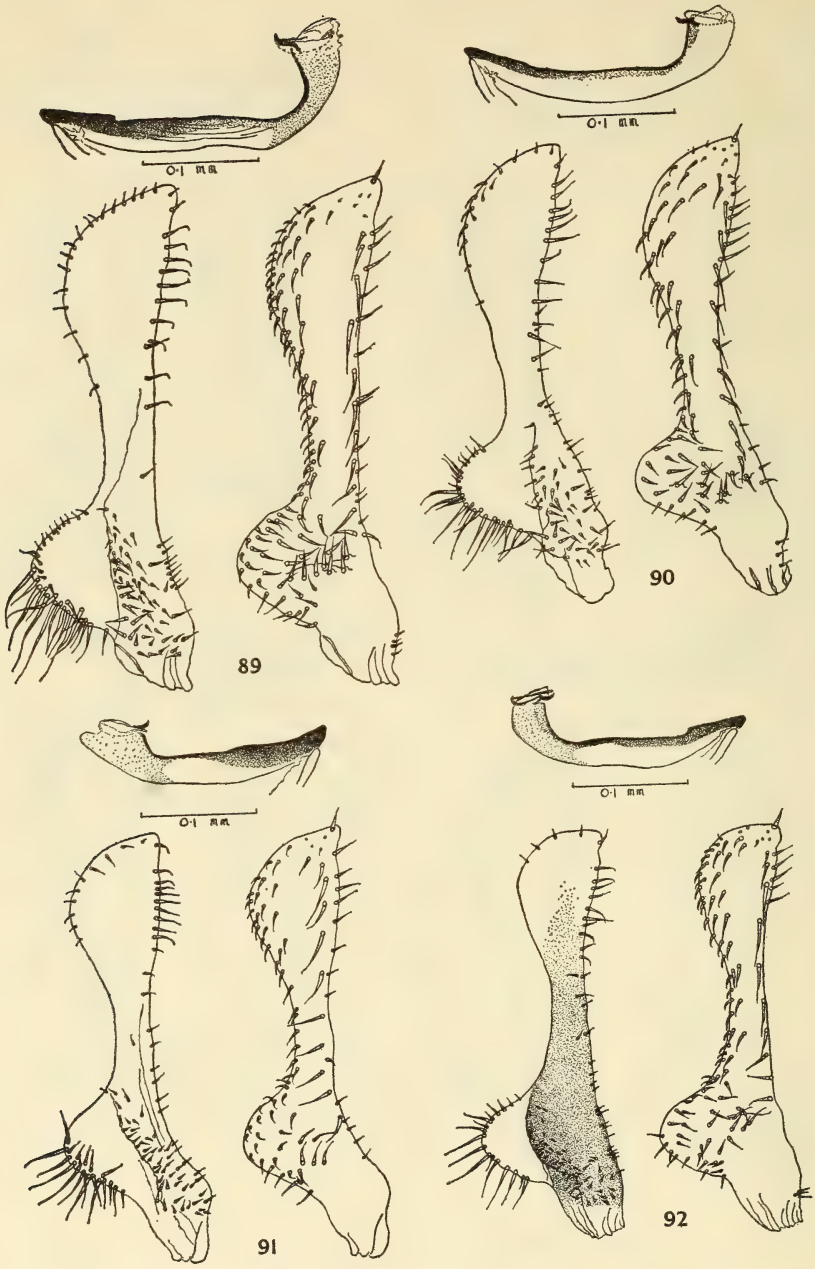

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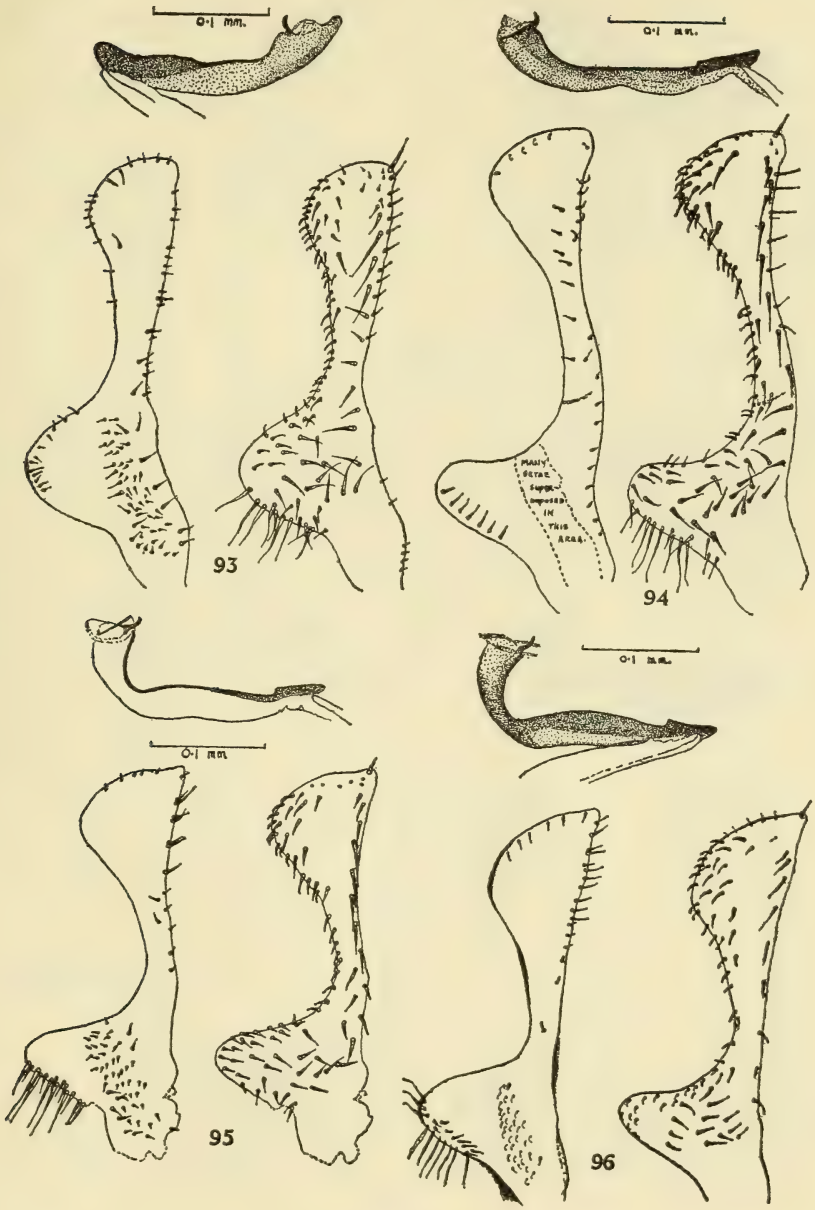

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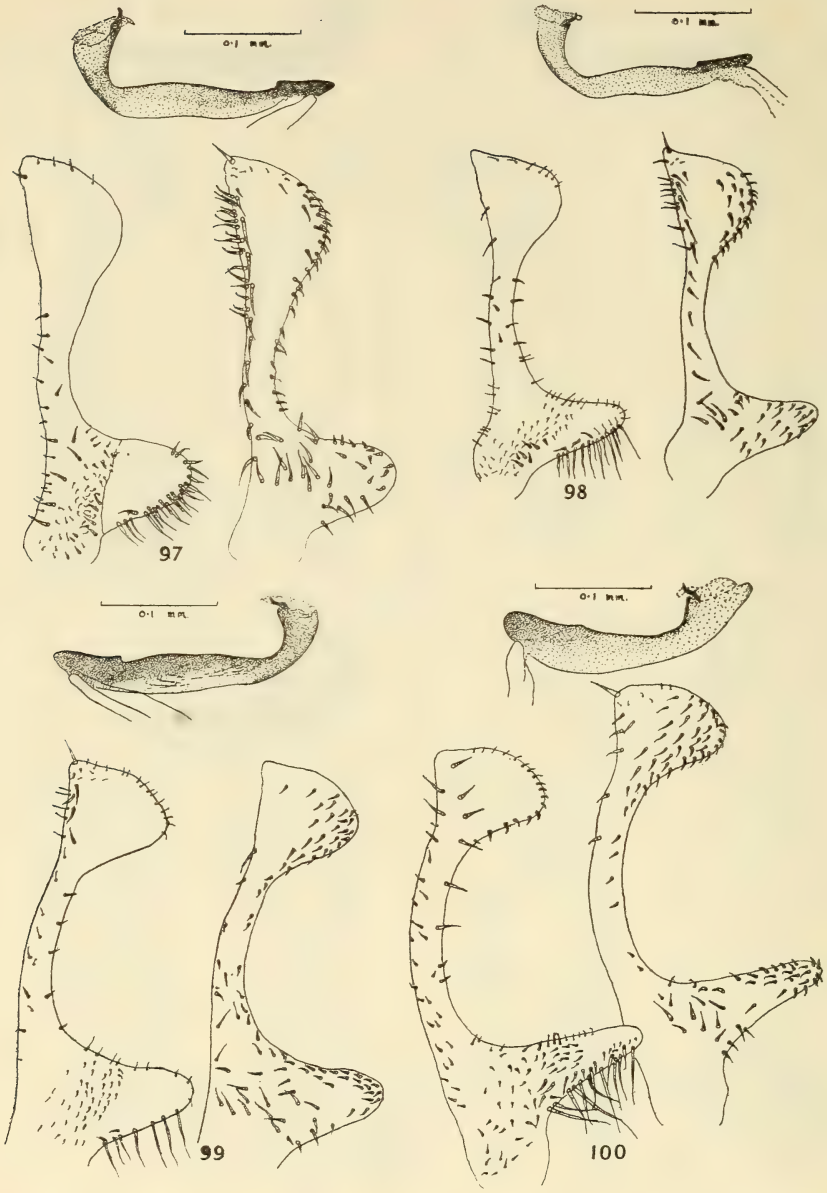

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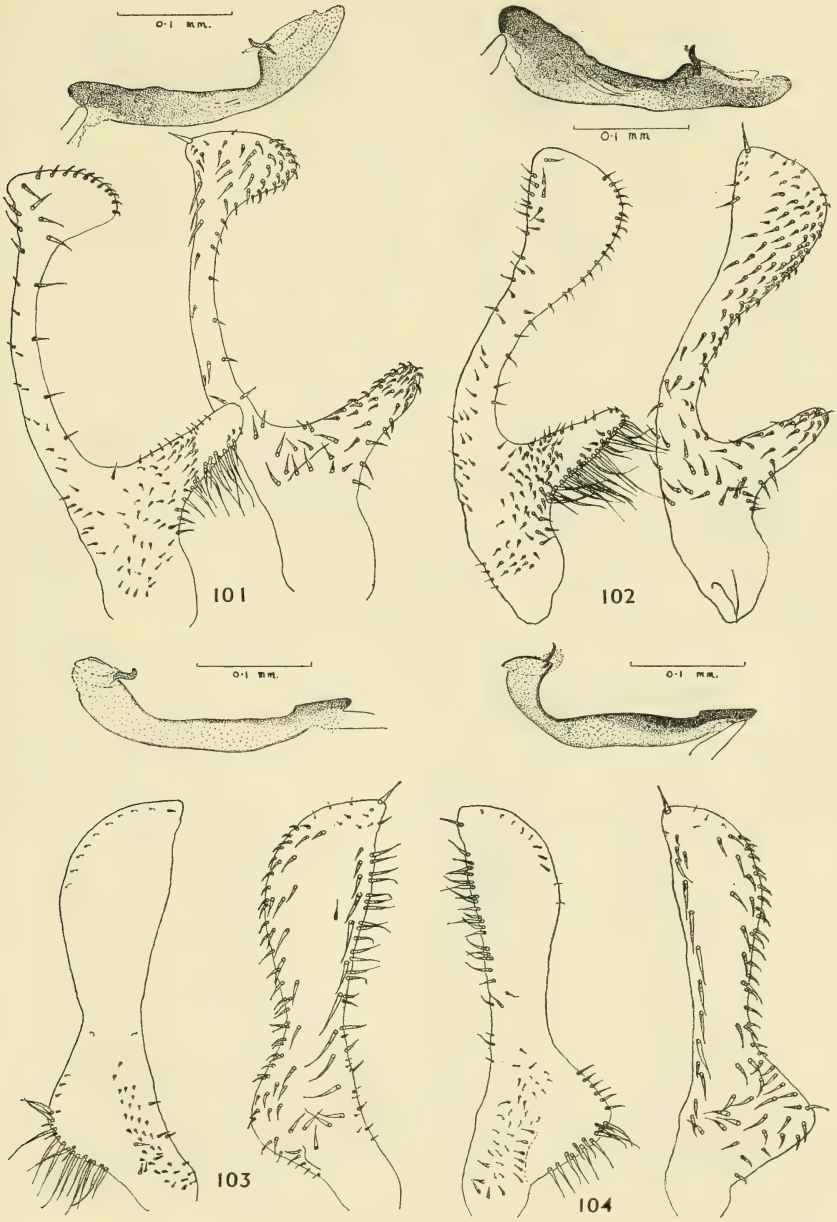

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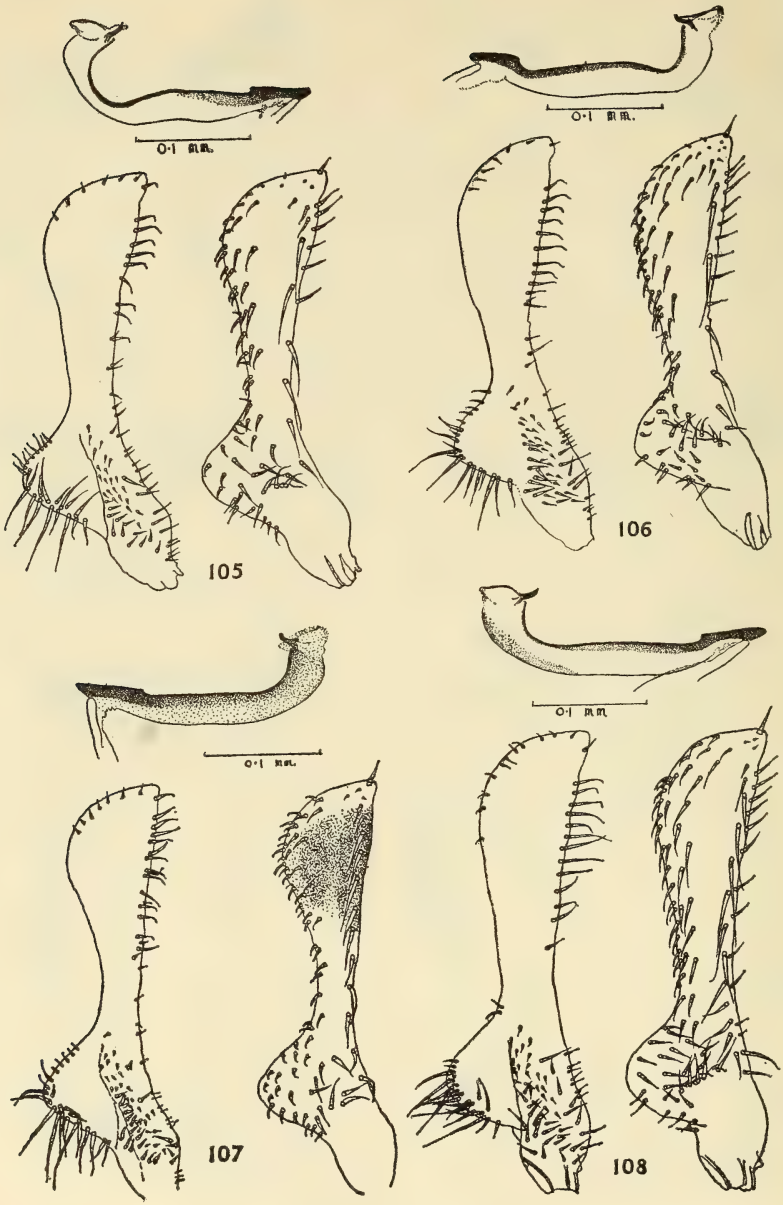

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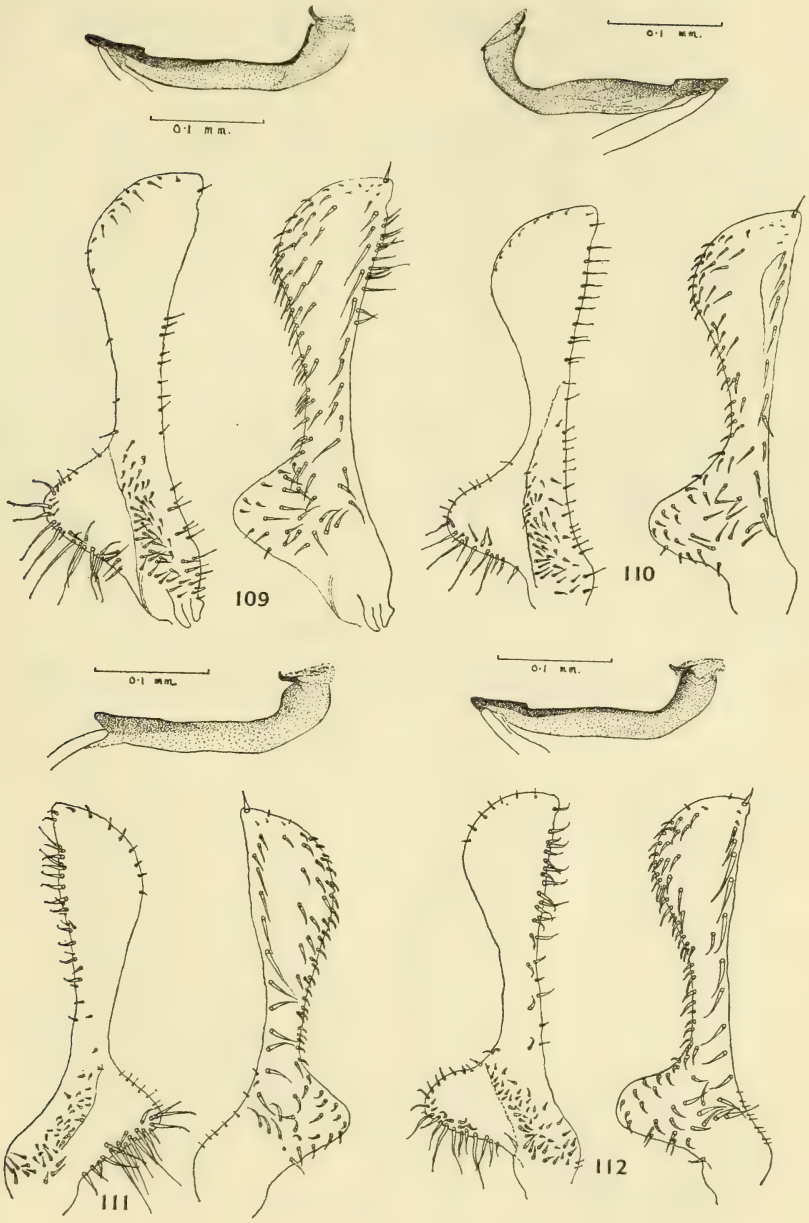

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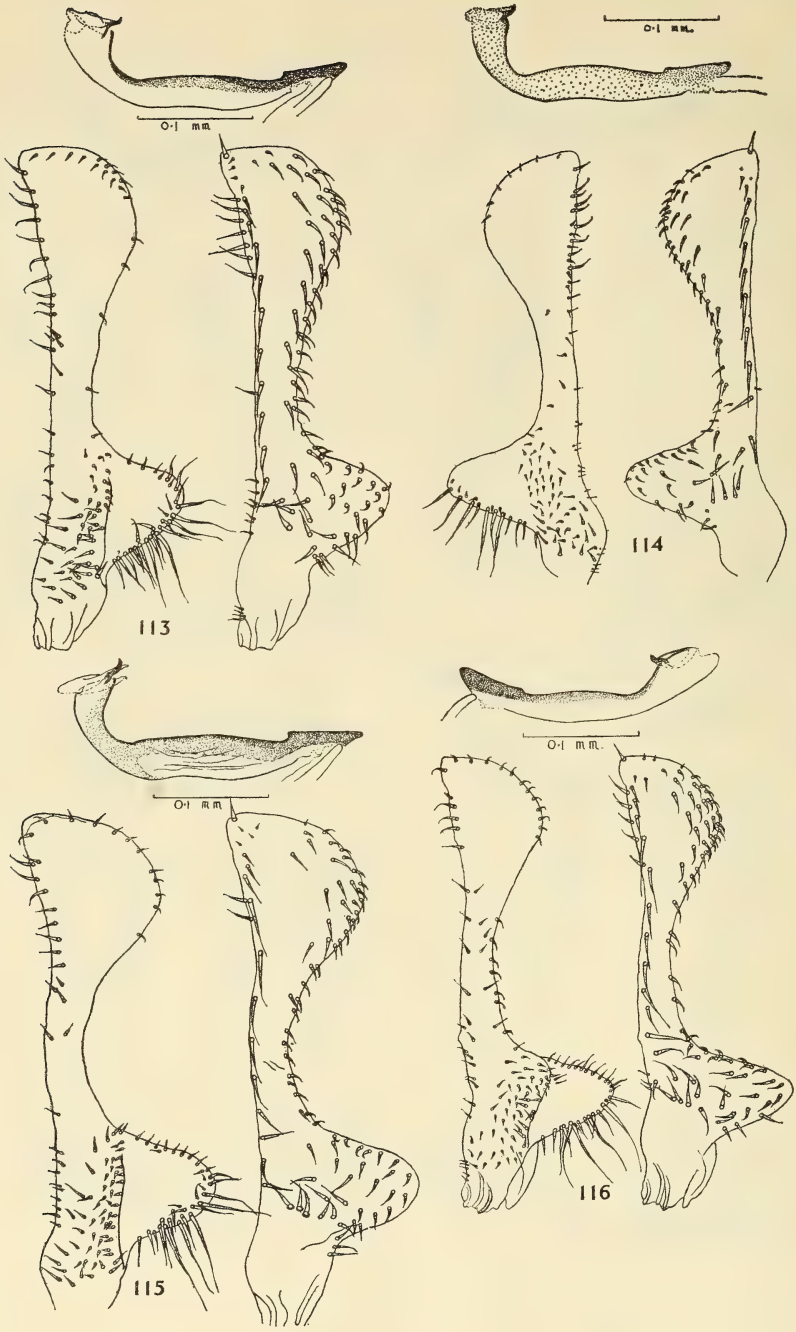

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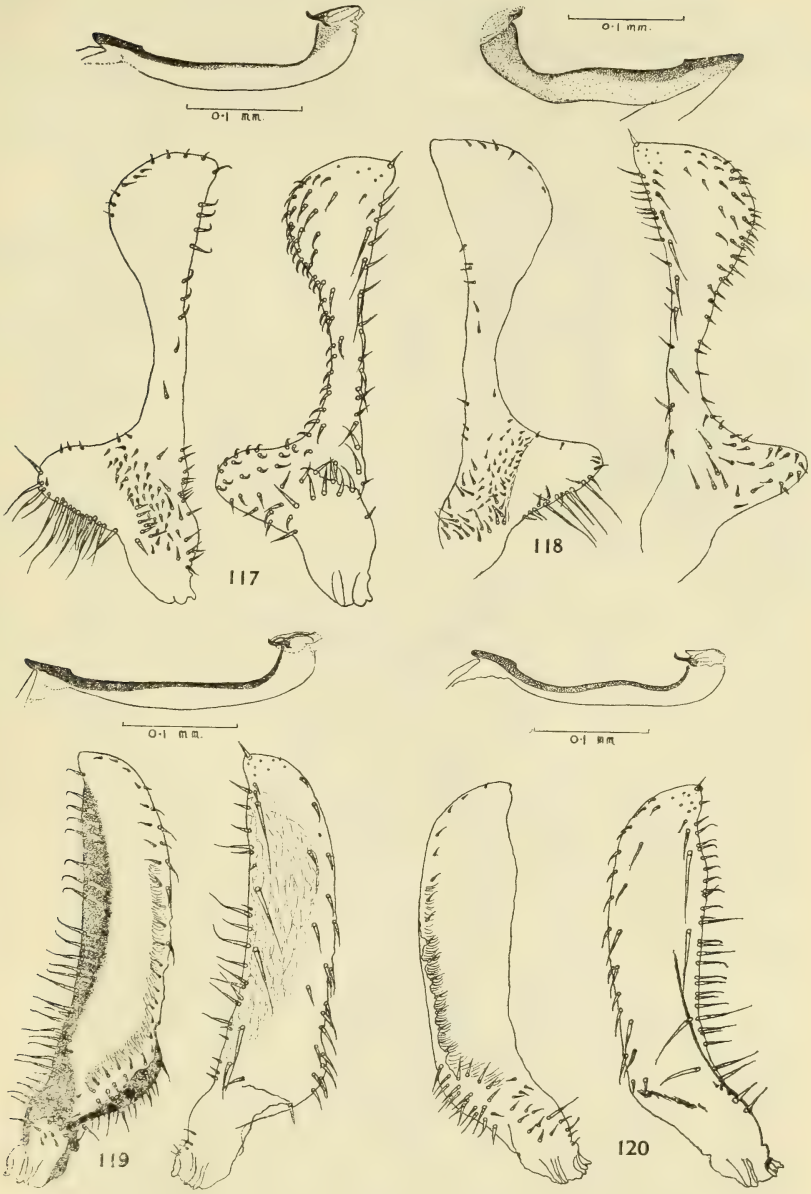

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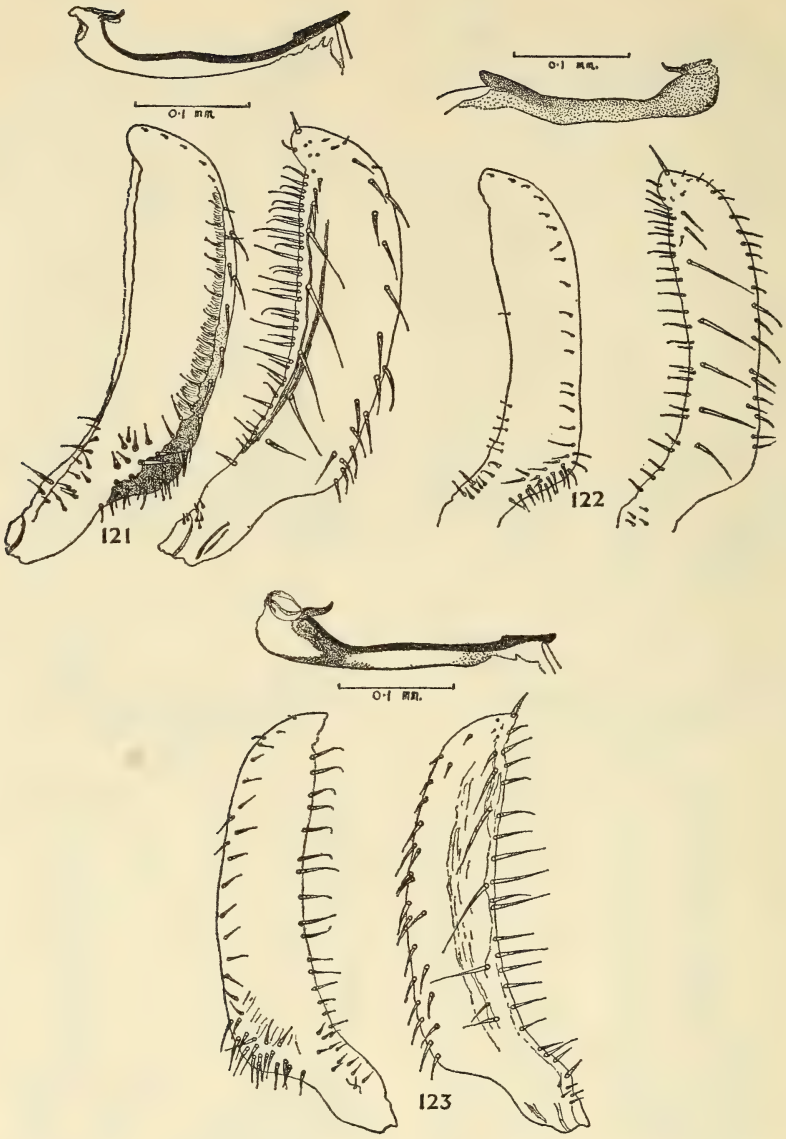


(For explanation of figures. see page 310)

Subgenus *Boreioglycaspis*

Glycaspis (*Boreioglycaspis*) Moore 1964, pp. 221-3, Text-fig. 7, 8, 10, 11, 13, 14.
Type Species: *Glycaspis* (*Boreioglycaspis*) *melaleucae* Moore.

To the three Australian and four exotic species previously described (Moore 1964), a further five Australian species are added, to give a total of twelve species in this subgenus.

Previously recorded morphological characters used for the delimitation of the subgenus (Moore 1964) require slight alteration i.e. the aspect of the genal processes is variable from almost horizontal to vertical.

Glycaspis (*Boreioglycaspis*) *melaleucae*

Moore 1964, pp. 223-224, Text-figs. 14, 15, 25.

General Colour: Cream to orange, with variable dark markings.
Claspers & Aedeagus: As in Text-fig. 124.
Host Plants: *Melaleuca quinquenervia* (Cav.) S. T. Blake; *M. leucadendron* (L.); *M. argentea* W. V. Fitzg.; *M. nervosa* (Lindl.) Cheel.
Type Locality: 14¼ mi. W. Grafton, New South Wales.
Specimens Examined: (slides) (from *M. quinquenervia*) 1♂ "Umina, N.S.W., 12 vi 1967". (from *M. leucadendron*) 1♂ "Cape Riv., 70 mi. S. Charters Towers, Qld., 3 v 1966"; 1♂ "Mt. Surprise, Qld., 22 v 1966"; 1♂ "Einasleigh Riv., Qld., 22 v 1966"; 1♂ "6 mi. S. Quamby, Qld., 30 v 1966"; 1♂ "0.5 mi. S. Howard Spgs., N.T., 3 vii 1966, *M. ?leucadendron*"; 2♂s "Upper Victoria Riv. X-ing, N.T., 7 vii 1966, *M. ?leucadendron*"; 2♂s "25 mi. S. Turkey Crk., W.A., 13 vii 1966"; 1♂ "King Leopold Ra., W.A., 19 vii 1966, *M. ?leucadendron*"; 2♂s "Lennard Riv., W.A., 20 vii 1966, *M. ?leucadendron*"; 1♂ "Yule Riv., W.A., 31 vii 1966"; 1♂ "Millstream Lagoon, W.A., 3 viii 1966. (from *M. argentea*) 2♂s "Cooinda, N.T., 23 vi 1966, *M. ?argentea*"; 1♂ "East Alligator Riv., N.T., 23 vi 1966, *M. ?argentea*"; 2♂s "Geikie Gorge, W.A., 15 vii 1966". (from *M. nervosa*) 1♂ "3 mi. E. Broome, W.A., 21 vii 1966". (host unknown) 1♂ "Tweed Riv., N.S.W., 25 xi 1922, W.W.F." (Froggatt); 2♂s "Toowoomba, Qld., 21 x 1963, H. M. Brookes", (to SI). (In alcohol): (from *M. quinquenervia*) 3♂s 6♀s "12 mi. W. Grafton, N.S.W., 10 iv 1966"; 1♂ 7♀s "2 mi. S. Tweed Hds., N.S.W., 11 iv 1966"; 1♀ "Redlands Bay, Qld., 13 iv 1966" 3♂s 6♀s "Toowoon Bay, N.S.W., 28 iv 1967"; 1♂ 2♀s "Umina, N.S.W., 12 vi 1967". (from *M. leucadendron*) 4♂s 13♀s "Cape Riv., Qld., 3 v 1966"; 3♀s "Mt. Surprise, Qld., 22 v 1966"; 1♂ 3♀s "Einasleigh Riv., Qld., 22 v 1966"; 2♀s "6.5 mi. S. Quamby, Qld., 30 v 1966"; 2♀s "0.5 mi. S. Howard Spgs., N.T., 3 vii 1966, *M. ?leucadendron*"; 2♀s "Rum Jungle, N.T., 4 vii 1966, *M. ?leucadendron*"; 3♂s 9♀s "Upper Victoria Riv. Crossing, N.T., 7 vii 1966, *M. ?leucadendron*"; 4♂s 11♀s "25 mi. S. Turkey Ck., W.A., 13 vii 1966"; 1♂ 8♀s "Mary Riv., W.A., 14 vii 1966, *M. ?leucadendron*"; 2♀s "King Leopold Ra., W.A., 19 vii 1966, *M. ?leucadendron*"; 18♂s 24♀s "Lennard Riv., W.A., 20 vii 1966, *M. ?leucadendron*"; 1♂ 5♀s "Yule Riv., W.A., 31 vii 1966"; 2♂s 10♀s "Millstream Lagoon, W.A., 3 viii 1966". (from *M. argentea*) 4♂s 6♀s "Cooinda, N.T., 23 vi 1966"; 2♂s 9♀s "Cooinda, N.T., 23 vi 1966, *M. ?argentea*"; 4♂s 8♀s "E. Alligator Riv., N.T., 23 vi 1966, *M. ?argentea*"; 1♂ 13♀s "Geikie Gorge, W.A., 15 vii 1966"; 8♂s 8♀s with same label data; 1♂ 1♀ with same label data. (from *M. nervosa*) 1♀ "Mary Riv., N.T., 25 vi 1966"; 2♀s "3 mi. E. Broome, W.A., 21 vii 1966"; 1♀ "15 mi. S. Darwin, N.T., 3 vii 1966, *M. ?nervosa*". (dried specimens) 5♂s 10♀s "Tweed Riv., N.S.W., 25 xi 1922, W. W. Froggatt, ti-tree wool"; 5♂s 11♀s "Toowoomba, Qld., 21 x 1963, H. M. Brookes", to SI; 1♀ "McArthur Riv., Gulf, N.T., 1 vi 1961—18 vii 1961, A. Fricker".
Notes: The following constant coloration serves to distinguish the species:- anterior and median femora narrowly edged black distally; a narrow longitudinal black line from distal edges of anterior femora to half

the length of each femur. Specimens from Umina, collected during winter (June) are more darkly marked than any others. Specimens from Lennard River, W.A., collected during July, are marked brown rather than black, and the colouring is less distinct. The claspers and aedeagi of males show specific stability, although there is slight variation in the number of dark spines on the claspers. This species occasionally produces some flocculence at the tips of some shoots. This is apparently referred to on specimens labelled by Froggatt, as "ti-tree wool". A forewing is illustrated in Text-fig. 137.

Glycaspis (*Boreioglycaspis*) *paludis*
Moore 1964, pp. 224-225, Text-fig. 16.

Claspers & Aedeagus: Not known.
Host Plant: *Melaleuca quinquenervia.*
Type Locality: Palm Beach, Qld.
Other Specimens Examined: (in alcohol) 1♀ "2 mi. S. Tweed Heads, N.S.W., 11 iv 1966, *M. quinquenervia*".
Notes: The species appears to be near *G.* (*B.*) *devicola*, sp. nov., and may be separated on the coloration of the forewings of ♀ specimens (Text-fig. 138).

Glycaspis (*Boreioglycaspis*) *devicola*, sp. nov.
(L. *devius* = lonely, out of the way; *-icola* = an inhabitant)

General Colour: Cream to orange with extensive dark markings.
Claspers & Aedeagus: As in Text-fig. 125.
Length of Aedeagus: (5 specimens) Distal: 0.065 mm. to 0.074 mm. Proximal: 0.133 mm. to 0.153 mm. Total Length, 0.205 mm. to 0.227 mm.
Host Plant: *Melaleuca viridiflora* Sol. ex Gaertn.
Type Locality: 17 mi. SW. East Alligator Riv. Crossing, N.T.
Types: Holotype male on slide labelled "17 mi. SW. E. Alligator Riv., N.T., 24 vi 1966, *M. ?viridiflora*". Paratypes: (slides) 2♂s with same label data; 1♂ "Hell's Gate, N.T., 19 vi 1966, *M. viridiflora*"; 1♂ "15 mi. S. Darwin, N.T., 3 vii 1966, *M. ?viridiflora*". (In alcohol) 1♀ "Mt. Surprise, Qld., 22 v 1966, *M. ?viridiflora*"; 4♂s 6♀s "Cooinda, N.T., 23 vi 1966, *M. viridiflora*"; 1♀ with same label data; 2♂s 3♀s "17 mi. SW. E. Alligator Riv., N.T., 24 vi 1966, *M. ?viridiflora*"; 2♂s 3♀s "0.5 mi. S. Howard Spgs., N.T., 3 vii 1966, *M. ?viridiflora*".
Notes: The more extensive dark coloration on the wing (Text-fig. 139), together with the host association, serve to separate this species from *G. paludis.*

Glycaspis (*Boreioglycaspis*) *denigrata*, sp. nov.
(L. *denigratus* = blackened)

General Colour: Yellow, with variable dark markings.
Claspers & Aedeagus: As in Text-fig. 126.
Length of Aedeagus: (2 specimens) Distal: 0.074 mm. to 0.117 mm. Proximal: 0.077 mm. to 0.119 mm. Total Length, 0.191 mm. to 0.196 mm.
Host Plant: *Melaleuca acacioides* F. Muell.
Type Locality: 33 mi. W. Croydon, Qld.
Types: Holotype male on slide labelled "33 mi. W. Croydon, Qld., 25 v 1966, *M. acacioides*". Paratypes: (slide) 1♂ with same label data. (in alcohol) 1♂ 16♀s with same label data.

Glycaspis (*Boreioglycaspis*) *devexa*, sp. nov.
(L. *devexus* = sloping. Referring to the genal processes)

General Colour: Orange to yellow, sometimes with faint dark marks.
Claspers & Aedeagus: As in Text-fig. 127.
Length of Aedeagus: (7 specimens) Distal: 0.072 mm. to 0.086 mm. Proximal: 0.128 mm. to 0.149 mm. Total Length, 0.200 mm. to 0.234 mm.
Host Plants: *Melaleuca leucadendron; M. cajuputi* Powell.

Type Locality: 6 mi. S. Quamby, Qld.
Types: Holotype male on slide labelled "6 mi. S. Quamby, Qld., 30 v 1966, *M. leucadendron*". Paratypes: (slides) 1♂ with same label data; 1♂ "Einasleigh Riv., Qld., 22 v 1966, *M. leucadendron*"; 2♂s "Mt. Surprise, Qld., 22 v 1966, *M. leucadendron*"; 2♂s "Warlock Ponds, N.T., 15 vi 1966, *M. cajuputi*". (in alcohol) 5♀s "Ellis Beach, Qld., 12 v 1966, *M. leucadendron*"; 8♀s "Mt. Surprise, Qld., 22 v 1966, *M. leucadendron*"; 2♀s "Einasleigh Riv., Qld., 22 v 1966, *M. leucadendron*"; 2♂s 11♀s "6 mi. S. Quamby, Qld., 30 v 1966, *M. leucadendron*"; 1♂ 13♀s "Warlock Ponds, N.T., 15 vi 1966, *M. cajuputi*"; 3♀s 1 nymph "Mataranka Spgs., N.T., 20 vi 1966, *M. cajuputi*".
Notes: Absence of black marks on the anterior and median femora, and the semi-vertical genal processes, serve to distinguish this species from *G. melaleucae*.

Glycaspis (*Boreioglycaspis*) *muminae*, sp. nov.

(*Mumina* = the Mother Goddess or Fertility Mother Cult practised by the Aborigines between the Roper River and the Victoria River, Northern Territory. The Goddess was regarded as causing natural species to appear).

General Colour: White and orange, strongly marked with brown to black.
Claspers & Aedeagus: As in Text-fig. 128.
Length of Aedeagus: (4 specimens) Distal: 0.074 mm. to 0.079 mm. Proximal: 0.122 mm. to 0.131 mm. Total Length, 0.198 mm. to 0.207 mm.
Host Plant: *Melaleuca viridiflora*.
Type Locality: 28 mi. N. Road Junction (Camooweal-Darwin) Nthn. Territory.
Types: Holotype male on slide labelled "28 mi. N. Road Jcn., N.T., 12 vi 1966, *M. viridiflora*". Paratypes: (slides) 1♂ 1♀ with same label data; 2♂s "Roper Valley HS., N.T., 19 vi 1966, *M. viridiflora*". (in alcohol) 1♂ 3♀s "79 mi. W. Croydon, Qld., 25 v 1966, *M. viridiflora*"; 1♂ 3♀s "32 mi. W. Soudan, N.T., 10 vi 1966, *M. viridiflora*"; 2♀s "Hell's Gate, N.T., (Roper Riv.), 19 vi 1966, *M. viridiflora*".

Glycaspis (*Boreioglycaspis*) *abudicola*, sp. nov.

(L. *ab-* = away from; *udus* = wet, moist; *-icola* = an inhabitant)

General Colour: Pale yellow to orange, lightly marked black, sometimes lightly suffused red.
Claspers & Aedeagus: As in Text-fig. 129.
Length of Aedeagus: (3 specimens) Distal: 0.086 mm. to 0.090 mm. Proximal: 0.131 mm. to 0.146 mm. Total Length, 0.221 mm. to 0.236 mm.
Host Plant: *Melaleuca nervosa*.
Type Locality: 30 mi. W. Duaringa, Qld.
Types: Holotype male on slide labelled "30 mi. W. Duaringa, Qld., 29 iv 1966, *M. nervosa*". Paratypes: (slides) 2♂s with same label data. (in alcohol) 2♀s "90 mi. N. Clermont, Qld., 2 v 1966, *M. nervosa*"; 2♂s "32 mi. SW. Mt. Garnet, Qld., 21 v 1966, *M. nervosa*"; 7♂s 14♀s "30 mi. W. Duaringa, Qld., 29 iv 1966, *M. nervosa*".
Notes: The genal processes of this species, and those of *G. muminae*, are more noticeably depressed (being vertical) than those of any other known *Glycaspis* species.

Glycaspis (*Boreioglycaspis*) *australiensis*

Moore 1964, pp. 225-6, Text-figs. 10, 11, 17.

General Colour: Cream to yellow, with brown to black markings. On female highland specimens, the dark coloration on the forewing forms a black transverse band, along the stem of M+Cu.
Claspers & Aedeagus: As in Text-fig. 130.
Length of Aedeagus: (3 specimens) Distal: 0.099 mm. to 0.104 mm. Proximal: 0.171 mm. to 0.191 mm. Total Length, 0.270 mm. to 0.293 mm.
Host Plant: *Tristania conferta* R.Br. (brush box)
Type Locality: Coolangatta, on the N.S.W.-Queensland border.

Types: Holotype female in BP; paratypes in BP and AM.
Specimens Examined: (slides) 3♂s "Mt. Archer summit, Rockhampton, Qld., 28 iv 1966, *T. conferta*". (in alcohol) 4♂s 15♀s and 1♂ genitalia, with same label data; 1♀ "Mt. Hypipame (crater edge), Qld., 9 v 1966, *T. conferta*". (dried) 1♂ "36 mi. W. Woodenbong, N.S.W., 30 ix 1954, K. L. Taylor".
Notes: No lerps or flocculence appear to be formed by this species. A forewing is illustrated in Text-fig. 140.

Glycaspis (*Boreioglycaspis*) *borneensis*
Moore 1964, p. 227, Text-fig. 19.

General Colour: Yellow.
Claspers & Aedeagus: Not known.
Host Plant: Not known.
Type Locality: North Borneo.
Types: Holotype female in BP.
Other Specimens Examined: 2♀s "British N. Borneo, Tenompok, 15 ii 1959, T. C. Maa, Collector, BISHOP", to OM.
Notes: The general coloration, and wing-shape and venation, suggest that these two specimens belong to this species, but until the males are studied there necessarily is some doubt. Forewing as in Text-fig. 141.

Glycaspis (*Boreioglycaspis*) *polymelasma*
Moore 1964, pp. 225-6, Text-fig. 18.

General Colour: Yellow and black.
Claspers & Aedeagus: Not known.
Host Plant: Not known.
Type Locality: North Borneo.
Types: Holotype female in BP.
Note: No further specimens were examined. Forewing as in Text-fig. 142.

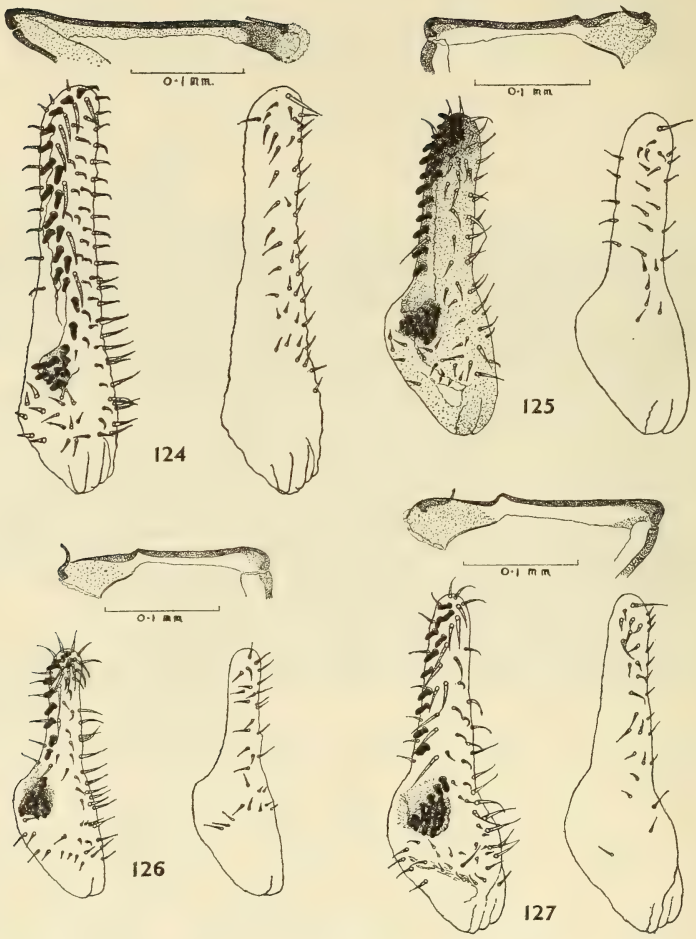
Glycaspis (*Boreioglycaspis*) *penangensis*
Moore 1964, p. 227, Text-figs. 20-22.

General Colour: Yellow.
Claspers & Aedeagus: Not known.
Host Plant: Not known.
Type Locality: Penang Island.
Types: Holotype female in BP.
Note: No further specimens were examined. Forewing as in Text-fig. 143.

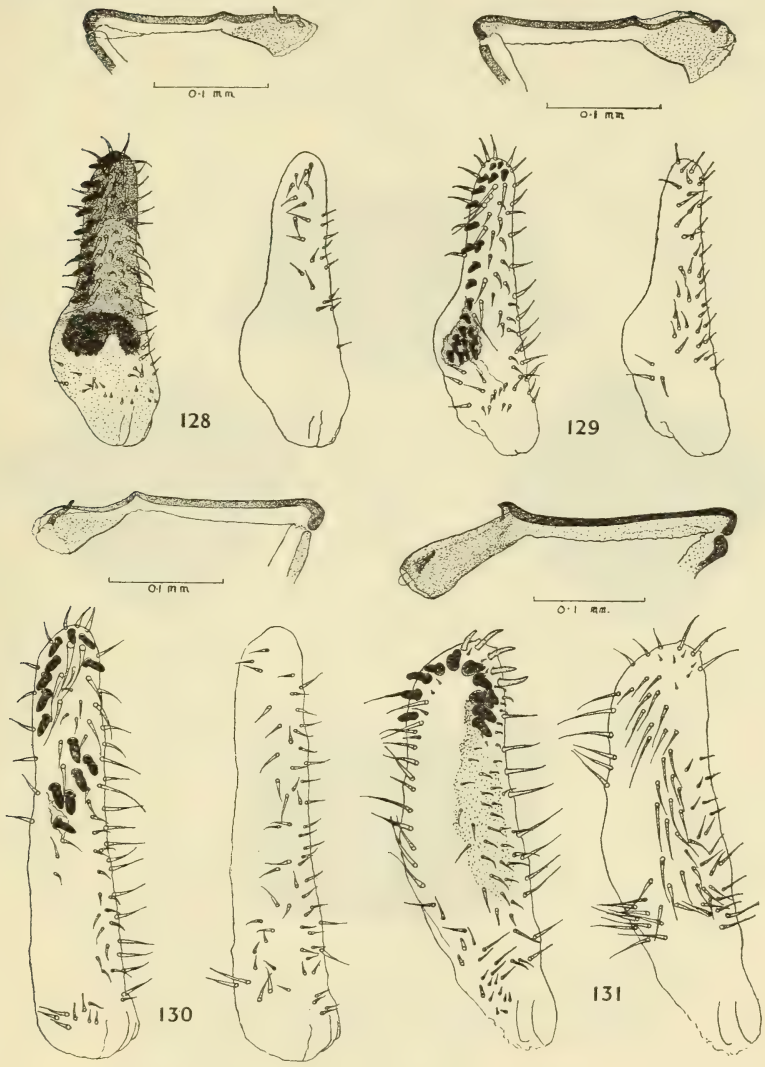
Glycaspis (*Boreioglycaspis*) *forcipata* (Crawford)

Epipsylla forcipata Crawford 1917, pp. 167-8, fig. 2.
Glycaspis (*Boreioglycaspis*) *forcipata*: Moore 1964, pp. 226-230. Text-figs. 13, 23, 24, 26.
General Colour: Yellow sometimes marked with brown.
Claspers & Aedeagus: As in Text-fig. 131.
Length of Aedeagus: (2 specimens) Total Lengths, 0.315 mm., 0.331 mm.
Host Plant: Not known.
Type Locality: Palawan Id., Philippine Is.
Types: Lectotype in UM, Paralectotypes in UM. Other specimens in BP, AM.
Notes: No further specimens were examined. Forewing as in Text-fig. 144.

Fig. 124. Claspers & aedeagus of *Glycaspis* (*Boreioglycaspis*) *melaleucae.*
Fig. 125. Claspers & aedeagus of *Glycaspis* (*Boreioglycaspis*) *devicola,* sp. nov.
Fig. 126. Claspers & aedeagus of *Glycaspis* (*Boreioglycaspis*) *denigrata,* sp. nov.
Fig. 127. Claspers & aedeagus of *Glycaspis* (*Boreioglycaspis*) *devexa,* sp. nov.
Fig. 128. Claspers & aedeagus of *Glycaspis* (*Boreioglycaspis*) *muminae,* sp. nov.
Fig. 129. Claspers & aedeagus of *Glycaspis* (*Boreioglycaspis*) *abudicola,* sp. nov.
Fig. 130. Claspers & aedeagus of *Glycaspis* (*Boreioglycaspis*) *australiensis.*
Fig. 131. Claspers & aedeagus of *Glycaspis* (*Boreioglycaspis*) *forcipata.*
Fig. 132. Colour pattern on Scutum of some ♀s of *Glycaspis* (*Glycaspis*) *retrusa,* sp. nov.
Fig. 133. Forewing of ♂ *Glycaspis* (*Glycaspis*) *flavilabris.*
Fig. 134. Forewing of ♂ of *Glycaspis* (*Glycaspis*) *egregia,* sp. nov.
Fig. 135. Forewing of ♂ of *Glycaspis* (*Glycaspis*) *felicitaris,* sp. nov.
Fig. 136. Forewing of *Glycaspis* (*Glycaspis*) *emphanes,* sp. nov.
Fig. 137. Forewing of *Glycaspis* (*Boreioglycaspis*) *melaleucae.*
Fig. 138. Forewing of ♀ of *Glycaspis* (*Boreioglycaspis*) *paludis.*
Fig. 139. Forewing of *Glycaspis* (*Boreioglycaspis*) *devicola,* sp. nov.
Fig. 140. Forewing of *Glycaspis* (*Boreioglycaspis*) *australiensis.*
Fig. 141. Forewing of *Glycaspis* (*Boreioglycaspis*) *borneensis.*
Fig. 142. Forewing of *Glycaspis* (*Boreioglycaspis*) *polymelasma.*
Fig. 143. Forewing of *Glycaspis* (*Boreioglycaspis*) *penangensis.*
Fig. 144. Forewing of *Glycaspis* (*Boreioglycaspis*) *forcipata.*



(For explanation of figures, see page 335)



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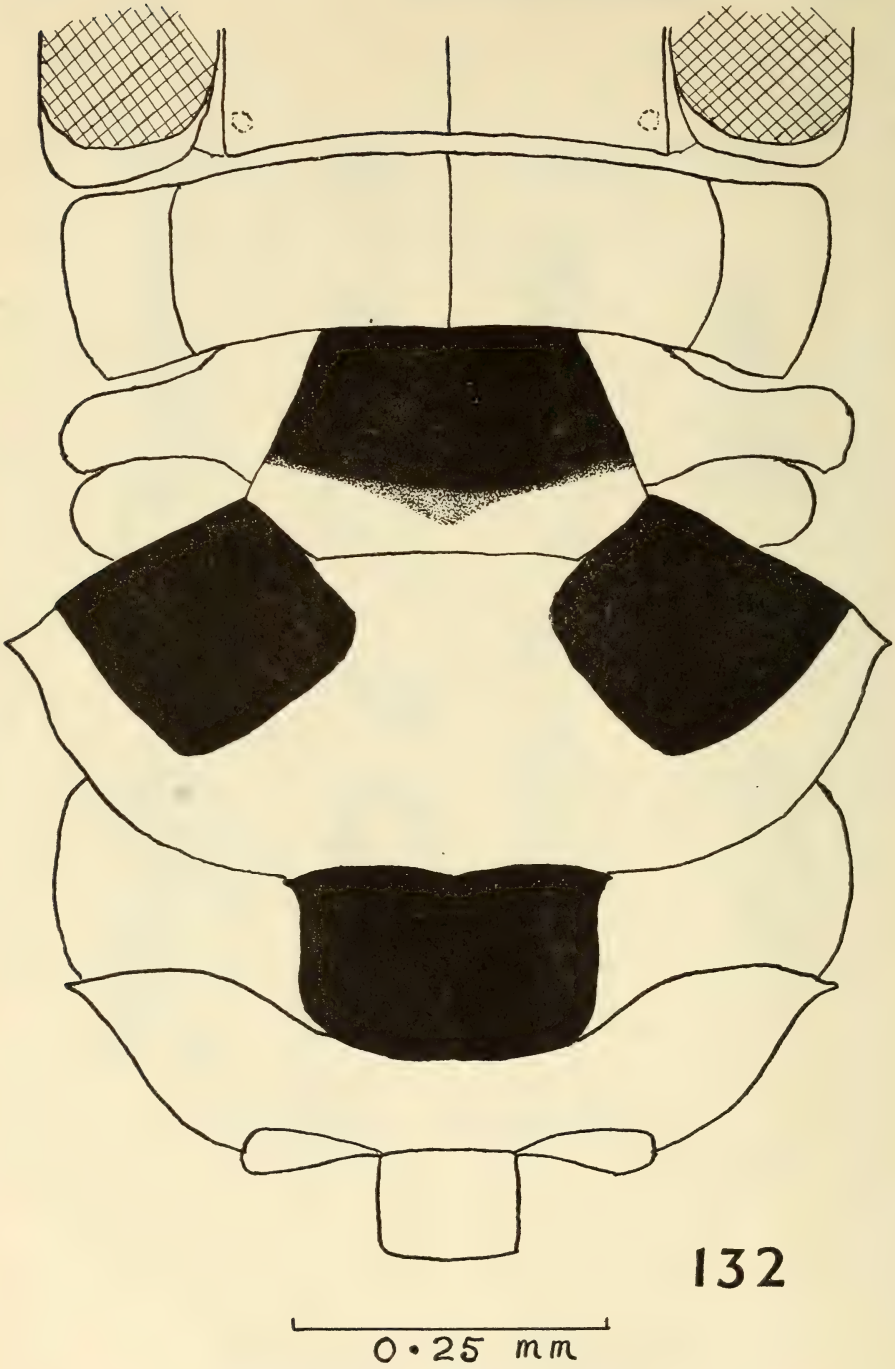

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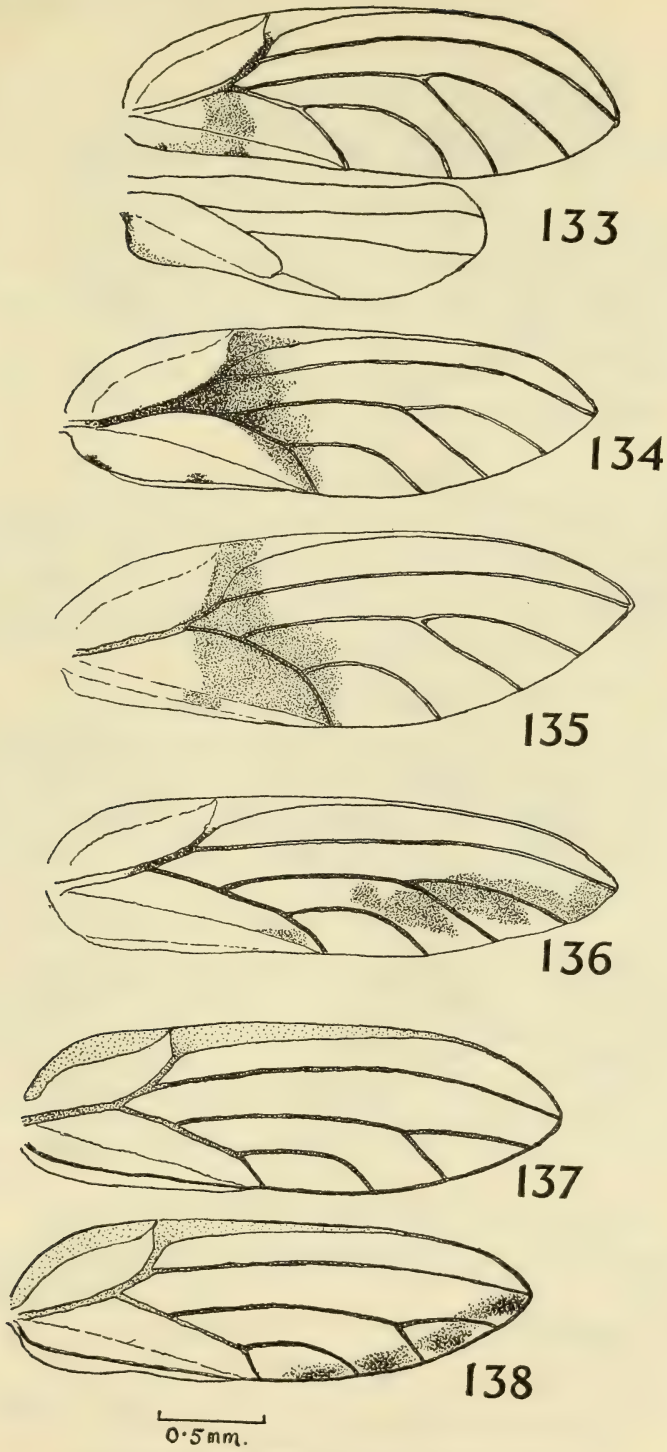

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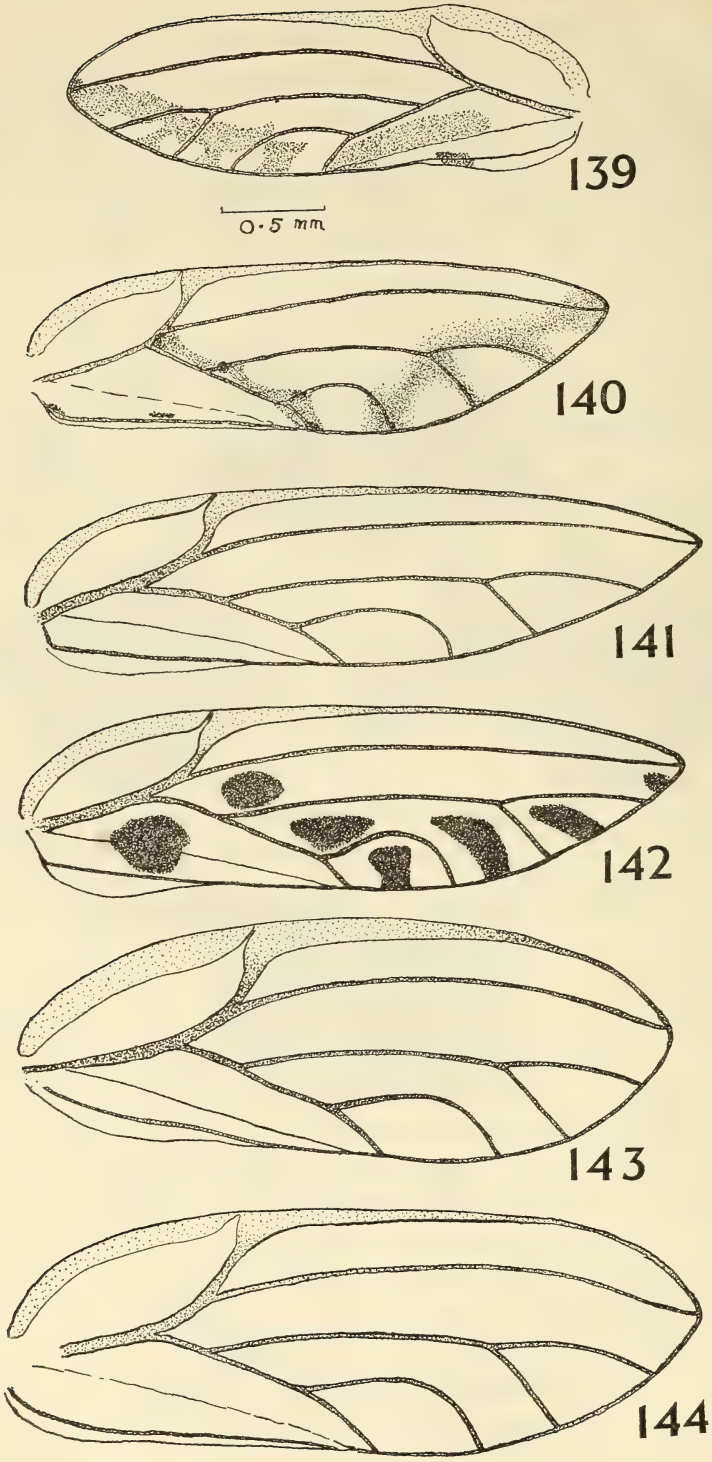

(For explanation of figures, see page 335)

LIST OF SYNONYMS

Subgenus *Alloglycaspis,* Moore 1961, = Subgenus *Glycaspis* Moore 1961.

Glycaspis (*Alloglycaspis*) *mirabilis,* Moore 1961, = *Glycaspis* (*Glycaspis*) *granulata* (Froggatt) 1901.

Glycaspis (*Alloglycaspis*) *ochros,* Moore 1964, = *Glycaspis* (*Glycaspis*) *mesicola* Moore 1964.

Glycaspis (*Alloglycaspis*) *convallaria,* Moore 1961, = *Glycaspis* (*Glycaspis*) *locaridensis* Moore 1961.

Glycaspis (*Alloglycaspis*) *vellerosa,* Moore 1961, = *Glycaspis* (*Glycaspis*) *mannifera* (Froggatt) 1900.

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OBSERVATIONS ON SOME AUSTRALIAN FOREST INSECTS

24. RESULTS FROM A STUDY OF THE GENUS *GLYCASPIS* (HOMOPTERA: PSYLLIDAE)

by K. M. MOORE
(Forestry Commission of New South Wales)

(Figures 1-9, maps 1-5, tables 1-3).

SUMMARY

As a sequence to the taxonomic Revision of the genus *Glycaspis,* results obtained from the Australia-wide survey are presented.

Information concerning lerp, the surplus excretion of *Glycaspis* nymphs, is reviewed.

Seasonal variation in coloration of species in this genus is recorded for the first time.

Known distribution, and host plants, of species in the three subgenera are given, together with an interpretation of their possible phylogeny.

The classification of some *Eucalyptus* spp. as presented by Blakely is now apparently unsatisfactory, as workers in many disciplines have contributed new information. The significance of the *Glycaspis* spp. host associations, of possible value in a re-examination of *Eucalyptus* spp., is discussed.

Entomological studies presenting evidence for the theory of continental drift, as it concerns Australia, are briefly discussed.

INTRODUCTION

An Australia-wide study of the genus *Glycaspis* was made during the period April, 1966, to March, 1967, and the route followed during this project is shown in Map 1.

The extent and constancy of the host associations of the various species were investigated, and information of possible value to a reappraisal of the classification of the genus *Eucalyptus* was sought.

The distribution of some of the more widespread species of *Glycaspis* is given in Maps 2 to 5.

The *Glycaspis* (*Glycaspis*) spp./Hosts/Distribution, in the sequence of the insect taxonomy, are given in Table 1; *Glycaspis* spp., and their host spp., are listed alphabetically in Tables 2 and 3 respectively.

Glycaspis spp. are now known to occur in each Australian State (including Kangaroo Id. and Tasmania), New Guinea, Penang Id., Borneo, and the Philippine Islands of Palawan and Balabac. A link between the Australian psyllid fauna and that of a different biogeographical region is thus now apparent, whereas Heslop-Harrison (1949) suggested that no such evidence was available at that time.

All species of the two more primitive *Glycaspis* subgenera occur on *Eucalyptus* spp., although certain eucalypt species are not utilised as hosts; and species of the most recent subgenus occur on *Tristania* and *Melaleuca* spp.

In Australia, some species have adapted to arid environments where rainfall may be less than 8 inches per annum, and other species to moist environments where rainfall may exceed 120 inches p.a. They occur from sea-level to above 4000' altitude, and in areas where the lower or higher extremes of temperature recorded in Australia are experienced.

Prior to 1961 seven species had been described, and information on the biology of those species was very limited, so that little was known concerning the host associations of *Glycaspis* species. The few hosts recorded with any certainty were:- *Eucalyptus* sp. by Dobson for *G. eucalypti; E. leucoxylon* by Schwarz for *G. eucalypti*(?); *E. coccifera* by Froggatt for *G. nigrocincta;* and *E. gomphocephala* by Solomon for *G. occidentalis.*

Subsequent biological studies (Moore 1961, 1961a, 1964, 1964a) provided additional knowledge concerning host associations and the degree of host specificity for some species, and results from this project provide further information on these aspects.

COLORATION

Results from this project have accentuated the unreliability of coloration as a means of differentiating between most *Glycaspis* species.

Seasonal variation in coloration in this genus was brought to the attention of the writer by Dr. T. C. R. White, of the University of Adelaide. Large numbers of specimens collected by him from *E. camaldulensis* in the Botanic Park, Adelaide, during the months of June and July, 1967, were all relatively dark; large numbers collected during January, 1968, were all very pale specimens; and specimens collected during September, 1967, showed either dark or pale coloration, with some intergradation between these two colour categories. On critical examination of the male claspers and aedeagi of the three populations, all specimens were determined as *G. brimblecombei*. Many other species of this genus have also provided indications that such seasonal colour variation is not unusual, although no variation occurred in *G. baileyi* and other species intensively studied for some years by the writer.

LERP AND ALLIED SUBSTANCES

The Aboriginal word "lerp" has been used by a number of writers to denote several different substances, particularly those white exudations associated with trees or insects, and which are sweet to the taste. The early settlers in Australia sometimes referred to these substances as "manna".

Bennett (1834) refers to a substance occurring on leaves, trunks and branches of trees, exuding in liquid form in minute drops, solidifying and falling to the ground, where a large quantity could be collected and eaten by the natives. He reports that the natives called this substance "cuningaban", and that they thought "manna" to be the excrement of cicadas. From the description given by Bennett, it is considered that the substance mentioned by him is not that currently referred to as "lerp", i.e. the numerous kinds and forms of excremental coverings of species of the insect family Psyllidae.

Anderson (1849) gives a concise account of a substance which the Aboriginals called lerp, produced by insects on the leaves of the mallee *Eucalyptus dumosa,* and collected during 1849 in the area between lat. 36°20' and 37°10'S., and long. 142°40' and 144°20'E. (i.e. approximately the south-eastern Wimmera District of Victoria, where *E. dumosa* certainly occurs). There appears to be no doubt that a psyllid species belonging to the genus *Glycaspis,* and almost certainly *G. pervagata,* constructed the "conical caps" referred to. This appears to be the first certain reference to lerp associated with the exudation of insects of the genus *Glycaspis.* Anderson's paper was again published in its entirety, immediately after the paper by Dobson (1851).

Dobson (1851) also determined the origin of lerp by establishing that the species *G. eucalypti,* which he briefly described, constructed its sweet covering, or lerp, from an excess of exudation while feeding on the leaves of a *Eucalyptus* sp. at Hobart, Tasmania. He also refers to two different kinds of lerp produced by another two species belonging to genera other than *Glycaspis.*

Bancroft (1869), Wooster (1879) and Tepper (1884) all refer in a general way to this substance or similar substances, as manna, melitose, lerp, honeydew, lac, and wax.

Dixon (1884) gives an abstract of Anderson's paper when referring to the composition and analysis of lerp.

Beveridge (1884) records his observations during the years 1845 and 1846 on "laarp" as a food of the Aborigines.

Schwarz (1898), referring to lerp, follows the interpretation of Anderson.

Froggatt (1900) refers to psyllid coverings as lerps, scales, lerp-scales, leaf-manna, angle sugar, and sugar lerp.

Heslop-Harrison (1949) comments on the analysis of lerp presented by Anderson, the production and forms of lerp, and its presumed survival value to the nymphs.

Moore (1961, 1961a) presented additional information on lerp.

Basden (1966), in a study of the chemistry of these substances, refers to the saccharine secretion from a number of trees of *Eucalyptus* spp. and *Angophora* spp. as manna, which is entirely different in composition from the sugary secretion of aphids, scales, lerps and other insects. He states that manna occurs only on the site of a wound inflicted by an insect. This appears to be the material referred to by Bennett. In another paper, Basden (1966a) refers to *Eurymela distincta* (Signoret) (Homoptera: Eurymelidae) as the "sugar lerp insect". He states that lerp and honeydew are the secretions of an insect which has ingested the phloem sap, extracted the elements it needs, and excreted the remainder with or without change in composition, and that lerp (presumably referring to the secretion of *E. distincta*) is almost completely soluble in water. Lerps of *Glycaspis* spp. are hygroscopic, and are not soluble in water when occurring under natural conditions in the field.

From the above references, Anderson is regarded as being the first to attribute the use of the word lerp to the Aborigines who used this word when they referred to the sweet coverings of *Glycaspis* species.

The application of the word "lerp" by entomologists is now widespread and consistent, so that its usage should be confined to the currently accepted interpretation denoting the various coverings constructed by those insect species of the family Psyllidae of the Homoptera. More appropriate names might then be applied to the varied exudations of numerous insect species belonging to other families, and of trees.

The shapes of lerps and the subgenera to which the species belong, indicate a lengthy evolutionary process in the formation of the genus *Glycaspis*.

Because of time limits during this project, it was not possible to determine the lerp shape associated with all of the species obtained, and the rearing of adults from discrete lerps was restricted, so that general indications given by the presence or absence of a particular lerp shape, had to be relied on when interpreting the phylogeny of some species.

An estimate of the approximate numbers of species associated with each lerp shape within the genus is:- galls 15; flat lerps 5; round lerps in *Synglycaspis* 16; round lerps in *Glycaspis* 55; oval lerps 16; rectangular lerps 5. There are also 12 species in the subgenus *Boreioglycaspis*, none of which construct lerps.

It has recently been reported that a lerp-forming psyllid species of the genus *Pachypsylla* occurs in Japan (Miyatake 1968), and that both galls and lerps are formed by this one species.

Capener (personal communication 1969) knows of only one lerp-forming psyllid in South Africa, i.e. *Arytaina mopani* Pettey.

INDICATIONS OF PARTHENOGENESIS

Biological studies to determine if parthenogenesis occurs within the genus apparently have not been made.

Indications that the females of some species of *Glycaspis* reproduce parthenogenetically, at least seasonally, were obtained during this project, for the males of some species either have not been obtained or have been most difficult to obtain, although intensive and extensive collections were made. These indications were most noticeable in the drier areas of the inland, and the relatively dry subtropical northern portion of the continent during winter.

PHYLOGENY OF THE GENUS *GLYCASPIS*

Various interpretations of the phylogeny of any biological group are no doubt possible when knowledge concerning the group is limited, as is the case concerning the genus *Glycaspis*.

The genus at present consists of the three subgenera *Synglycaspis*, *Glycaspis* and *Boreioglycaspis*, which indicate its evolutionary sequence. Specific characters which might be utilised as a basis on which their phylogeny could be interpreted assumed varying importance during this study and it was determined that all known characters need to be considered together.

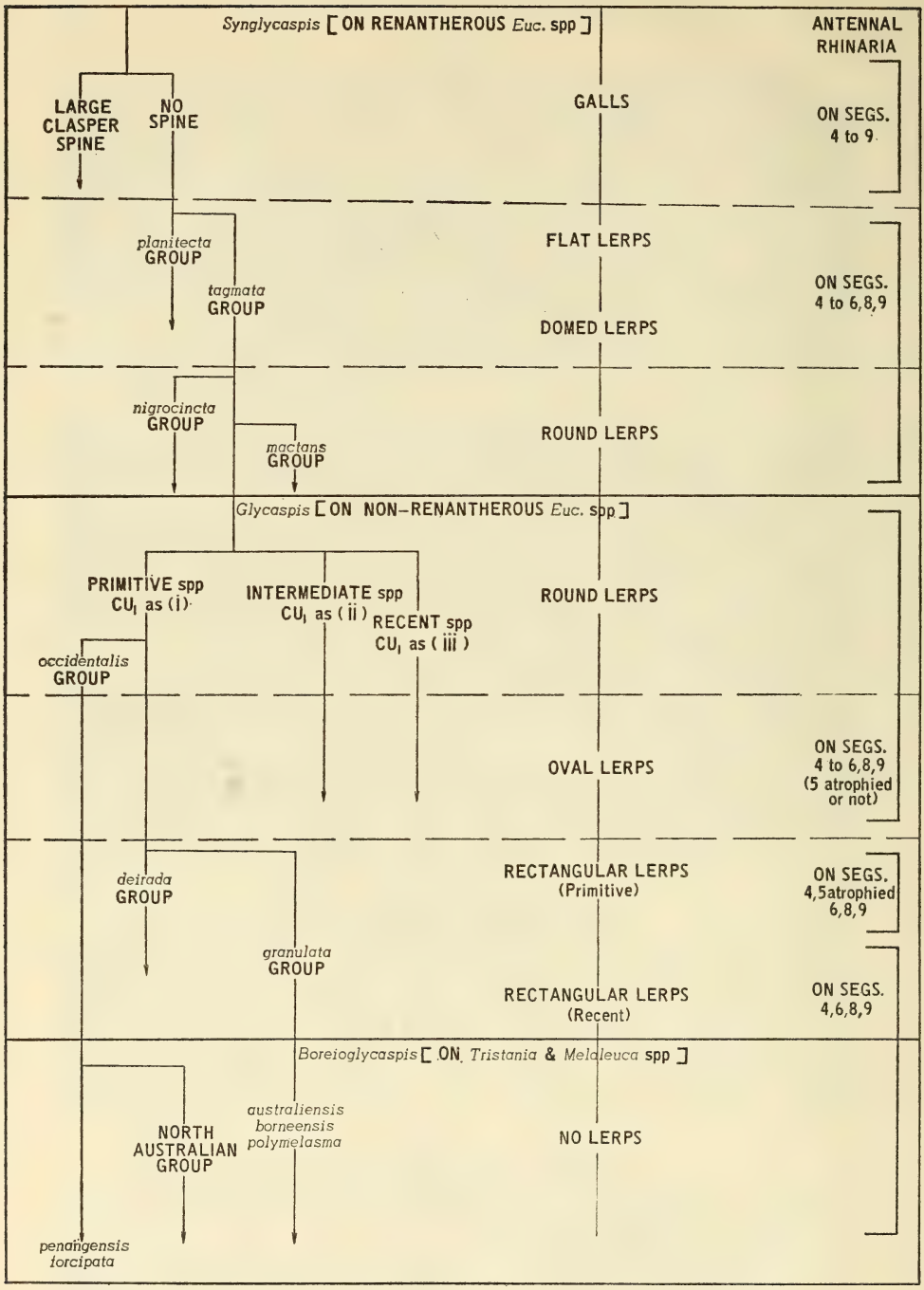

Figure 1. Presumed phylogeny of the genus *Glycaspis*.

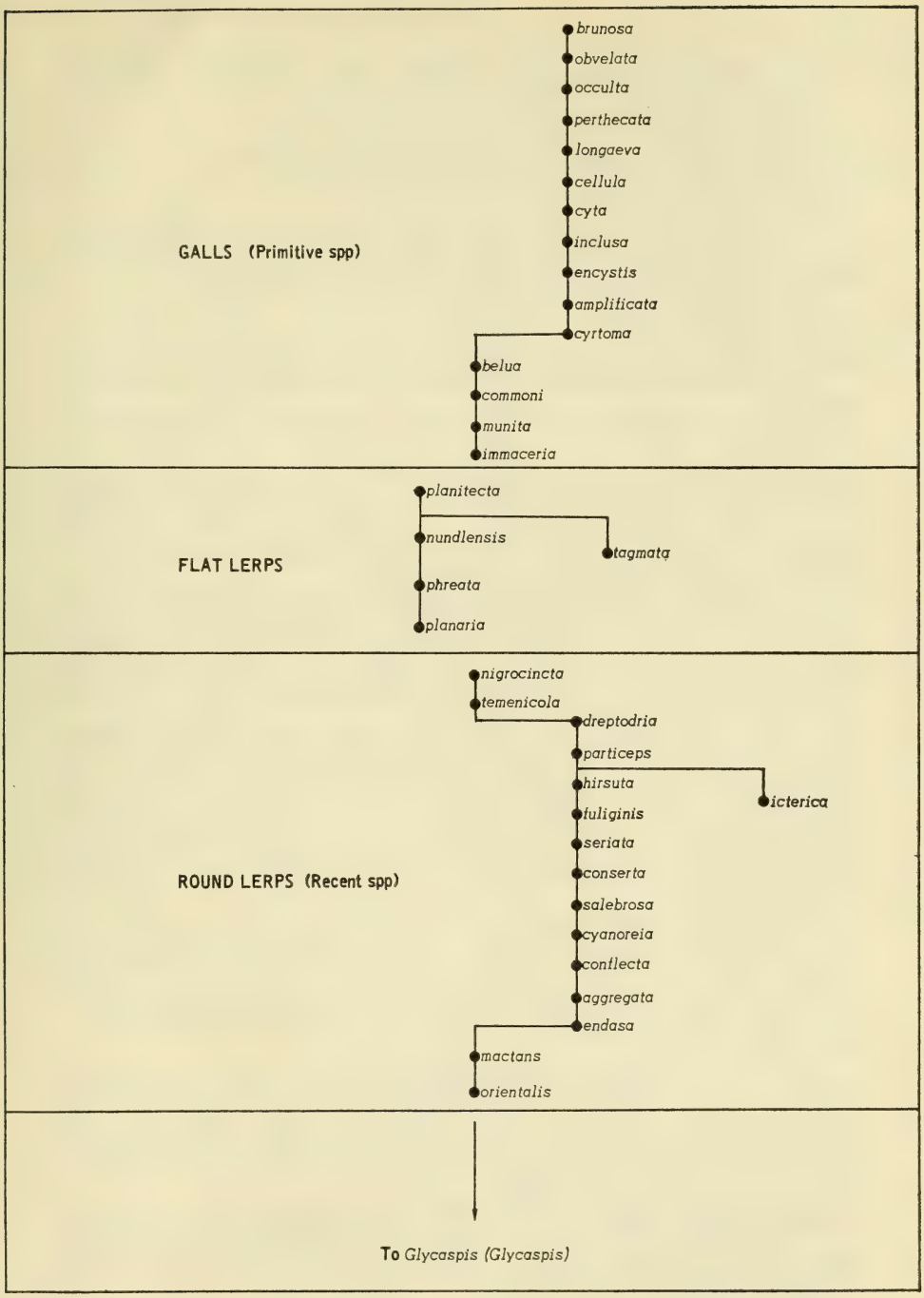

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Figure 2. Presumed phylogeny of the subgenus *Synglycaspis*.

The separation of the three subgenera, and the presumed phylogeny of the genus, are based on information pertaining to the following aspects:-

1. Nymph product (i.e. gall, lerp) and the lerp shape.
2. Antennal segments on which the rhinaria occur.
3. Morphological characters of the male aedeagi and claspers.
4. Length of M+Cu stem in the forewing venation.
5. Shape and length of vein Cu_1 of the hindwing.
6. Host associations.

It is assumed that most of the lerp shapes recorded, and the identifications given for the host species, are correct, but some inaccuracies no doubt have occurred in this extensive project concluded in a limited time.

The presumed phylogeny of the genus as a unit is presented in figure 1.

Glycaspis (*Synglycaspis*)

The stem of M+Cu in the forewing venation is always short, and the vein Cu_1 of the hindwing of all known species is as that shown in figure 4.

The presumed phylogeny of species in this subgenus is presented in figure 2.

Each species utilises as its host, one or more of the renantherous species of *Eucalyptus*.

The 36 species in this subgenus are considered to be the most primitive within the genus, and construct galls, flat lerps, and round lerps. The phylogeny of the species is indicated by these characteristics, the species forming galls being the most primitive group; those constructing flat lerps the intermediate group; and round lerp-forming species the most recent. The antennal rhinaria also indicate the relative antiquity of this subgenus.

The gall-forming species appear to be the group most readily separable into species on the adult male morphological characters, and on the presence or absence of a large basal spine on each of the male claspers they are separable into two subgroups. The most primitive species, with the largest basal spine on each clasper, are *G. brunosa, G. obvelata* and *G. occulta*. The most recent species, without large basal spines on the claspers, are *G. belua, G. commoni, G. munita* and *G. immaceria*.

Species constructing flat lerps are often separable only when some details of their biology are known. They possess the most homogeneous adult morphological characters of any group within the genus. At present, they are separable into two groups on the texture of their lerps. One group constructs lerps of fine texture which are in the same horizontal plane as the leaf surface, and cover the nymph in a relatively deep depression in the leaf; the other group constructs relatively coarse-textured lerps which rise above the leaf surface, to cover the nymphs which feed in a shallow depression in the leaf surface.

Species constructing round lerps are difficult to separate on the adult male morphological characters alone, but three subgroups, two of which exhibit evolutionary divergence based on characters of the male aedeagi and claspers, are evident. One divergent group consists of two species utilising *E. coccifera* and *E. linearis* respectively, as their host. The other group, also of two species, utilises *E. acmenioides* and *E. umbra* as their respective host.

Glycaspis (*Glycaspis*).

As with the species in *Synglycaspis,* lerp characteristics and the antennal rhinaria provide an indication of the phylogeny of those species which suggest a discrete line of evolution within this subgenus, i.e. species constructing round lerps are the most primitive and form a link with the species constructing round lerps in *Synglycaspis;* species constructing oval lerps are the intermediate group; and species constructing rectangular lerps are the most recent in a discrete line of evolution within the subgenus.

The presumed phylogeny of species in this subgenus is shown in figure 3.

Each species utilises one or more of the non-renantherous *Eucalyptus* spp. (excluding Series iv and v) as its host, while more than one *Glycaspis* species may utilise a *Eucalyptus* species which at present is considered to be a discrete species.

Species constructing round lerps in this subgenus showed intergradation in the length and shape of the vein Cu_1 of the hindwing, which necessitated

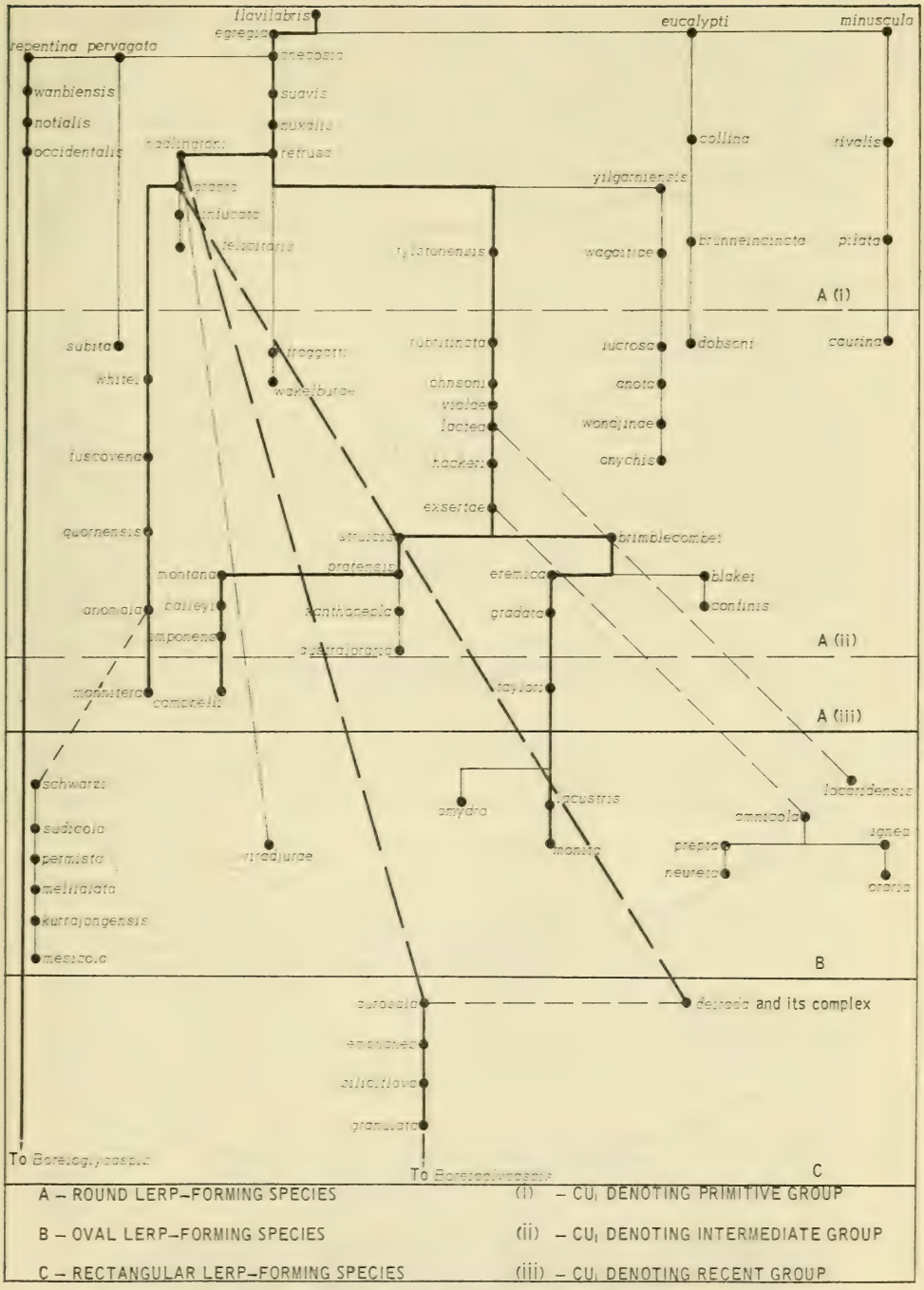

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Figure 3. Presumed phylogeny of the subgenus *Glycaspis*.

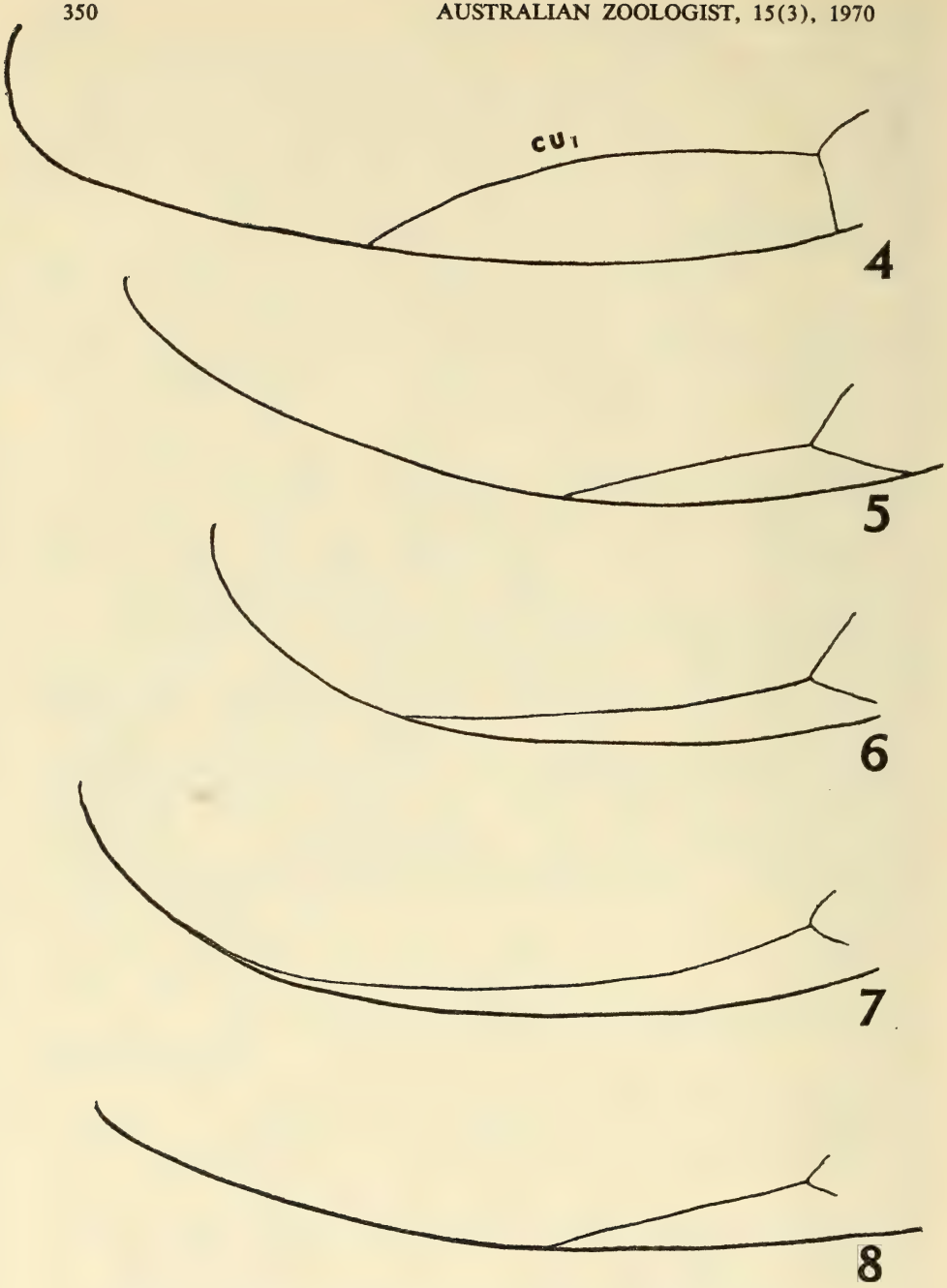


Figure 4. Shape of hindwing vein Cu_1, subgenus *Synglycaspis*.
Figure 5. Shape of hindwing vein Cu_1, subgenus *Glycaspis*, Group (i).
Figure 6. Shape of hindwing vein Cu_1, subgenus *Glycaspis*, Group (ii).
Figure 7. Shape of hindwing vein Cu_1, subgenus *Glycaspis*, Group (iii).
Figure 8. Shape of hindwing vein Cu_1, subgenus *Boreioglycaspis*.

the separation of species into three arbitrary groups based on the length and general shape of that character. Measurements were made along a straight line parallel with the long axis of the wing, and from the commencement of the vein at the cell base to its termination at the edge of the wing.

In Group (i), the shorter Cu_1 venation is similar to that in Text-figure 5 and may vary in length from 0.047 mm. to 0.115 mm. As the vein lengthens, it becomes similar to that of Group (ii) specimens (figure 6), and may vary in length from 0.115 mm. to 0.162 mm. Eventually, the vein assumes a shape similar to that of Group (iii) specimens (figure 7), and may vary in length from 0.162 mm. to 0.207 mm.

The shorter venation indicates the most primitive species, and the longer venation the more recent species.

The short stem of the veins M+Cu on the adult forewings of *G. flavilabris* which is considered to be the most primitive species in Group (i), appears to represent a link between the subgenera *Synglycaspis* and *Glycaspis,* and also indicates the close affinities of *G. flavilabris* with the species *G. eucalypti* and *G. minuscula.* These three species appear to represent evolutionary divergences within the subgenus *Glycaspis.*

The progressive lengthening of vein Cu_1 is also correlated with a progressive protrusion of the basal one-third, or "foot" portion, of the male claspers, so that species of more recent phylogeny possess the longer Cu_1 vein together with the more extended "foot" near the base of the claspers. These two characters provide the sequence adopted in the taxonomic paper.

Among the round lerp-forming species, those in Group (i) possess scimitar-shaped claspers; four species in Group (ii) possess that characteristic, and no species with claspers of that shape occur in Group (iii).

The subgenus *Glycaspis,* containing 79 species, is thus the most complex of the three subgenera. Prolific speciation and widespread dispersal have been characteristics of the subgenus, and speciation appears to be current in some species.

The *occidentalis* group of species (see Moore 1964, p. 151) bear scimitar-shaped claspers, and construct round lerps; vein Cu_1 of the hindwing is similar to that in figure 5, i.e. Group (i) of the round lerp-forming species of *Glycaspis* (*Glycaspis*).

It is thus evident that this group diverged at an early stage in the evolution of the subgenus *Glycaspis,* the morphology of the aedeagi and claspers suggesting that divergence was from the widespread southern species *G. pervagata.* Species provisionally included in the group are *buxalis, repentina, wanbiensis, notialis, occidentalis, wagaitjae, wakelburae,* and possibly *johnsoni, violae, hackeri* and *suavis.*

The species *G. johnsoni,* because of distinctive clasper shape, appears to have affinities with *G. violae, G. lactea* and *G. hackeri.* These species may represent further evolutionary divergence.

Indications of their phylogeny are considered to be fragmentary, because of the probable extinction of some *Glycaspis* spp. during evolutionary processes, or because some species of possible value to a more accurate interpretation of their phylogeny are not known. There is also the possibility of incorrect identification of a host plant, or incorrect interpretation of lerp shape.

The lerp shape of some species in Group (i) is not known, and it is possible that some may construct round to oval lerps. Those particular species would then provide a link with the more recent rectangular lerp-forming species which also possess scimitar-shaped claspers together with the short Cu_1 vein. *G. grapta* might well be a species from which rectangular lerp-forming species have originated.

The rhinaria on the antennae of the rectangular lerp-forming species, *G. aurosala, G. emphanes* and *G. deirada,* occur on segments 4, 5, 6, 8 and 9, with that on segment 5 atrophied, while rhinaria on other species also constructing rectangular lerps (*G. siliciflava* and *G. granulata,* the two most recent species in the subgenus), occur on segments 4, 6, 8 and 9.

There are thus two groups of *Glycaspis* spp. constructing rectangular lerps, with the latter group of more recent phylogeny than the former group. Common characters of species in both of these groups are the scimitar claspers and the shape of the vein Cu_1 of the hindwing.

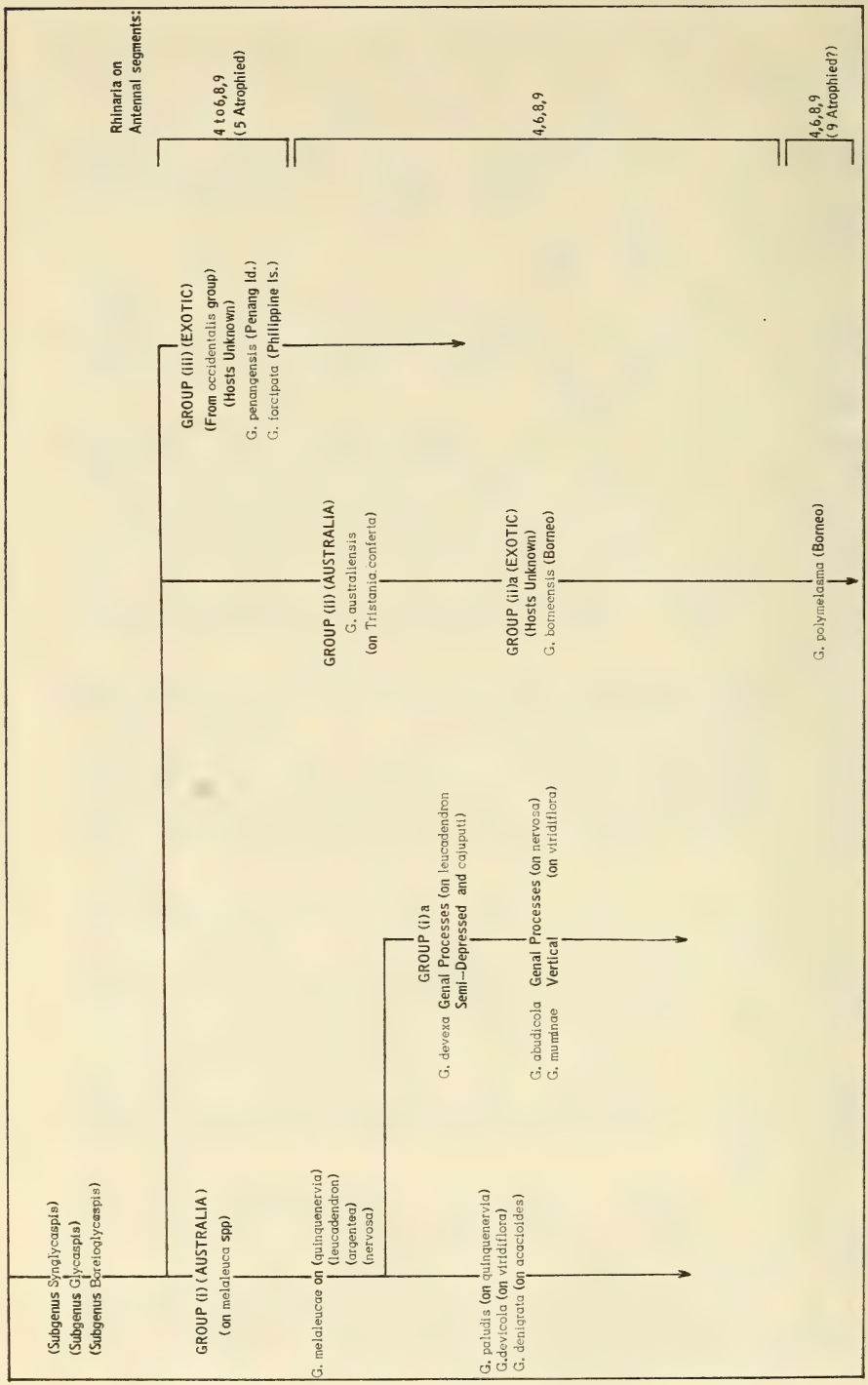
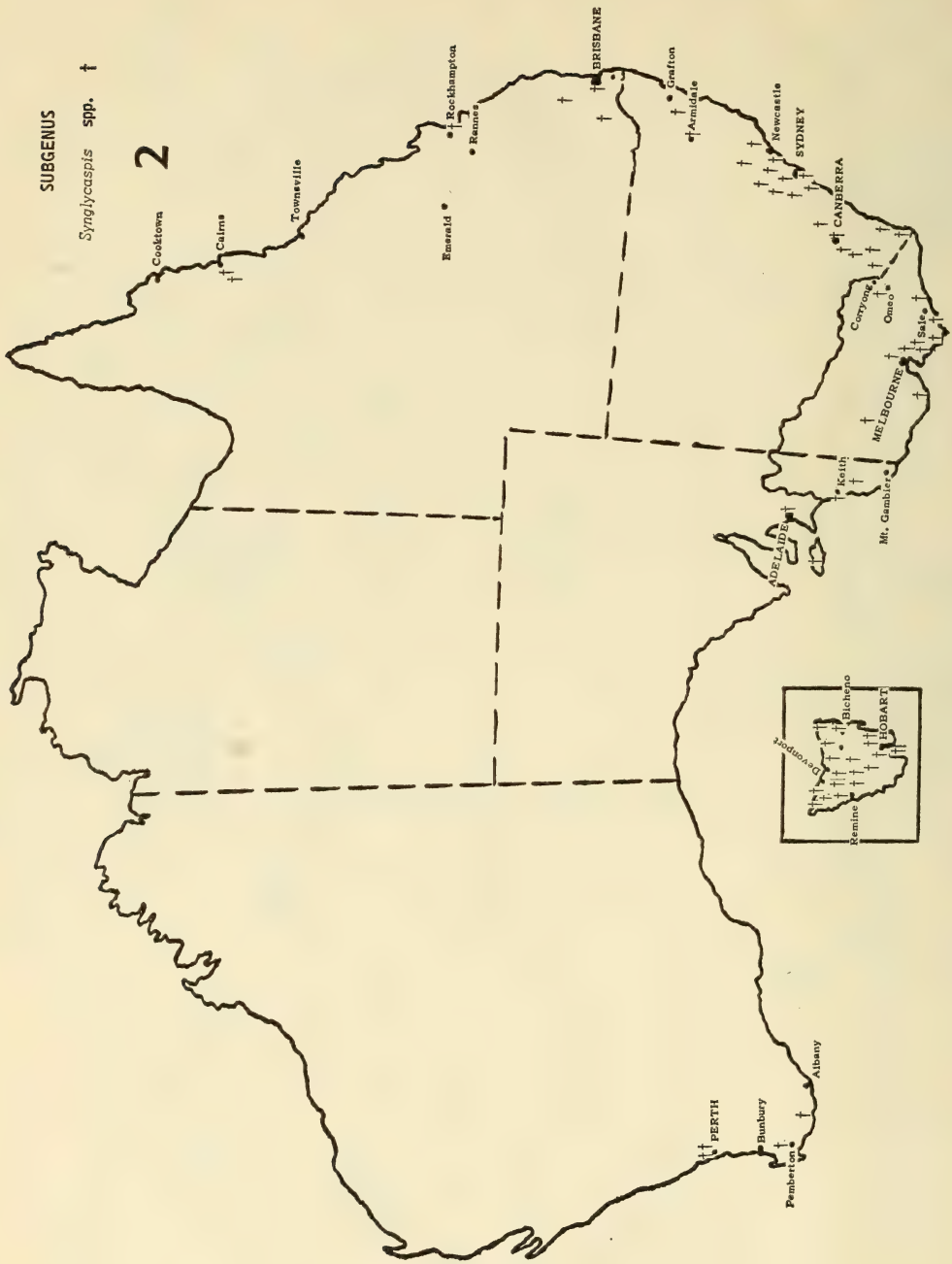
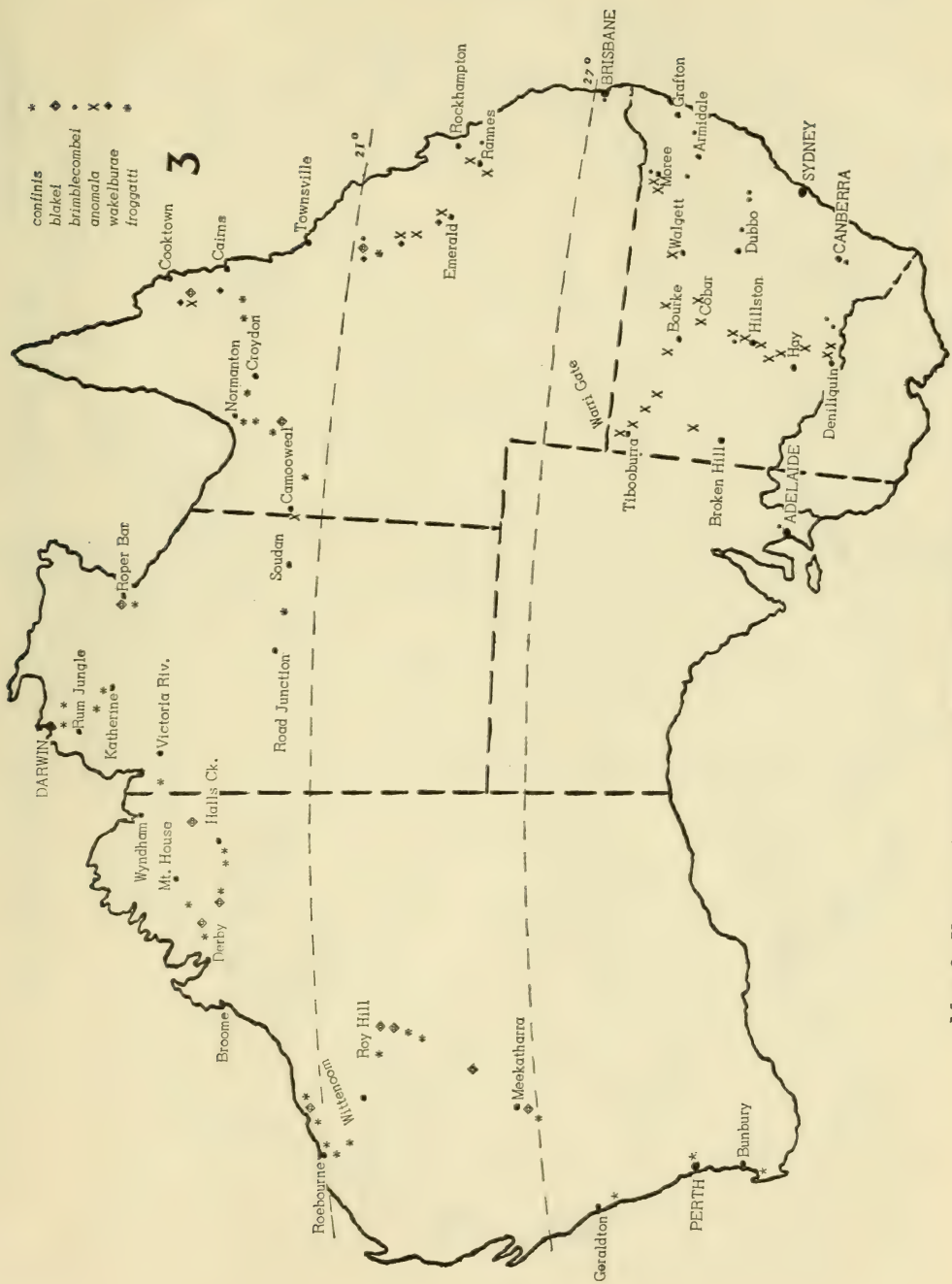


Figure 9. Presumed phylogeny of the subgenus *Boreioglycaspis*.

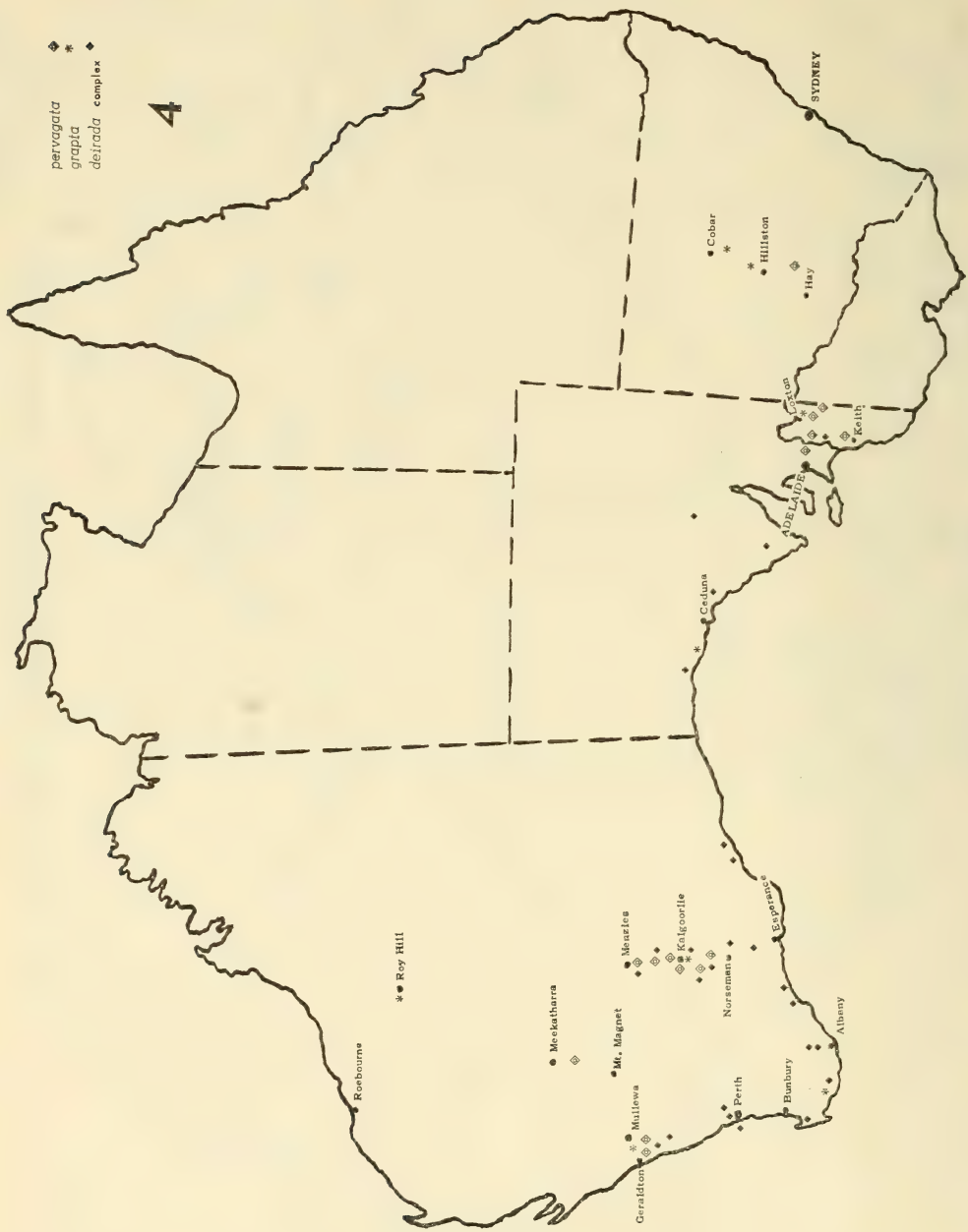
Map 1. Route followed during investigations on *Glycaspis* spp.



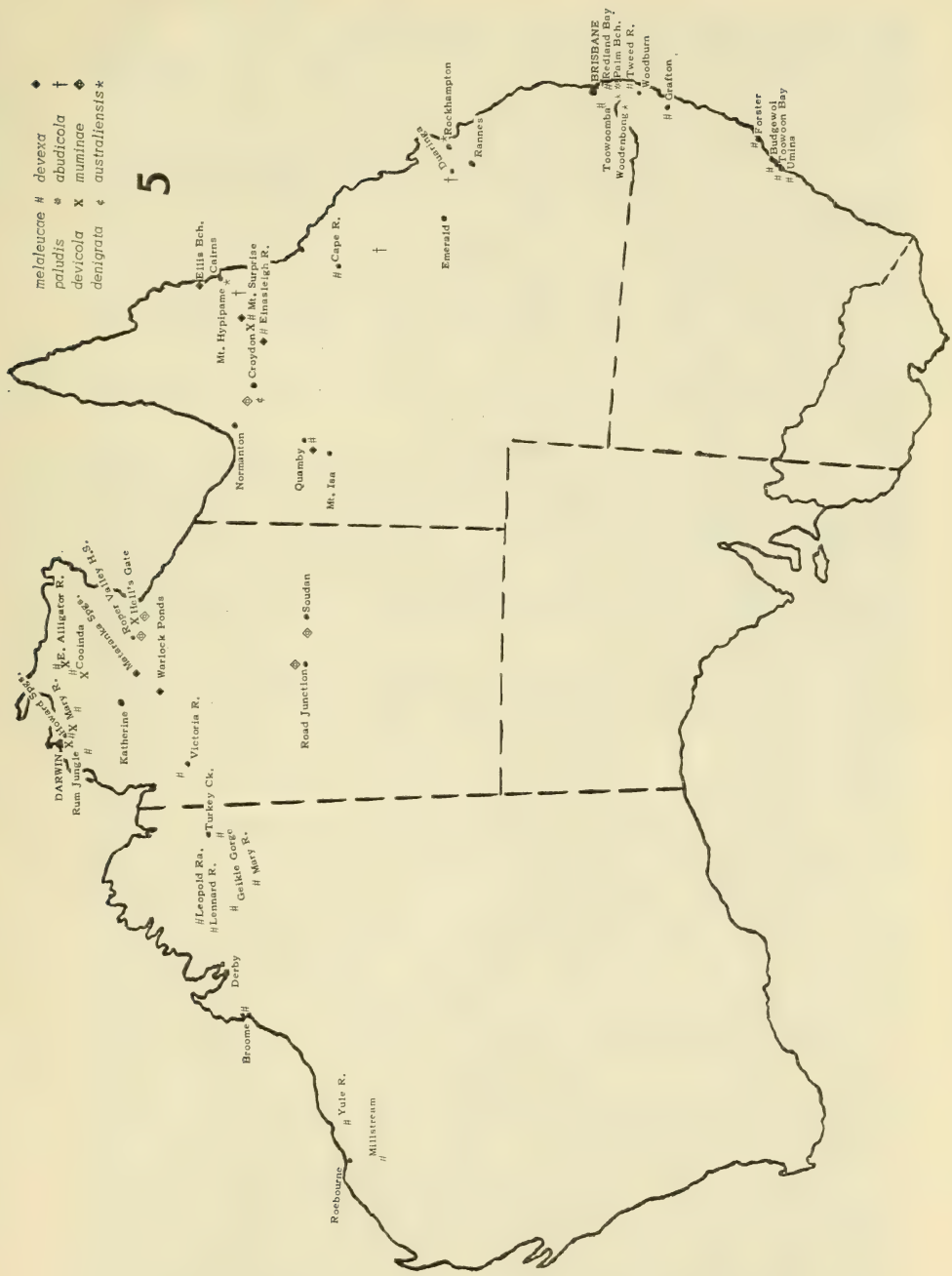
Map 2. Known distribution of species in the subgenus *Synglycaspis*.



Map 3. Known distribution of some species in the subgenus *Glycaspis*. (northern dispersal)



Map 4. Known distribution of some species in the subgenus *Glycaspis* (southern dispersal)



Map 5. Known distribution of some species in the subgenus *Boreioglycaspis*

It is indicated that some species forming rectangular lerps acquired that habit at an early stage in the evolution of the subgenus *Glycaspis*.

Glycaspis (*Boreioglycaspis*).

The shape of the hindwing vein Cu_1 on specimens in this subgenus approximates that shown in figure 8, and the length of the vein is relatively stable.

The presumed phylogeny of species in this subgenus is shown in figure 9.

There is no evidence that species in this subgenus form lerps or galls, although some species on *Melaleuca leucadendron* or *M. quinquenervia* at times produce a quantity of white flocculence among the young shoots of the host plant where they usually feed.

There appear to be five arbitrary groupings within the subgenus:- (a) the single species *australiensis* with closest affinity to the subgenus *Glycaspis;* (b) the *melaleucae* group, of species which have retained more or less prognathous genal processes; (c) one species with genal processes deflexed; (d) two species with vertical processes; (e) the two known exotic species *penangensis* and *forcipata* which, from the shape of the wing, appear to have diverged from the *occidentalis* group of species.

For a clearer understanding of the evolutionary sequence in the genus *Glycaspis,* more detailed studies are necessary.

DISTRIBUTION

Synglycaspis spp. predominate in Tasmania and in the south-east of the mainland, with a pattern of dispersal northwards through the relatively narrow coastal and tablelands region, with one species reaching at least to Cairns, in Queensland, and with an isolated population of one species in the south-western corner of Western Australia (Map 2). No specimens of this subgenus were collected on the mainland between Adelaide, in South Australia, and Deep River, in Western Australia, although they were obtained from Kangaroo Island, in South Australia. Five of the six most primitive gall-forming species occur in Tasmania.

Such a distribution pattern, and concentration of numbers of species, together with the presence of 5 of the six most primitive gall-formers in Tasmania, might indicate that the subgenus originated in Tasmania and spread northwards and westwards after reaching the mainland. The single Western Australian species appears to have reached that State prior to the onset of aridity which now divides the southern half of the continent, and which severely restricts, or possibly prohibits, the natural dispersal of biological units from the east to the west across southern Australia.

No species of *Synglycaspis* constructing galls or flat lerps were obtained from Western Australia, and only three species of the subgenus *Glycaspis* have been collected in Tasmania.

In the subgenus *Glycaspis,* more or less continuous distribution patterns over wide areas are apparent for a number of species, i.e. a southern dispersal from N.S.W. to Western Australia for *G. pervagata* (see Map 4), and a northern dispersal from Queensland to Western Australia for *G. froggatti* and *G. blakei* (see Map 3), although some species appear to be very localised (i.e. *G. cnecosia, G. caurina,* etc.) or may be confined to widely separated areas where their host occurs (i.e. *G. lucrosa, G. anota,* etc.).

The three most primitive species, *G. flavilabris, G. eucalypti* and *G. minuscula,* occur from Rylstone in N.S.W. to Hobart in Tasmania, and this appears to represent the earliest dispersal of species in the subgenus. On present knowledge, their general distributions are:- from Rylstone to Canberra (*G. flavilabris*), from Kiandra to Hobart (*G. eucalypti*) and from Goulburn to Melbourne (*G. minuscula*).

A second apparent dispersal, by species of close affinities with the three abovementioned species, seems to have been northwards from the Rylstone-Canberra area, to the Brisbane-Calliope area in Queensland, and across the north of the continent to Port Hedland, in Western Australia (*G. suavis, G. buxalis*).

A third apparent dispersal, perhaps during the same time-period as the second, seems to have been across the south of the continent from central N.S.W. to Roy Hill in Western Australia (*G. pervagata, G. grapta,* Map 4).

After considerable speciation in the area between Adelaide and Rylstone (*rivalis, pilata, whitei, fuscovena*), a proliferation of species whose origins appear to have been in the northern areas of the continent seems to have occurred (*wagaitjae, lucrosa, anota, wondjinae, onychis* and *froggatti*), with their dispersal in both easterly and westerly directions across the north. The western dispersal (*G. froggatti*) reached Western Australia and thence southwards, to intermingle with a species of the third dispersal (*G. pervagata*) which had moved northwards in Western Australia to Nannine, where both *froggatti* and *pervagata* occur together on *E. striaticalyx*.

Speciation and dispersal of the species *blakei, eremica, gradata* and *brimblecombei,* which are of close affinities, and *xanthopepla, pratensis, australoraria* and *struicis* then appear to have occurred in the north and east of the continent.

G. blakei seems to have originated in the northern areas of the continent, dispersing west and south to Meekatharra in Western Australia, and east and south to the Clermont area in Queensland. From the Clermont area, *G. brimblecombei* on *E. camaldulensis* and other species, appears to have evolved from *G. blakei* and dispersed southwards to the Adelaide area in South Australia. Near Perth, Western Australia, *G. confinis* also appears to have evolved from *G. blakei* and dispersed southwards to the Albany area. Further speciation then seems to have occurred in the general area between Rockhampton-Clermont in Queensland, to Adelaide in South Australia, and more recently in the eastern coastal and tableland regions of southern Queensland to southern New South Wales (*montana, baileyi, imponens, campbelli*).

By this time, the oval lerp-forming species appear to have evolved. They have only been collected within the general area Clermont in Queensland to Quorn in South Australia.

Rectangular lerp-forming species appear to have originated, and attained their most recent stage of evolution, in the eastern areas, and show a relatively early dispersal in two directions, both northwards to the Clermont area and westwards across the south of the continent to the southern areas of Western Australia.

No species constructing rectangular lerps have been obtained from Tasmania, Victoria or the Northern Territory, although it is likely that some occur at least in Victoria.

The more recent rectangular lerp-forming species *G. siliciflava* and *G. granulata* have a known distribution from Sussex Inlet (near Nowra, N.S.W.), to Mt. Spec (near Cairns, Queensland). It is in this area that the more primitive species of *Boreioglycaspis* appear to have evolved. *G. australiensis* with closest affinities to the subgenus *Glycaspis,* occurs on *Tristania conferta;* and *G. melaleucae* occurs on four *Melaleuca* species. The known distribution of the former species is confined to the Queensland-N.S.W. border area and northwards to Cairns; the latter species shows a continuous distribution from the Hawkesbury River (30 mi. N. Sydney) northwards through the coastal areas and across the continent to near Roebourne, Western Australia (see Map 5). Further speciation in *Boreioglycaspis* occurred on various *Melaleuca* spp. which are distributed across northern Australia.

Extensive collecting in Papua-New Guinea, and throughout the Indonesian chain of islands to the west, should indicate the route of dispersal of *Boreioglycaspis* spp. from Australia to Borneo and the Philippine Islands.

HOST ASSOCIATIONS

Until recent years, records of insect/host associations in Australian entomology had been neglected or almost non-existent, so that the record of host associations of this discrete genus appears to be unique.

During previous investigations on the *Glycaspis* spp. host associations (Moore 1961) when little was known concerning this aspect, it was considered that a very restricted, or even discrete, host association was usual for most of the species. More recent extensive collecting has shown an increased number of hosts for some discrete *Glycaspis* species, and it appears that most species will eventually be found to occur on more than one host plant species when their associations are better known.

Species/Host associations, are presented alphabetically in Tables 2 and 3 respectively.

Some species are widely distributed, while others are of local distribution (see Table 1); the former species usually are associated with a number of host species, while the latter appear to be more or less host specific.

As *Glycaspis* spp. ingest the sap of their host plants it appears that certain available chemical compounds in their food would be critical to the survival, or mortality, of certain species or groups of species on certain hosts. Some of the widely distributed species are apparently more tolerant to a greater range of chemical components (evident from their more numerous host associations), and the localised species less tolerant (evident from their relative host specificity).

During this study it was found that the *Glycaspis* sp. obtained from a certain host has reliably indicated the host plant species or a species of affinities with it, e.g. *G. baileyi* from *saligna, resinifera* and *robusta; G. whitei* from *polyanthemos* and *fasciculosa;* etc.

In contradistinction to those examples, there are also a number of discrete *Glycaspis* species utilising a single widespread host species, e.g. *G. brimblecombei, G. blakei, G. eremica* and *G. gradata* all utilising *E. camaldulensis* as their host.

Limited feeding trials with nymphs of *G. baileyi* on *Angophora floribunda* and *E. acmenioides* showed that they apparently could not survive on these species (Moore 1961).

The completion of the life-cycle of *G. baileyi* on *E. camaldulensis* (its normal host is *E. saligna*) suggests a similarity between the chemical composition of the leaves of both these eucalypt species. However, the *E. camaldulensis* plants were grown in an area atypical of their natural habitat and in an area where *E. saligna* occurs naturally, so that possibly the chemical composition of the plant might also have been atypical, by virtue of its altered environment.

Glycaspis spp. have now been obtained from approximately 133 *Eucalyptus* spp.; an additional 45 eucalypt species were sampled, but no *Glycaspis* spp. were obtained; thus about 180 *Eucalyptus* spp. have been sampled for *Glycaspis* spp. during, and prior to, this project.

No *Glycaspis* spp. were obtained from the following eucalypt species, and the extent of collecting is indicated by the following suffix letters:- E = extensive (several areas); M = moderate (few areas); R = restricted (one or two areas). The prefix numbers in parentheses are those of the relevant species in Blakely's "Key" (1955).

(1)	*erythrocorys*	R	(29)	*foelscheana*	M	(296)	*pachyloma*	R
(2)	*tetragona*	E	(32)	*calophylla*	M	(298)	*todtiana*	R
(3)	*eudesmioides*	M	(36)	*ficifolia*	R	(299)	*patens*	R
(5)	*ebbanoensis*	R	(42)	*terminalis*	E	(301)	*buprestium*	R
(6)	*odontocarpa*	M	(43)	*cliftoniana*	R	(305)	*guilfoylei*	R
(12)	*baileyana*	R	(45)	*gummifera*	E	(314)	*microcorys*	E
(16)	*tessellaris*	M	(50)	*eximia*	M	(447)	*decipiens*	M
(17)	*papuana*	M	(53)	*citriodora*	R	(449)	*lansdowneana*	R
(18)	*grandifolia*	M	(54)	*maculata*	E	(525)	*pruinosa*	E
(19)	*clavigera*	E	(85)	*cosmophylla*	R	(567)	*cneorifolia*	E
(19a)	*confertiflora*	E	(94)	*grossa*	R	(568)	*micranthera*	M
(20)	*gilbertensis*	R	(108)	*macrandra*	R	(599)	*macrocarpa*	M
(21)	*aspera*	E	(158)	*goniantha*	R	(600)	*pyriformis*	R
(22)	*setosa*	R	(168)	*falcata*	R	(602)	*pachyphylla*	M
(26)	*dichromophloia*	E	(171)	*erythronema*	R	(605)	*kingsmillii*	R
			(247)	*megacarpa*	R			

DISCUSSION ON THE SIGNIFICANCE OF *GLYCASPIS* SPP. HOST ASSOCIATIONS

Although this project is primarily an entomological investigation, it is considered that the host associations of some *Glycaspis* spp. studied might provide information of value in any reassessment of the phylogeny of the genus *Eucalyptus.*

Some aspects of Blakely's classification of *Eucalyptus* spp. are apparently unsatisfactory because of more recent information presented by workers in various disciplines. Blake (1953) studied Northern Australian species; Ingle

& Dadswell (1953) examined the anatomy of wood; Chattaway (1955) utilised the anatomy of bark; Pryor (1959) studied the evolution of the genus; Gauba & Pryor (1958, 1959, 1961) utilised seed-coat anatomy; Carr & Carr (1962, 1962a) used vegetative and floristic characters; Johnston & Marryatt (1965) listed previously published corrections to the classification of the genus; Hillis (1966, 1967, 1967a) examined the relationships of the polyphenolic composition of the leaves, and Banks & Hillis (1969) intensively investigated the polyphenols in leaves of *E. camaldulensis* throughout its range. Pryor & Byrne (1969) studied patterns of variation in *E. camaldulensis.*

The following information is presented with the knowledge that an insect/host association does not necessarily indicate the phylogeny of the host-plant group, but when the insect/host associations of the single genus *Glycaspis* are considered, it then appears that certain limited indications of the eucalypt phylogeny, based on those associations, might be of value.

In this discussion, certain information concerning the phylogeny of the *Glycaspis* spp. is recorded, and by correlation of this information with their host associations, some additional knowledge concerning the phylogeny of the eucalypt group might be indicated.

There seems to be no evidence which suggests a particular period in time at which the inception of the genus *Glycaspis* occurred in Australia, nor any information as to the evolutionary development attained by the genus *Eucalyptus* by that time.

It has been suggested that evolutionary divergence within the genus *Glycaspis* at the subgeneric level, might indicate evolutionary divergence within the genus *Eucalyptus* (Moore 1961), and the numerous host associations determined during this project have supported this suggestion.

From a study of the evolutionary relationships of butterflies and their food plants, Ehrlich & Raven (1965) obtained little information useful for the reconstruction of phylogenies. They proposed a comparable pattern of adaptive radiation for each of the limited groups of butterflies studied, and concluded that secondary plant substances play the leading role in determining patterns of utilisation by the various groups. It appears that *Glycaspis* spp. also follow a similar general pattern of evolutionary relationships with their food plants, with a pattern of adaptive radiation evident in some groups.

The possibility of incorrect identifications of some hosts, or misinterpretations of lerp shape of some *Glycaspis* spp. during this project is again emphasised here. Detailed collection localities for the *Glycaspis* spp. are given in the taxonomic paper.

The following discussion is based categorically on Blakely's Series groups in the genus *Eucalyptus;* figures in parentheses refer to his species numbers.

Series iv & v. Corymbosae (& *Clavigerae* of Blake).

It is of interest to find that no *Glycaspis* spp. have been correlated with any of the eucalypts in these Series, species numbers (16) to (55) inclusive. Of the 18 *Eucalyptus* spp. investigated, seven were sampled extensively, six moderately and five restrictedly.

The absence of *Glycaspis* spp. may indicate that the chemical components of the leaves are not suitable for the survival of *Glycaspis* spp., and that this eucalypt group may represent an evolutionary divergence within the genus. On the negative evidence of the consistent absence of *Glycaspis* spp. from either this eucalypt group or the genus *Angophora,* it is suggested that there may be affinities between these two groups. These indications are in accord with those of Gauba & Pryor (1961), and with Ingle & Dadswell (1953) who record that "Timbers of the Corymbosae Non Peltatae and Corymbosae Peltatae are very similar to those of the genus *Angophora,* and anatomically it is difficult to distinguish between them".

Species of the psyllid genus *Eucalyptolyma* consistently utilise a number of *Angophora* and corymbose eucalypt species as well as other eucalypt species as their hosts, and a study of these psyllid associations may provide information relevant to the phylogeny of the eucalypt and *Angophora* groups.

Series xxiii-xxxiv, Renantheroideae, Renantherae, Renantherae (Normales).

It appears to be of some importance that species of the most primitive subgenus *Synglycaspis* utilise as their hosts only those species of *Eucalyptus*

contained in these Series (with the possible exception of *E. rodwayi*), and apparently are unable to survive on non-renantherous species. It is from these host associations of *Glycaspis* spp. at the subgeneric levels that an evolutionary divergence of the renantherous eucalypt group is indicated. Gauba & Pryor (1958) suggest that the combined group Renantherae and Renantherae-Normales might well be constituted a subgenus.

The comparative morphology, phylogeny and host associations of *Glycaspis* spp. in the subgenera *Synglycaspis* and *Glycaspis,* also suggest that the renantherous eucalypt species might be a more primitive group than those non-renantherous species known to be hosts of species in the subgenus *Glycaspis.*

It appears that a number of indications of host phylogenies, based on the *Glycaspis* spp. occurrences, at the specific level, are unsubstantiated by botanical evidence, but it should be remembered that a number of the hosts are of uncertain identification, and more detailed collections and identifications are necessary.

At the same time, the morphology of the male claspers and aedeagi of the two divergent *Synglycaspis* spp. forming round lerps on *E. acmenioides* (313) and *E. umbra* (311), suggest that their host plants constitute a divergent group of renantherous eucalypt species. This concept supports Hillis' view that the two "white mahogany" species should be kept separate from the "stringybarks". The divergent *Synglycaspis* spp. occurring on *E. coccifera* (418) and *E. linearis* (405) suggest divergence of the two host species.

The occurrence of a *Synglycaspis* species constructing flat lerps on *E. diversifolia* (297) suggests that this eucalypt is correctly placed in the renantherous species group by Blakely who indicated (p. 40) that *E. diversifolia* is very close to the Renantherae.

One anomalous result from some collections made, was that two species of the subgenus *Synglycaspis* (*G. tagmata* & *G. nigrocincta*), and one species of *Glycaspis* (*Glycaspis*), i.e. *G. eucalypti,* were obtained from *E. rodwayi* (215a). *G. tagmata* was bred by Mr. D. Martin, from material collected and identified by him; the host plant material of the *nigrocincta* and *eucalypti* collections was identified by Professor Jackson. It is possible that either some of the botanical material was incorrectly determined (probably on inadequate samples), or that species of *Synglycaspis* and *Glycaspis* both occur on the one host. Should the latter be the case, it would be the only known instance, so that more detailed investigations to resolve this point are indicated.

Carr & Carr (1962a *in* Leeper) suggested that the genus *Eucalyptus* (*sensu* Carr & Carr) should consist of Blakely's Series Eudesmieae and Miniatae; *E. jacksonii* (56); *E. preissiana* (246); *E. megacarpa* (247); *E. gamophylla* (288); Section Renantheroideae; Section Renantherae (except *E. guilfoylei* (305)); *E. microcorys* (314); and Series Myrtiformes. It is suggested from the *Glycaspis* spp. host associations determined during this project, that the inclusion of the species *E. tetrodonta* (7), *E. phoenicea* (13), *E. miniata* (14) and *E. gamophylla* (288) in their genus *Eucalyptus* may not be warranted, as psyllid species of the subgenus *Glycaspis* (*Glycaspis*) utilise these species as their hosts.

Series i *(Eudesmieae)*, ii *(Miniatae)* & iii *(Tetrapterae).*

Because of some doubt as to the correct placement of some of the species in these Series, they were intensively collected from, to determine if any *Glycaspis* spp. occurred on them, and if so, whether any indications as to the host plants' affinities with the remainder of the genus *Eucalyptus* could be correlated with the phylogeny of the *Glycaspis* spp. The following information was obtained:-

Eudesmieae.

E. ebbanoensis (5). A psyllid species constructing rectangular lerps, and of another genus of affinities with *Glycaspis,* occurred in large numbers on this host at Comet Vale, Western Australia, and several specimens were bred from the leaves. The construction of rectangular lerps by species in genera other than *Glycaspis,* previously had not been known. As rhinaria on this psyllid species occur on antennal segments 4 to 6, 8 and 9, the species is more primitive than any of the rectangular lerp-forming species of *Glycaspis*

occurring on certain non-renantherous species (see Table 1). The consistency of these lerps, from a visual assessment only, appeared similar to *Eucalyptolyma* spp. lerps found on *Angophora* and the eastern "bloodwood" and "spotted gum" groups of the Series Corymbosae-Peltatae, or to lerps of the round lerp-forming species of *Synglycaspis* on renantherous species.

Blakely's concept of the species in his Series Eudesmieae, that "Members of this Series are closely allied to *Angophora*—" (p. 13), may be supported by the above observations on the lerps occurring on *E. ebbanoensis,* but not by the *Glycaspis* sp. on *E. tetrodonta.*

E. tetrodonta (7). Large numbers of *Glycaspis* (*Glycaspis*) *lucrosa* were obtained from this species, which suggests that *E. tetrodonta* shows affinities with other non-renantherous eucalypts which also support populations of *Glycaspis* (*Glycaspis*) species (see Table 1). *Glycaspis lucrosa* is of close affinities with those species occurring on the eucalypts *phoenicea* (13), *miniata* (14), *brevifolia* (206), *gamophylla* (288), *alba* (207), *bigalerita* (209) and *houseana* (286).

Blake (1953) suggests that the Eudesmieae of Blakely should perhaps be limited to *erythrocorys* (1), *tetragona* (2), *eudesmioides* (3), *odontocarpa* (6) and perhaps *tetrodonta* (7). Each of these species was sampled for *Glycaspis* spp. which were not obtained on any except *E. tetrodonta.*

Gauba & Pryor (1959) found that *E. tetrodonta* was the only species in the Eudesmieae without any suberisation in the chalaza region of the seeds.

Miniatae.

E. phoenicea (13) and *E. miniata* (14). The occurrence of the one species *G. anota* on both of these species suggests that the hosts may have close affinities, and that they might be grouped with those non-renantherous eucalypt species supporting other *Glycaspis* (*Glycaspis*) species (see Table 1).

Gauba & Pryor (1961) found that the so-called "chalaza cork" of seeds of these two species is missing, as it is from *E. tetrodonta* (7) also. The *Glycaspis* spp. associations suggest affinities of these three eucalypt species.

Chattaway (1955) records that both *E. phoenicea* and *E. miniata* undoubtedly display affinities with *E. gummifera* (45) and other "bloodwoods". The *Glycaspis* associations do not support such affinities.

Tetrapterae.

E. tetraptera (15). The relatively primitive *G. felicitaris* utilises this species as host, thus indicating an affinity of its host with those non-renantherous species supporting *Glycaspis* (*Glycaspis*) species (see Table 1).

Series vi to xxii and xxxv to xlvii (non-renantherous species).

During the early stages of this project, some indications based on the phylogeny and host associations of the *Glycaspis* (*Glycaspis*) species constructing round lerps on host plants in these Series, appeared to suggest a possible evolutionary sequence of their *Eucalyptus* spp. hosts; e.g. from Table 1, it appears that: (i) the "box" group of species might be the more primitive representatives, and the *E. saligna* group of species the most recent species, in these Series; (ii) the association of the most primitive species *G. flavilabris* with *E. goniocalyx* (229) might suggest that its host is a primitive "box" species, as the sequential primitive and closely related *Glycaspis* spp. *egregia, cnecosia, suavis, buxalis* and *retrusa* all utilise species in the "box" group; (iii) the utilisation of *E. striaticalyx* (149) as host by *G. froggatti,* suggested that this host might be grouped with the "box" species which are also its hosts; (iv) at Nannine, Western Australia, both *G. froggatti* and *G. pervagata* occur on *E. striaticalyx* (149), after dispersing in different directions from the east, via a northern and a southern route respectively. *G. pervagata* appears to have essentially southern "mallee" associations, and *G. froggatti* essentially northern "box" associations, so that *E. striaticalyx* might be interpreted as showing some affinities with both the "mallee" and "box" groups. However, present knowledge concerning the phylogeny of the eucalypts does not necessarily support these indications.

At the same time, some *Glycaspis* spp. associations appear to support botanical interpretations of eucalypt affinities, such as: (i) the two closely related species *fasciculosa* (560) in South Australia and *polyanthemos* (558) in eastern New South Wales are both hosts of *Glycaspis* (*Glycaspis*) *whitei;*

(ii) *G. froggatti* occurs on *E. normantonensis* as well as on five other "box" species; (iii) *G. buxalis* and *G. froggatti* are both associated with *E. intertexta* (291) as well as with some "box" species, which appears to support the concept that *intertexta* is of close affinities with the "box" species; (iv) *G. anota* occurs on both *E. phoenicea* (13) and *E. miniata* (14) which supports evidence that these two eucalypts are of close affinities; (v) *G. wondjinae* utilises *E. alba* (207), *E. bigalerita* (209) and *E. houseana* (286) as its hosts; (vi) *G. anomala* occurs on a number of "box" species; (vii) *G. onychis* utilises both *E. brevifolia* (206) and *E. gamophylla* (288) as its hosts; (viii) *G. johnsoni* utilises *E. blakelyi* (186), *E. dealbata* (189) and *E. dwyeri* (190) which are of close affinities, as its hosts; (ix) *G. brimblecombei* utilises *tereticornis* (178), *blakelyi* (186), *dealbata* (189), *camaldulensis* (197), *bridgesiana* (225) and possibly *nitens* (263) as hosts; (x) *G. australoraria* utilises *punctata* (78), *longifolia* (81), *tereticornis* (178) and *amplifolia* (184) as hosts; *G. pratensis* occurs on *tereticornis* (178) and *amplifolia* (184); (xi) similarities in the aedeagi of the *Glycaspis* spp. *brimblecombei, blakei, confinis, campbelli, imponens* and *baileyi* indicate their close affinities, and it is suggested that their hosts may also have affinities with each other, i.e. *camaldulensis* (197), *bridgesiana* (225), *tereticornis* (178), *blakelyi* (186), *dealbata* (189), *?nitens* (263), *propinqua* (75), the northern "gum" *Eucalyptus* sp., *rudis* (204), *cornuta* (96), *saligna* (60), *robusta* (67), *resinifera* (69) and *cypellocarpa* (262); (xii) the occurrence of *G. baileyi* on the eucalypts *saligna* (60), *resinifera* (69) and *robusta* (67) suggests close affinities of their hosts.

It thus becomes apparent that some *Glycaspis* spp. have evolved in close association with certain groups of eucalypt species, each of which may be regarded as being composed of species of some affinities.

The evolution of *Glycaspis* spp. no doubt proceeded under such significant environmental influences as altitude, latitude, and temperature and humidity regimes, typical of discrete localities.

Interpretations of some *Glycaspis/Eucalyptus* associations as possible indicators of the phylogeny of their individual hosts thus appear to be unreliable at the species level, although some appear to agree with botanical information concerning the eucalypt phylogeny.

Biogeographical influences during the evolution of the *Glycaspis* spp. *caurina, lucrosa, anota* and *wondjinae,* as well as the *montana, baileyi, imponens* and *campbelli* group of species, are apparent, and adaptive radiation in each group could explain their similarities.

Physiological and chemical variability between or within the discrete host species are assumed to have considerably influenced the evolution of the various *Glycaspis* spp. through adaptive responses, as the following examples may indicate:-

(i) The occurrence of *G. wakelburae* (a species of close affinities with *G. froggatti*) on a "box" species at present known as *Eucalyptus* sp. under review, from 118 mi. N. Clermont to near Cooktown in Queensland, might indicate that this eucalypt is a biological entity distinct from those other "box" species which are hosts of *G. froggatti.*

(ii) The utilisation of *E. camaldulensis* as host by four discrete *Glycaspis* spp. appears to be of considerable interest. The widespread species *G. brimblecombei* was obtained on *E. camaldulensis* from Adelaide, South Australia, to 107 mi. N. Clermont, Queensland (see Map 3). At the latter collecting site it occurred on a host (a "gum" identified as *Eucalyptus* sp.) together with *G. blakei,* a species of close affinities. From that collecting site, across the north of the continent and thence south to 11 mi. S. Meekatharra, Western Australia, no *brimblecombei* specimens were obtained, but the species *G. blakei* was consistently collected from hosts which always appeared to be this "gum" species. The host plant material collected at the latter site was identified by C. A. Gardner as *E. camaldulensis* (197). The "gum" *Eucalyptus* sp. on which G. *blakei* occurs, appears to be included with *E. camaldulensis* and its five varieties by Blakely.

From near Perth to Cape Leeuwin, Western Australia, *G. confinis,* another species of close affinities with *G. blakei* and *G. brimblecombei,* occurred on *E. rudis* (204) and *E. cornuta* (96).

(iii) Similarly, the discrete species *G. eremica* and *G. gradata* occur on *E. camaldulensis* growing in the far north-west of N.S.W., and from near Hay, N.S.W., to Bendigo, Victoria, respectively, so that further biological divergence from the *E. camaldulensis* which is the host of *G. brimblecombei* is again suggested for the hosts in those approximate areas*.

The *Glycaspis* spp. associations suggest some physiological and/or chemical divergence among groups of *E. camaldulensis* occurring in the discrete areas which might be delimited by the distribution of each of these four *Glycaspis* spp. On examination of the distribution of Blakely's varieties of *E. camaldulensis* it is suggested that *G. brimblecombei* is associated with the variety *camaldulensis* only, of Blakely.

Banks & Hillis (1969) have recently examined the polyphenols in samples of *E. camaldulensis* collected throughout its natural habitat. Samples were grouped by computer analysis and a "mature leaf" dendrogram was constructed from the crude data. There were two major groupings, A to H and I to T, based on certain polyphenols in the leaves.

It is of considerable interest that, in the group A to H, only four localities (i.e. Ng, approximately Bogan River, N.S.W.; Sc, south of Lake Eyre, South Australia; Qo, near Injune, Queensland, and Nh, near Wilcannia, N.S.W.) out of about 35 localities given, do not appear to coincide with the known distribution of *G. blakei* which utilises the "gum" *Eucalyptus* sp. as host. This occurrence of *G. blakei* on the *"camaldulensis"* in the general area of the group A to H localities, appears to indicate that there may be some biologically variable factors in the host species, to which evolutionary influences in *Glycaspis* have responded sufficiently to allow adaptation of, firstly, the species *G. blakei,* then in other discrete localities within the overall distribution of *camaldulensis,* adaptations of the species *brimblecombei, eremica* and *gradata.*

Pryor & Byrne (1969) studied the pattern of variation in *E. camaldulensis* from sites between the approximate latitudes 14°S. in the Northern Territory, to 35°S. in South Australia, and principally between meridians 130°E. and 140°E. They found that there was an apparent discontinuity about latitude 27°S., and suggested that the total population of *E. camaldulensis* would be better regarded as forming two rather closely related taxa, as northern and southern populations respectively, but that this interpretation would be dependent on further studies of the zone of apparent discontinuity.

From the collections of *Glycaspis* spp. during this project, it has been found that the most southern distribution of *G. blakei,* and presumably of its particular host, a "gum" *Eucalyptus* sp., corresponds favourably in Western Australia with the interpretation of Pryor & Byrne (i.e. to about latitude 27°S.). In Queensland, the same insect/host association did not correspond so favourably, in that the most northern distribution of *G. brimblecombei* and the most southern of *G. blakei,* coincided on the same host at a locality 107 mi. N. Clermont (Belyando River bridge, on the Charters Towers road) slightly south of latitude 21°S*.

Further intensive collecting in areas to the west of the project route might well extend further to the south the distribution limits for *G. blakei,* but the overlapping distribution limits for *G. blakei* and *G. brimblecombei* on the same plant, appears significant for the areas traversed during this project.

Glycaspis spp. became associated with certain eastern "gum" eucalypt species (*tereticornis* (178), *camaldulensis* (197) etc.) at a relatively late stage of evolutionary development within *Glycaspis* (see Table 1) but the interpretation that this suggests a more recent evolution of those "gum" species which are their hosts, is not necessarily substantiated on present information concerning the insect/host interactions.

With the knowledge of the *Glycaspis* spp./Host associations presented here as a basis, a considerable field of investigations along these same lines remains, both in substantiating this work and providing further information on those species concerning which little is known.

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* See postscript, p. 373.

AUSTRALIAN CONTINENTAL DRIFT

Of recent years, biological evidence for the supposed drift in the relative positions of the large land masses of the world during the geological time-scale is accumulating.

The botanical aspects of evidence in support of such land movements are strikingly presented by Good (1964). Of particular interest is the theoretical drift of Australia to its present position, and the conclusion that, from the botanical aspect, New Guinea and Australia cannot have been in their present relative positions for any considerable length of time in geological terms, and that their present contiguity is now as close as, or closer than, it has been in the past. With Australia in its present position, there is apparently a profound line of botanical demarcation between this continent and New Guinea, so that Australia and its flora appear to have become intruded into a more orderly picture.

Some entomological information supporting the evidence for continental drift is given by Britton (1953), and the distributions of the hemipterous Peloridiidae and the dipterous Blepharoceridae are discussed. According to Heslop-Harrison (1956) the larval forms of Psyllidae in many cases approximate those of the Peloridiidae and the external male genitalia have many points in common with that of the latter.

Gressitt (1959) reports that in general, his study of the Cerambycidae confirms his view that New Guinea is part of the Oriental Region as far as insects are concerned, and that the precinctive genera, being of Oriental relationship, indicate that the Australian elements were recently superimposed on an Oriental fauna.

Duffy (1968) has included the Territory of Papua & New Guinea with the Oriental Region, because of faunistic relationships.

From present knowledge concerning the origin and dispersal of *Glycaspis* spp., there appears to be an analogy with these previous interpretations, in that the most primitive subgenus (*Synglycaspis*) is concentrated in the southern and south-eastern areas of the continent; the intermediate subgenus (*Glycaspis*) is distributed throughout the continent, with three female specimens only, recorded from New Guinea; four species of the most recent subgenus (*Boreioglycaspis*) occur from Penang Island to the southern Philippine Islands, which suggests that the subgenus spread northwards on *Melaleuca* spp. from its apparently southern limits on the Central Coast of N.S.W., across the north of the continent, and beyond Australia to the Philippine Islands.

On present information, it thus appears that a possible route of dispersal of the subgenus *Boreioglycaspis* from Australia was by way of the north-west of the continent, rather than through Cape York to New Guinea and thence westward through the Indonesian Islands. This hypothetical interpretation is dependent on future information from extensive collections for *Glycaspis* spp. throughout New Guinea and the islands to the west and the north; but of recent years, intensive collecting by the B.P. Bishop Museum Field Station staff at Wau, New Guinea, and requests for specimens from the Agricultural and Forests organisations of New Guinea, have given no indication of the occurrence of the subgenus *Boreioglycaspis* on that island.

Some entomological evidence for the supposed drift of Australia towards New Guinea rather than away from it, thus appears to be consistent with the botanical interpretation presented by Good.

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TABLES

Table 1. *Glycaspis* (*Glycaspis*) spp./Host/Distribution, in the sequence of insect taxonomy. Known lerp shape given in parentheses

(R) = round
(O) = oval
(RT) = rectangular

Table 2. Species/Host Associations, genus *Glycaspis* (alphabetical).

[S] = *Synglycaspis*
[G] = *Glycaspis*
[B] = *Boreioglycaspis*

(G) = gall
(F) = flat lerp
(R) = round lerp
(O) = oval lerp
(RT) = rectangular lerp

Table 3. Host/Species Associations, genus *Glycaspis* (alphabetical).

TABLE 1

Species		Hosts	Distribution
flavilabris	(R)	*goniocalyx*	Rylstone-Canberra (NSW)
eucalypti	(R)	*viminalis rodwayi ?ovata ?dalrympleana*	Kiandra-Hobart (NSW-Tas)
minuscula	(R)	*cinerea rubida cephalocarpa ?viminalis*	Goulburn-Melbourne (NSW-V)
egregia	(R)	*moluccana*	Brisbane-Calliope (Q)
cnecosia	(R)	*cambageana*	Banana (Q)
suavis	(R)	*populnea Euc.* sp. (box)	Clermont-Hillston (Q-NSW)
buxalis	?(R)	*microtheca ?intertexta ?melanophloia*	E. Qld.-Pt. Hedland (Q-WA)
retrusa	?(R)	*largiflorens leptophleba microtheca tectifica*	Hillston-Vic. Riv. X-ing (NSW-NT)
pervagata	(R)	*dumosa gracilis incrassata pileata brachycalyx torquata striaticalyx lesouefii ?calycogona ?salmonophloia ?dongarraensis ?griffithsii ?foecunda*	Goolgowie-Geraldton (NSW-WA)
repetina	(R)	*oleosa porosa ?foecunda ?leucoxylon*	(SA)
collina		*?melanophloia*	Gayndah-Rockhampton (Q)
brunneincincta	(R)	*?major ?propinqua ?tessellaris*	Plunkett-Callide (Q)
dobsoni	(?R-O)	*viminalis*	Hobart-Cygnet (T)
hadlingtoni		*intertexta ?largiflorens*	Cobar-Willandra Crk. (NSW)
rylstonensis		*blakelyi*	Rylstone (NSW)
grapta	(?R-O)	*oleosa ?salmonophloia*	Cobar-Geraldton (NSW-WA)
wanbiensis	(R)	*oleosa ?foecunda ?leucoxylon*	(SA)
notialis	(R)	*gracilis pileata-dumosa ?oleosa ?porosa*	Bow Hill-Norseman (SA-WA)
occidentalis	(R)	*gomphocephala redunca ?oleosa ?calycogona*	Perth-Kalgoorlie (WA)
yilgarniensis		*gamophylla ?lesouefii*	Mundiwindi-Menzies (WA)
infucata	(R)	*leptopoda*	Geraldton (WA)
felicitaris	(R)	*tetraptera*	Esperance (WA)
subita		*cornuta*	Stirling Ra. (WA)
rivalis	(R)	*paniculata ?ovata*	Lisarow-Lakes Entrance (NSW-Vic)
pilata	(R)	*paniculata*	Kurrajong (NSW)
whitei	(R)	*fasciculosa polyanthemos*	Rylstone-Adelaide (NSW-SA)
fuscovena	(?R-O)	*odorata ?fasciculosa ?woollsiana ?microcarpa ?leucoxylon*	Narrandera-Adelaide (NSW-SA)
wagaitjae	(R)	*?tetrodonta*	Darwin (NT)
caurina	(R)	*jensenii*	Timber Crk (NT)
lucrosa	(R)	*tetrodonta*	Normanton-Darwin (Q-NT)

Species		Hosts	Distribution
anota	(R)	*phoenicea miniata*	Georgetown-Derby (Q-WA)
wondjinae	(R)	*houseana alba bigalerita*	Townsville-Kimberleys (Q-WA)
quornensis		*albens microcarpa ?leucoxylon*	Quorn-Omeo ?Merriwa (SA-NSW)
anomala	?(R)	*microtheca largiflorens cambageana thozetiana ?populnea ?woollsiana ?microcarpa*	Deniliquin-Clermont (NSW-Q)
johnsoni		*blakelyi dwyeri dealbata ?largiflorens*	A.C.T.-Narrabri (NSW)
violae		*?melanophloia*	131 N. Clermont (Q)
onychis	(R)	*brevifolia gamophylla*	Mt. Isa-Hamersley Ra. (Q-WA)
lactea	(R)	*?blakelyi ?dealbata*	Strahorn SF (Dubbo) (NSW)
hackeri		*?*	Brisbane (Q)
rubritincta	(R)	*confluens*	Kimberleys (WA)
exsertae		*exserta*	Clermont (Q)
froggatti	(R-RT)	*argillacea oligantha striaticalyx tectifica normantonensis microtheca microneura leptophleba ?intertexta*	Normanton-Nannine (Q-WA)
blakei	?(R)	*Euc.* sp. (gum)	107 N. Clermont-Meekatharra (Q-WA)
eremica	?(R)	*?camaldulensis*	Quorn-Milparinka (SA-NSW)
taylori	(R)	*globulus ovata*	Hobart-Mt. Victoria (T-NSW)
gradata	?(R)	*?camaldulensis ?largiflorens*	Bendigo-Willandra Crk. (V-NSW)
confinis	(R)	*rudis ?cornuta*	Perth - C. Naturaliste (WA)
wakelburae	(R-O)	*thozetiana microtheca Euc.* sp. (box)	Emerald-Cooktown (Q)
brimblecombei	(R)	*camaldulensis dealbata tereticornis blakelyi bridgesiana ?nitens Euc.* sp. (gum)	Adelaide-Clermont (SA-Q)
mannifera	(R)	*moluccana ?polyanthemos*	Prospect-Tumut (NSW)
xanthopepla	(R)	*seeana*	Plunkett (Q)
pratensis	(R)	*tereticornis amplifolia*	Prospect-Rockhampton (NSW-Q)
australoraria	(R)	*tereticornis amplifolia longifolia punctata*	Adelaide-Brisbane (SA-Q)
struicis	(R)	*tereticornis*	Merrylands (NSW)
montana	(R)	*dunnii*	Clouds Crk. (Grafton) (NSW)
baileyi	(R)	*saligna robusta resinifera*	Lisarow-Clouds Crk. (NSW)
imponens	(R)	*propinqua*	Kincumber (NSW)
campbelli	?(R)	*cypellocarpa ?ovata ?cephalocarpa*	Eden-Montrose (NSW-Vic)
locaridensis	(O)	*populnea ?blakelyi ?melliodora*	Parkes-Dubbo-Clermont (NSW-Q)
amnicola	(O)	*camaldulensis polyanthemos ?oleosa ?tereticornis*	Quorn-Moree (SA-NSW)
prepta	(O)	*blakelyi melliodora ?tereticornis ?longifolia ?camaldulensis*	Corryong-Prospect (V-NSW)
wiradjurae		*?oleosa ?intertexta*	Hillston (NSW)
permista	(O)	*paniculata*	Sydney-Wamberal (NSW)
schwarzi	(O)	*leucoxylon odorata porosa*	(SA)
sudicola	(O)	*sideroxylon*	Deniliquin-Springsure (NSW-Q)

Species		Hosts	Distribution
ignea	(O)	*deanei ?longifolia punctata*	Wyong-Eden (NSW)
kurrajongensis	(O)	*paniculata*	Kurrajong (NSW)
mellialata	(O)	*paniculata*	Wyong (NSW)
neureta	(O)	*melliodora*	Breeza-You Yangs (NSW-V)
oraria	(O)	*robusta X resinifera*	Mona Vale (NSW)
amydra	(O)	*goniocalyx bridgesiana largiflorens mannifera* ss. *?melliodora*	Rylstone-Canberra (NSW)
monita		*fasciculosa*	Keith (SA)
lacustris	(O)	*ovata*	Lakes Entrance (V)
mesicola		*?drepanophylla*	Goodna-Carnarvon Ra. (Q)
deirada	(RT)	*dundasii*	Fraser Ra. (WA)
deirada group complex	(RT)	*loxophleba gracilis foecunda redunca intertexta gomphocephala campaspe cylindriflora cornuta annulata calycogona salmonophloia salubris platypus diversicolor ?rudis ?oleosa ?occidentalis ?comitae-vallis ?lesouefii*	Eba-Perth (SA-WA)
aurosala	(RT)	*thozetiana*	Clermont-Charleville (Q)
emphanes	(RT)	*cambageana*	Emerald-Clermont (Q)
siliciflava	(RT)	*robusta*	Wamberal (NSW)
granulata	(RT)	*saligna grandis botryoides ?robusta*	Sussex Inlet-Mt. Spec (NSW-Q)

TABLE 2

Species		Host
[B] *abudicola*		*Melaleuca nervosa*
[S] *aggregata*	(R)	*Euc. haemastoma*
[G] *amnicola*	(O)	*camaldulensis polyanthemos ?tereticornis ?oleosa*
[S] *amplificata*	(G)	*acmenioides*
[G] *amydra*	(O)	*bridgesiana goniocalyx ?melliodora largiflorens mannifera* ss.
[G] *anomala*	?(R)	*microtheca largiflorens cambageana thozetiana ?populnea ?woollsiana ?microcarpa*
[G] *anota*	(R)	*phoenicea miniata*
[G] *aurosala*	(RT)	*thozetiana*
[G] *australiensis*		*Tristania conferta*
[G] *australoraria*	(R)	*Eucalyptus longifolia amplifolia tereticornis punctata*
[G] *baileyi*	(R)	*Eucalyptus saligna robusta resinifera*
[S] *belua*	(G)	*niphophila*
[G] *blakei*	(?R)	*Eucalyptus* sp. (gum)
[B] *borneensis*	?	?
[G] *brimblecombei*	(R)	*Eucalyptus dealbata camaldulensis ?nitens tereticornis blakelyi bridgesiana Euc.* sp. (gum)
[G] *brunneincincta*	(R)	*?major ?propinqua ?tessellaris*
[S] *brunosa*	(G)	*coccifera*
[G] *buxalis*	(?R)	*microtheca ?melanophloia ?intertexta*
[G] *campbelli*	(?R)	*Euc. cypellocarpa ?ovata ?cephalocarpa*
[G] *caurina*	(R)	*jensenii*
[S] *cellula*	(G)	*?amygdalina*
[G] *cnecosia*	(R)	*cambageana*
[G] *collina*	?	*?melanophloia*
[S] *commoni*	(G)	?
[G] *confinis*	(R)	*rudis ?cornuta*
[S] *conflecta*	(R)	*eugenioides ?oblonga ?macrorhyncha ?agglomerata*
[S] *conserta*	(R)	*sieberi*
[S] *cyanoreia*	(R)	*stricta*
[S] *cyrtoma*	(G)	*piperita*

Species		Host
[S] *cyta*	(G)	*pilularis*
[G] *deirada*	(RT)	*dundasii*
[G] *deirada* complex		*loxophleba ?rudis gracilis foecunda intertexta gomphocephala campaspe ?occidentalis cylindriflora cornuta annulata ?oleosa calycogona ?comitae-vallis salmonophloia salubris redunca ?lesouefii platypus diversicolor*
[B] *denigrata*		*Melaleuca acacioides*
[B] *devexa*		*leucadendron cajuputi*
[B] *devicola*		*viridiflora*
[G] *dobsoni*	(R-O)	*Eucalyptus viminalis*
[S] *dreptodria*	(R)	*simmondsii ?amygdalina ?radiata ?stellulata*
[G] *egregia*	(R)	*moluccana*
[G] *emphanes*	(RT)	*cambageana*
[S] *encystis*	(G)	*agglomerata*
[S] *endasa*	(R)	*robertsonii*
[G] *eremica*	(?R)	*?camaldulensis*
[G] *eucalypti*	(R)	*viminalis rodwayi ?dalrympleana ?ovata ?obliqua*
[G] *exsertae*	?	*exserta*
[G] *felicitaris*	(R)	*tetraptera*
[G] *flavilabris*	(R)	*goniocalyx*
[B] *forcipata*	?	?
[G] *froggatti*	(R-RT)	*argillacea oligantha tectifica striaticalyx ?intertexta normantonensis microtheca mirconeura leptophleba*
[S] *fuliginis*	(R)	*globoidea ?andreana*
[G] *fuscovena*	(?R-O)	*odorata ?fasciculosa ?woollsiana ?microcarpa ?leucoxylon*
[G] *gradata*	(?R)	*Eucalyptus ?camaldulensis ?largiflorens*
[G] *granulata*	(RT)	*saligna grandis botryoides ?robusta*
[G] *grapta*	(?R-O)	*oleosa ?salmonophloia*
[G] *hackeri*	?	?
[G] *hadlingtoni*	?	*intertexta ?largiflorens*
[S] *hirsuta*	(R)	*pilularis ?cypellocarpa*
[S] *icterica*	(R)	*marginata ?jacksonii*
[G] *ignea*	(O)	*deanei ?longifolia punctata*
[S] *immaceria*	(G)	*rossii*
[G] *imponens*	(R)	*propinqua*
[S] *inclusa*	(G)	*umbra*
[G] *infucata*	(R)	*leptopoda*
[G] *johnsoni*	?	*blakelyi dwyeri dealbata ?largiflorens*
[G] *kurrajongensis*	(O)	*paniculata*
[G] *lactea*	(R)	*?blakelyi ?dealbata*
[G] *lacustris*	(O)	*ovata*
[G] *locaridensis*	(O)	*populnea ?blakelyi ?melliodora*
[S] *longaeva*	(G)	*linearis*
[G] *lucrosa*	(R)	*tetrodonta*
[S] *mactans*	(R)	*acmenioides*
[G] *mannifera*	(R)	*moluccana ?polyanthemos*
[B] *melaleucae*		*Melaleuca quinquenervia argentea leucadendron nervosa*
[G] *mellialata*	(O)	*Eucalyptus paniculata*
[G] *mesicola*	?	*?drepanophylla*
[G] *minuscula*	(R)	*cinerea cephalocarpa rubida ?viminalis*
[G] *monita*	?	*fasciculosa*
[G] *montana*	(R)	*dunnii*
[B] *muminae*		*Melaleuca viridiflora*
[S] *munita*	(G)	*Eucalyptus simmondsii*
[G] *neureta*	(O)	*melliodora*
[S] *nigrocincta*	(R)	*coccifera rodwayi delegatensis*
[G] *notialis*	(R)	*gracilis ?oleosa ?porosa pileata-dumosa* complex
[S] *nundlensis*	(F)	*radiata subplatyphylla*
[S] *obvelata*	(G)	*?sieberi*
[G] *occidentalis*	(R)	*gomphocephala ?oleosa ?calycogona redunca*

Species		Host
[S] *occulta*	(G)	*?simmondsii*
[G] *onychis*	(R)	*brevifolia gamophylla*
[G] *oraria*	(O)	*robusta X resinifera*
[S] *orientalis*	(R)	*umbra*
[B] *paludis*		*Melaleuca quinquenervia*
[S] *particeps*	(R)	*Eucalyptus obliqua baxteri ?oblonga ?macrorhyncha ?caliginosa*
[B] *penangensis*	?	?
[G] *permista*	(O)	*Eucalyptus paniculata*
[S] *perthecata*	(G)	*haemastoma*
[G] *pervagata*	(R)	*dumosa gracilis pileata incrassata brachycalyx torquata striaticalyx ?calycogona ?salmonophloia ?dongarraensis lesouefii ?griffithsii ?foecunda*
[S] *phreata*	(F)	*oblonga*
[G] *pilata*	(R)	*paniculata*
[S] *planaria*	(F)	*piperita*
[S] *planitecta*	(F)	*oblonga caliginosa diversifolia baxteri robertsonii simmondsii niphophila stellulata pauciflora ?amygdalina obliqua coccifera rossii macrorhyncha dives*
[B] *polymelasma*	?	?
[G] *pratensis*	(R)	*tereticornis amplifolia*
[G] *prepta*	(O)	*blakelyi melliodora ?tereticornis ?longifolia ?camaldulensis*
[G] *quornensis*	?	*albens microcarpa ?leucoxylon*
[G] *repentina*	(R)	*oleosa porosa ?foecunda ?leucoxylon*
[G] *retrusa*	(?R)	*largiflorens leptophleba ?tectifica microtheca*
[G] *rivalis*	(R)	*paniculata ?ovata*
[G] *rubritincta*	(R)	*confluens*
[G] *rylstonensis*	?	*blakelyi*
[S] *salebrosa*	(R)	*piperita andrewsii*
[G] *schwarzi*	(O)	*leucoxylon odorata porosa*
[S] *seriata*	(R)	*pilularis*
[G] *siliciflava*	(RT)	*robusta*
[G] *struicis*	(R)	*tereticornis*
[G] *suavis*	(R)	*populnea Euc.* sp.
[G] *subita*	?	*cornuta*
[G] *sudicola*	(O)	*sideroxylon*
[S] *tagmata*	(F)	*rodwayi*
[G] *taylori*	(R)	*globulus ovata*
[S] *temenicola*	(R)	*linearis simmondsii ?pauciflora*
[G] *violae*	?	*?melanophloia*
[G] *wagaitjae*	(R)	*?tetrodonta*
[G] *wakelburae*	(R-O)	*thozetiana microtheca Euc.* sp.
[G] *wanbiensis*	(R)	*oleosa ?leucoxylon ?foecunda*
[G] *whitei*	(R)	*fasciculosa polyanthemos*
[G] *wiradjurae*	?	*?oleosa ?intertexta*
[G] *wondjinae*	(R)	*houseana alba bigalerita*
[G] *xanthopepla*	(R)	*seeana*
[G] *yilgarniensis*	?	*gamophylla ?lesouefii*

POSTSCRIPT

The suggestion of biological divergence in *E. camaldulensis* in the far north-west of N.S.W. (p. 365) was confirmed by the presence of *G. eremica* and the absence of *G. brimblecombei* from numerous collections by the writer west of White Cliffs, during May, 1970.

G. blakei was obtained in association with *G. brimblecombei* from *E. camaldulensis* at Gongolgon (Bogan Riv.) and Wilcannia (Darling Riv.). This suggests that some specimens of the host in these two localities show affinities with both the northern taxon (indicated by *G. blakei*) and the southern taxon (indicated by *G. brimblecombei*), and agrees with the findings of Banks & Hillis (1969) for their samples Ng3 & Nh2 in Group A to H (northern taxon) and samples Ng1, Ng2 & Nh1 in Group I to T (southern taxon).

TABLE 3

Host	Species
Euc. acmenioides	*amplificata mactans*
agglomerata	*encystis ?conflecta*
alba	*wondjinae*
albens	*quornensis*
amplifolia	*pratensis australoraria*
?amygdalina	*dreptodria cellula planitecta*
?andreana	*fuliginis*
andrewsii	*salebrosa*
annulata	*deirada* complex
argillacea	*froggatti*
baxteri	*planitesta particeps*
bigalerita	*wondjinae*
blakelyi	*brimblecombei prepta rylstonensis johnsoni*
? ,,	*lactea locaridensis*
?bosistoana	*mannifera*
botryoides	*granulata*
brachycalyx	*pervagata*
brevifolia	*onychis*
bridgesiana	*amydra brimblecombei*
caliginosa	*planitecta ?particeps*
calycogona	*deirada* complex
? ,,	*pervagata ?occidentalis*
camaldulensis	*brimblecombei amnicola*
? ,,	*blakei eremica prepta gradata occidentalis*
cambageana	*anomala cnecosia emphanes*
? ,,	*brunneincincta*
campaspe	*deirada* complex (round lerps)
cephalocarpa	*minuscula*
? ,,	*campbelli minuscula*
cinerea	*minuscula*
coccifera	*brunosa nigrocincta planitecta*
?comitae-vallis	*deirada* complex
confluens	*rubritincta*
cornuta	*subita deirada* complex
? ,,	*confinis*
cylindriflora	*deirada* complex (round lerps)
cypellocarpa	*campbelli*
? ,,	*hirsuta*
?dalrympleana	*eucalypti*
dealbata	*johnsoni brimblecombei*
? ,,	*lactea*
deanei	*ignea*
delegatensis	*nigrocincta*
diversicolor	*deirada* complex
diversifolia	*planitecta*
dives	*planitecta*
?dongarraensis	*pervagata*
?drepanophylla	*mesicola*
dumosa	*pervagata*
dumosa-pileata	*pervagata notialis deirada* complex
dundasii	*deirada*
dunnii	*montana*
dwyeri	*johnsoni*
Euc. sp. (box)	*wakelburae suavis*
Euc. sp. (gum)	*blakei brimblecombei*
Euc. eugenioides	*conflecta*
exserta	*exsertae*
fasciculosa	*whitei monita*
? ,,	*fuscovena*

Host	Species
foecunda	*deirada* complex
? ,,	*wanbiensis repentina pervagata*
gamophylla	*yilgarniensis onychis*
globoidea	*fuliginis*
globulus	*taylori*
gomphocephala	*occidentalis deirada* complex
goniocalyx	*flavilabris amydra*
gracilis	*notialis pervagata deirada* complex
grandis	*granulata*
?griffithsii	*pervagata*
haemastoma	*perthecata aggregata*
houseana	*wondjinae*
incrassata	*pervagata*
intertexta	*hadlingtoni*
? ,,	*froggatti buxalis retrusa wiradjurae deirada* complex
?jacksonii	*icterica*
jensenii	*caurina*
largiflorens	*anomala retrusa*
? ,,	*hadlingtoni johnsoni ?gradata*
leptophleba	*froggatti retrusa*
leptopoda	*infucata*
lesouefii	*pervagata deirada* complex
? ,,	*yilgarniensis*
leucoxylon	*schwarzi*
? ,,	*quornensis repentina wanbiensis fuscovena*
linearis	*longaeva temenicola*
longifolia	*australoraria*
? ,,	*prepta ignea*
loxophleba	*deirada* complex
macrorhyncha	*?particeps ?conflecta*
? ,,	*planitecta particeps*
?major	*brunneincincta*
mannifera	*amydra*
marginata	*icterica*
Melaleuca acacioides	*denigrata*
Melaleuca argentea	*melaleucae*
Melaleuca cajuputi	*devexa*
Melaleuca leucadendron	*melaleucae devexa*
Melaleuca nervosa	*melaleucae abudicola*
Melaleuca quinquenervia	*melaleucae paludis*
Melaleuca viridiflora	*devicola muminae*
Euc. ?melanophloia	*collina buxalis violae*
melliodora	*neureta*
? ,,	*prepta amydra locaridensis*
microcarpa	*quornensis*
? ,,	*anomala fuscovena*
microneura	*froggatti*
microtheca	*froggatti anomala buxalis wakelburae retrusa*
? ,,	*locaridensis suavis*
miniata	*anota*
moluccana	*egregia mannifera*
niphophila	*belua planitecta*
?nitens	*brimblecombei*
normantonensis	*froggatti*
obliqua	*planitecta particeps*
? ,,	*eucalypti*
oblonga	*planitecta ?particeps phreata*
? ,,	*conflecta particeps*
?occidentalis	*deirada* complex (round lerps)
odorata	*schwarzi fuscovena*
oleosa	*repentina wanbiensis ?occidentalis grapta*

Host	Species
?oleosa	*wiradjurae notialis amnicola deirada* complex
oligantha	*froggatti*
ovata	*taylori lacustris*
? ,,	*eucalypti campbelli rivalis whitei*
paniculata	*kurrajongensis rivalis pilata permista mellialata*
pauciflora	*planitecta*
? ,,	*temenicola*
phoenicea	*anota*
pileata-dumosa	*pervagata notialis*
pilularis	*hirsuta seriata cyta*
piperita	*cyrtoma planaria salebrosa*
platypus	*deirada* complex
polyanthemos	*whitei amnicola*
? ,,	*mannifera*
populnea	*locaridensis suavis*
? ,,	*anomala*
porosa	*schwarzi notialis repentina*
propinqua	*imponens*
? ,,	*brunneincincta*
punctata	*australoraria ignea*
radiata	*dreptodria*
,, *subplatyphylla*	*nundlensis*
redunca	*deirada* complex *?occidentalis*
resinifera	*baileyi*
,, X *robusta*	*oraria*
robertsonii	*planitecta endasa*
robusta	*baileyi siliciflava*
? ,,	*granulata*
rodwayi	*tagmata eucalypti nigrocincta*
rossii	*immaceria planitecta*
rubida	*minuscula*
rudis	*confinis*
? ,,	*deirada* complex
saligna	*baileyi granulata*
salmonophloia	*deirada* complex (round lerps)
? ,,	*pervagata grapta*
salubris	*deirada* complex (round lerps)
seeana	*xanthopepla*
sideroxylon	*sudicola*
sieberi	*conserta*
? ,,	*obvelata*
simmondsii	*dreptodria munita temenicola planitecta*
? ,,	*occulta*
stellulata	*planitecta*
? ,,	*dreptodria*
striaticalyx	*pervagata froggatti*
stricta	*cyanoreia*
tectifica	*froggatti retrusa*
tereticornis	*brimblecombei pratensis struicis australoraria*
? ,,	*amnicola prepta*
?tessellaris	*brunneincincta*
tetraptera	*felicitaris*
tetrodonta	*lucrosa*
? ,,	*wagaitjae*
thozetiana	*anomala aurosala wakelburae*
torquata	*pervagata*
Tristania conferta	*australiensis*
Euc. umbra	*orientalis mactans inclusa*
viminalis	*eucalypti dobsoni*
? ,,	*minuscula*
woollsiana	*anomala fuscovena*

OBSERVATIONS ON LORD HOWE ISLAND BUTTERFLIES

by C. N. SMITHERS
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This note is based on observations made on Lord Howe Island between 18th and 30th November, 1969. Material collected, all by the author, is in the Australian Museum. The 23rd, 24th and 25th November were spent on a trip to the summit of Mount Gower, the afternoon of the 26th was spent on Roach Island, about three-quarters of a mile north of Lord Howe, the rest of the time was spent in the more closely settled, northern part of the island. At times when insects other than butterflies were being collected notes were made on butterflies seen.

Peters (1969) lists twenty-three species for the island. Of these twelve were seen or collected and one subspecies (*Anaphaeis java teutonia*) not previously recorded was taken. For seven of the remaining eleven species there is only one Lord Howe Island specimen recorded and few for the remaining four. A worthwhile project for a resident on the island would be the collection of representative samples covering all seasons.

Family PAPILIONIDAE

Papilio aegeus aegeus Donovan

Collected: 1♂, Intermediate Hill, 820', 18.xi.1969; 1♂, Lagoon Road, 28.xi.1969; 1♂, Lagoon Rd., 29.xi.1969; 1♂, Anderson Rd., 30.xi.1969.

This species was seen almost every day in the settled area of the island and was common in Anderson Rd. Of the many specimens seen only one was a female.

Family PIERIDAE

Eurema similax (Donovan)

Collected: 1♂, Lagoon Rd., 28.xi.1969. A second specimen was seen in the same area, 29.xi.1969.

Anaphaeis java teutonia (Fabricius)

Collected: 28♂, 7♀, Lagoon Rd., 28.xi.1969; 1♂, Anderson Rd., 30.xi.1969.

Wallace (1867) recorded *Anaphaeis java peristhene* (Boisduval) from Lord Howe. The specimens listed here are the first *A. j. teutonia* recorded from Lord Howe and they formed part of a tremendous "invasion" which took place on the 28th November. Prior to that date, although every day from the 18th was spent in the field and the northern part of the island was traversed on many occasions, not one specimen of a Pierid was seen. At about 9.30 a.m. on the 28th several specimens of *A. j. teutonia* were seen feeding at flowers along Lagoon Road, between the road and the beach (a matter of a few yards). By 10.30 a.m. it was possible to see several specimens at once along the length of Lagoon Road. This sudden appearance of literally hundreds of specimens along the western side of the island was very spectacular. The western side was the only area in which the species was seen on the 28th. A storm in the afternoon reduced flight activity in all species. By mid-morning on the 29th the concentration along Lagoon Road had disappeared and specimens were to be found flying singly over much of the northern end of the island (the southern part is difficult of rapid access). By the 30th very few remained and only single specimens were encountered here and there.

Information obtained from the Lord Howe Island Weather Station showed that a 60 knot NNW wind had been blowing during the night of the 27th and into the morning of the 28th. The butterflies collected on the morning of the 28th were flying in strong winds. The air movement was taking place from sea level to 40,000 feet.

Preliminary reports from co-operators in the Australian Museum migration study project indicate that fairly large scale movements in a generally NW direction were taking place in eastern Australia from the 19th November. It seems likely that the arrival of *A. j. teutonia* on Lord Howe was the result of

displacement of Australian migrating populations. The drop in numbers by the 30th November suggests that the migratory movement continued, the specimens leaving the island.

A. j. peristhene is known from New Caledonia and some other Pacific islands and is recorded from Norfolk Island but apparently not established there. Suitable host plants (*Capparis nobilis*) are present on Norfolk, but known host plants do not appear to have been reported from Lord Howe.

The available data indicate that *A. j. peristhene* and *A. j. teutonia* both invade Lord Howe Island from time to time but neither has become established owing to lack of suitable host plants.

Appias paulina ega (Boisduval)

Collected: 1♀, Lagoon Rd., 28.xi.1969; 1♀, Transit Hill, 29.xi.1969.

In addition to the psecimens taken two others were seen on Lagoon Road, one on 28.xi.1969 and one on 30.xi.1969. The sighting of four specimens from 28.xi.1969, without seeing any earlier, might lead one to suspect that the specimens may have arrived by displacement due to high winds, with *A. java*. On the other hand, previous records are available over a wide range of months (December to May) (Peters, 1969) indicating that the species is probably established and that those seen in November represent the early emerging specimens.

Ledward (according to MS. notes of G. A. Waterhouse in Australian Museum) reported *Hemicyclia australasica* Muell. Arg. be a food plant of *A. paulina ega*. This plant has been recorded on Lord Howe Island (Oliver, 1917).

Danaus plexippus (Linnaeus)

Collected: 1♀, "Pinetrees", 21.xi.1969; 1♂ Clear Place, 27.xi.1969; 1♀, Lagoon Rd., 27.xi.1969; 1♂, "Pinetrees", 21.xi.1969; 1♂, 1♀, Anderson Rd., 29.xi.1969; 2♂ Anderson Rd., 30.xi.1969.

This species was seen in several additional localities in the northern part of the island. Oviposition was observed on *Asclepias curassavica*, which is commonly grown in gardens. The plants were in full flower with some seed pods. Larvae were not esen.

Danaus chrysippus petilia (Stoll)

Collected: 1♂, Lagoon Rd., 27.xi.1969; 2♂, Lagoon Rd., 28.xi.1969; 1♀, Anderson Rd., 29.xi.1969.

A few additional specimens were seen, in or near gardens.

Polyura pyrrhus tiberius (Waterhouse)

Collected: 2♂, Transit Hill, 18.xi.1969. A few additional specimens were seen at Anderson Road.

Hypolimnas bolina nerina (Fabricius)

Collected: 1♀, Lagoon Rd., 26.xi.1969. This very tattered and worn specimen was the only one seen.

Vanessa kershawi (McCoy)

Although five specimens of this species were seen, none was captured. Sightings were as follows: 1, Intermediate Hill, 820', 18.xi.1969; 2, Mt. Eliza, 19.xi.1969; 1, "Pinetrees", 22.xi.1969; 1, Saddle, 1750', Mt. Gower, 25.xi.1969. Suitable host plants are to be found at all altitudes from sea level to the top of Mt. Gower and the species has been recorded as being common (Waterhouse, 1897) although it was not so at the time of my visit.

Vanessa itea (Fabricius).

Collected: 1♂, 2♀, Intermediate Hill, 820', 18.xi.1969; 3♀, Transit Hill, 18.xi.1969; 3♀, 1♂, Transit Hill, 29.xi.1969.

In addition to the specimens taken a few were seen in the northern part of the island, on Transit Hill, at "Pinetrees" and on Anderson Road. One was seen at the Saddle, 1750', Mt. Gower, 25.xi.1969.

Precis villida calybe (Godart)

Collected: 2♂, 3♀, Lagoon Road, 28.xi.1969, 1♂ Anderson Rd., 29.xi.1969.

Waterhouse (1897) records this species as "the commonest butterfly on the island". I did not see any before 28.xi.1969 when they suddenly became common along Lagoon Road. A few were seen on 29-30.xi.1969 in various areas of the northern part of the island. The sudden appearance of this species on the morning of the 28th November suggests that they arrived with *A. java teutonia.* Host plants (e.g. *Plantago, Verbena* etc.) are common.

Family LYCAENIDAE

Lampides boeticus (Linnaeus)

Collected: 1♀, Lagoon Rd., 18.xi.1969; 3♀, 6♂, Lagoon Rd., 19.xi.1969; 1♀, 4♂, Lagoon Rd., 28.xi.1969.

This species was very common but only in the area immediately behind the beaches where sand-holding legumes were growing. It was not seen elsewhere.

Zizina otis labradus (Godart)

Collected: 1♀, 1♂, Lagoon Rd., 19.xi.1969; 2♀, 4♂, Middle Beach Rd., 19.xi.1969; 1♀, 1♂, Middle Beach Rd., 21.xi.1969; 3♀, 4♂, Lagoon Rd., 28.xi.1969; 1♀, Lagoon Rd., 21.xi.1969; 1♀, Lagoon Rd., 18-30.xi.1969.

This species was very common in pastures, along roadsides and areas immediately behind the beaches.

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MIGRATION RECORDS IN AUSTRALIA. 1. ODONATA, HOMOPTERA, COLEOPTERA, DIPTERA AND HYMENOPTERA

by C. N. SMITHERS,
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Despite the fact that insect migrations are frequent and often spectacular in Australia, comparatively few observations have been recorded; most of these relate to species of Lepidoptera. This note is an attempt to bring together records of population movements in some orders; the Lepidoptera will be treated separately. I would like to thank the many people who have submitted reports of migrations and especially Mr. M. S. Upton for providing references to literature on migration in Australia.

ODONATA

AESHNIDAE

Aeshna brevistyla (Ramb.)

Record: *March 8th, 1969*. 35°10'S., 130°40'E., on board m.v. Iron Cavalier, 200 nautical miles from land in Great Australian Bight. 21.00 hrs. S.A.S.T. Temperature 68°F. Weather flat calm, although gale warnings had been received indicating that N. to NW. winds could be expected but these did not occur. Specimens came to mercury arc lamps on ship at same time as a great variety of other insects. (Obs. L. G. Packman.) *Note*: The other insects arriving at the ship at the same time included dytiscid beetles, dragonflies, moths, butterflies and ichneumonids.

Hemianax papuensis (Burm.)

Records: *Easter Sunday*, 1917. Garden Island, 12 miles south of Fremantle, Western Australia. In the morning. Species exceptionally numerous amongst shrubs and being preyed upon by white-winged black terns (Alexander, 1917). *Note*: Although this record cannot be taken as one of a migration, the aggregation of specimens perhaps being due to massed emergence, it suggests that the species might be a migrant in Australia and should, therefore, be watched for future flights.

November 1st, 1939. Off Montagu Island, New South Wales (Dr. D. L. Serventy). *Note*: Specimens in the Australian Museum taken away from land suggest that there may have been a population movement in progress at the time of capture.

CORDULIIDAE

Hemicordulia australiae Selys-Longchamps

Record: *November 19th, 1969*. Hyde Park, Sydney, New South Wales, WNW flight. 13.00-14.00 hours. Large numbers. Copulation observed. Specimens flying up to 100 feet above ground. (Obs. J. V. Peters.)

Hemicordulia tau Selys-Longchamps

Records: *April 18th, 1956*. Mona Vale, Sydney, New South Wales. N. (Obs. K. F. Williams.) *Note*: A specimen in the Australian Museum bears a label "swarm flying due North".

March 8th, 1969. 35°10'S, 130°40'E, on board m.v. Iron Cavalier. 200 nautical miles from land in Great Australian Bight (see under *Aeshna brevistyla*). (Obs. L. G. Packman.)

LIBELLULIDAE

Pantala flavescens (Fabricius)

Record: *April 11th, 1896*. "Nearest land Keeling Islands, N., 20W., 290 miles; NW of Australia, S., 70E, 900 miles. Arrived on ship at night in rain; wind moderate from East. Numerous in cabin and chestroom". (McLachlan,

1896.) *Note*: The data suggest migration from Australia. This widespread species has been recorded as a migrant in other parts of its range.

Undetermined species

Records: *March 25th, 1963*. Lindfield, Sydney, New South Wales. NW. 18.00-1821 hours. Slight NW. wind. 189/21 mins./400-500 yds. Speed estimated 5-10 m.p.h. Moving in ones and twos at heights from 8-30 feet. Flying in fading light. (Obs. K. A. Hindwood.)

March 26th, 1963. Bantry Bay to Oxford Falls, Sydney, New South Wales. W. 1800 hours. "Thousands". About 20 in view in front of car at once. Six feet or higher above car. (Obs. D. Sands.)

March 30th, 1963. Bayview, Sydney, New South Wales. N. From 1600 hrs. Ones and twos. (Obs. L. C. Haines.)

April 28th, 1963. Through centre of Sydney, New South Wales. W. (Obs. D. Sands.)

November 2nd, 1966. Maroubra, Sydney, New South Wales. Large numbers seen. (Obs. P. Staton.)

HOMOPTERA

APHIDIDAE

Neochmosis juniperi (Geer)

Record: *August 8th, 1947*. Fletcher, Queensland. E. (Upton, 1949.)

COLEOPTERA

DYTISCIDAE

Eretes australis Erichson

Record: *March 8th, 1969*. 35°10'S, 130°40'E. on board m.v. Iron Cavalier. 200 nautical miles from land in Great Australian Bight (see under *Aeshna brevistyla*). (Obs. L. G. Packman.)

COCCINELLIDAE

Leis conformis (Boisduval)

Record: *December-January, 1956-60*. Kendall's Lookout, Batlow, New South Wales. Large numbers congregating in toilet shed. (Obs. T. Greaves.)

DIPTERA

SYRPHIDAE

Syrphis viridiceps Macquaert

Records: *October 21st, 1951*. 5-7 miles East of Braidwood, New South Wales. WSW. flight. 15-35 hours. 18/22 yds/10 mins. (Common, 1954.) *Note*: This species was flying with *Vanessa itea, V. kershawi, Agrotis infusa,* ichneumonids and other Hymenoptera.

November 2nd, 1966. Ryde, Sydney, New South Wales. W. 8.00 hrs. Very large numbers. Specimens were feeding at flowers at 15.30 hours. (Obs. J. V. Peters.) *Note*: At the same time migrations of *Xanthogramma grandicorne, Vanessa kershawi* and *Anaphaeis java* were taking place in different directions.

November 2nd, 1966. Turramurra, Sydney, N.S.W. W. 7.30 hrs. Vast numbers. (Se under previous record for other species migrating). (Obs. C. N. Smithers.)

November 11th, 1966. Turramurra, Sydney, New South Wales. W. 7.30 hrs. Vast numbers. *Note*: *Xanthogramma grandicorne* also migrating, 31/30 yds./1 min. (including *X. grandicorne* specimens). (Obs. C. N. Smithers.)

Xanthogramma grandicorne (Macquaert)

Records: *November 2nd, 1966*. Ryde, Sydney, New South Wales. W. 8.00 hours. Very large numbers. Specimens feeding on flowers 15.30 hours. (Obs. J. V. Peters.) *Note*: (See under *Syrphis viridiceps* for other species migrating).

November 2nd, 1966. Turramurra, New South Wales. W. 7.30 hours. Vast numbers. (Obs. C. N. Smithers.) *Note*: (See under *Syrphis viridiceps* for other species migrating).

November 11th, 1966. Turramurra, New South Wales. W. 7.30 hours. Large numbers migrating, 31/30 yds/1 min. (including specimens of *Syrphis viridiceps*). (Obs. C. N. Smithers.) *Note*: (See under *Syrphis viridiceps* for other species migrating).

HYMENOPTERA

THYNNIDAE

Tachynomyia adusta Smith

Record: *October 21st, 1951.* 5-7 miles east of Braidwood, New South Wales. WSW. 15-35 hrs. 20/22 yds/10 mins. (Common, 1954.) *Note*: (See under *Syrphis viridiceps* for other species migrating).

Thynnoides sp.

Record: *October 21st, 1951.* 5-7 miles east of Braidwood, New South Wales. WSW. 15-35 hrs. (Common, 1954.) *Note*: (See under *Syrphis viridiceps* for other species migrating).

ICHNEUMONIDAE

Echthromorpha intricatoria (Fabricius)

Record: *October 21st, 1951.* 5-7 miles east of Braidwood, New South Wales. WSW. 15-35 hrs. 29/22yds/10 mins. (including specimens of *Lissopimpla excelsa*). (Common, 1954.) *Note*: (See under *Syrphis viridiceps* for other species migrating).

Lissopimpla excelsa (Costa)

Record: *October 21st, 1951.* 5-7 miles east of Braidwood, New South Wales. WSW. 15-35 hrs. 29/22 yds/10 mins. (including specimens of *Echthromorpha intricatoria*). (Common, 1954.) *Note*: (See under *Syrphis viridiceps* for other species migrating).

COMMENTS

Records of population movements in Odonata are few for Australia although many species are well known migrants; observation and recording population movements in this group would be a worthwhile contribution to the study of their biology. Clearly, there were large scale movements in Sydney towards the end of March, 1963 which, unfortunately went almost unobserved.

The sudden appearance of a variety of insects of various Orders on m.v. Iron Cavalier in the Great Australian Bight, on 8th March, 1969 under the weather conditions described by Captain L. G. Packman, suggests that forms migrating over land were displaced by wind, probably at high altitude, and transported to the area of observation.

The congregation of *Leis conformis* at Kendall's Lookout suggests aestivation as part of a cycle involving migration and dispersal.

The records of unidirectional, low-level flight by several species at once (Common, 1954) and other observations recorded above suggest typical, long distance migration movements.

Australian conditions offer excellent opportunities for the study of such dispersal flights.

For some of the records given above few details are available. When observing population movements it is important to make a note of the date, place, direction of flight, time of day and weather conditions; if possible, one or more counts should be made of the number of individuals crossing a line of known length over a known period of time. A series of specimens should be collected to determine condition and sex ratio and to enable a positive identification to be made; specimens should be kept for future reference. It is to be hoped that more observers will record their observations so that a general picture of movements in Australia can be built up.

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CORRECTION

by J. V. Peters

In the paper, "Notes on the Distribution of Australian Hesperioidea and Papilionoidea (Lepidoptera)", *Aust. Zool.*, 15(2):178-184, I erroneously credited myself with having collected 1♂ 1♀ of *Jalmenus icilius* at Gulgong, N.S.W. on 9/10.ii.1966. I therefore wish to apologise to Mr. Deniss Reeves as the specimens were very kindly given to me by him and had been bred from pupae collected by himself.

As it was not my intention to publish distribution records other than those of my own collecting and those in the Australian Museum collection I must acknowledge that Mr. Reeves discovered the colony of *J. icilius* at Gulgong and was good enough to show me the locality during Easter 1966.

PRELIMINARY DESCRIPTION OF A NEW BURROWING MUD-SHRIMP FROM EASTERN AUSTRALIA (CRUSTACEA, MACRURA REPTANTIA, LAOMEDIIDAE)

by
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and

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(Figure 1.)

In 1966, we described a new thalassinid shrimp of the family Laomediidae from New Zealand waters as *Jaxea novaezealandiae* (Wear & Yaldwyn, *Zool. Publs. Vict. Univ. Wellington,* 41). At that time we referred in passing to a large, undescribed burrowing laomediid of the genus *Laomedia* from eastern Australian shallow waters (1966: 2, 3). More material of this new form has now become available from mangrove swamps, and from the shallow subtidal channels draining such swamps, and a full illustrated description of this new form is in preparation. Due to unavoidable delays in the completion of this study, it now appears that a colour plate of this eastern Australian *Laomedia* will be published later this year (Healy & Yaldwyn, 1970, *Australian Crustaceans in Colour,* A. H. & A. W. Reed, Sydney, frontispiece) before a formal description is ready. We give here a preliminary description of this species so that its new name can become systematically available.

Family LAOMEDIIDAE

Genus *Laomedia* de Haan in Siebold, 1841.

Not of other authors (cf Neave, *Nomenclator Zoologicus*).

Laomedia healyi n.sp.

A degenerate-eyed, relatively-large, burrowing shrimp with stout, heavily-built and slightly unequal chelipeds. Anterolateral margin of carapace with an orbital spine above *linea thalassinica* and an antennal spine immediately below *linea.* Antennal peduncle short, penultimate segment subequal to ultimate; antennal flagellum with several, prominent, relatively-long, hair-like "branches" irregularly spaced along its length. Chelipeds with fingers heavy and toothed on inner margins. Branchial formula as for *Jaxea novaezealandiae* (i.e. 18 gills present), no podobranch on 1st maxilliped.

Laomedia healyi differs from the only other species in the genus, *L. astacina* de Haan, 1841, from Japan (see Sakai, 1962, *Pubs. Seto mar. biol. Lab.,* X(1):27-34, pls. V-VI), in numerous small details including the possession of an antennal spine on the anterolateral margin of the carapace and the presence of the highly characteristic "branches" along the antennal flagella.

Holotype: A female, carapace length (base of orbit to posterior midline of carapace) 16 mm, from burrow in intertidal mangrove mud, Careel Bay, Pittwater, New South Wales, December 1967, Anthony Healy & J. C. Yalwyn (Australian Museum No. P.15820). The frontispiece of the above mentioned book *Australian Crustaceans in Colour* is a colour photograph of the holotype alive, while the exact type-locality is at the foot of the mangrove tree illustrated

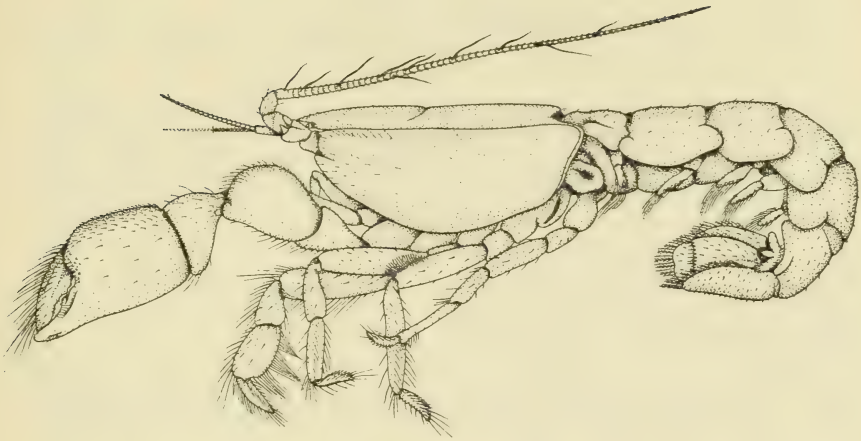

Figure 1.—*Laomedia healyi* Yaldwyn & Wear, Holotype. New South Wales.

at the left of plate 9 in Gillett & Yaldwyn, 1969, *Australian Seashores in Colour,* A. H. & A. W. Reed, Sydney.

Paratype specimens from New South Wales and Queensland are in the Australian Museum collections and will be listed with the full description of this species now being prepared for the *Australian Zoologist.*

ON SOME NEW GUINEA EARTHWORMS

by G. E. GATES
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Earthworm faunas of a few areas have been more or less thoroughly surveyed. Our knowledge of the megadriles of so many other parts of the world is fortuitous, a result of one or more accidental finds. Now, as a result of the interest of a Professor of Social Anthropology in native beliefs about earthworm sounds, three new species are added to the New Guinea list.

A drastic dissection of at least one specimen of each series was necessary. Theoretically a dissected specimen should be the holotype since genus and family can be determined only from internal structure. However, a dissection, even when most carefully made after the best of preservation, inevitably destroys something of systematic value. Accordingly, a holotype is not designated. Cotypes are deposited in the Australian Museum, Sydney.

Pheretima bulmeri, n. sp.

Schrader Range, Kaironk Valley, on ground in forest camp at 8,300 feet, August-September 1968, 0-0-2 (W-4259). Along with two specimens of *P. schraderi*.

External characteristics. Size, 195 by 12 mm. Segments, 104. Colour, in dorsum, slate. Prostomium, seemingly prolobous (1), epilobous and with open tongue (1). Setae, present from iii (unrecognisable in ii), xviii/8,9, 80/region of lxxiv. First dorsal pore, at 12/13.

Polythecal, spermathecal pores minute and superficial (but not seen), at 4/5-8/9. Female pore, in xiv, within a white circular area. Clitellum, annular, brownish but lighter ventrally, dorsal pores, intersegmental furrows and setae unrecognizable. Male pores, minute, each in a slight transverse depression within a longitudinally elliptical porophore that slightly displaces 17/18 and that just reaches 18/19. Genital markings, none.

Internal anatomy. Septa, 8/9 present ventrally (only?), 9/10 lacking (?). Pigment, reddish brown, in circular muscle layer.

Gizzard, massive, in viii. Intestinal origin, in xv. Typhlosole, present from region of xxvii, low and rather irregular. Intestinal caeca, none found.

Hearts, unaborted dorsal portions in viii to gizzard, in ix on left side only, last pair in xii.

(Holandric?) Seminal vesicles, in xi, xii, large. Pseudovesicles, in xiii, vertical. Prostates, confined to xviii, compact, discoidal, of heart-shaped outline with apex laterally. Duct, from median cleft of gland, 4+ mm. long, in a u-shaped loop, ectal limb much thicker and with muscular sheen, lumen circular in transverse section.

Spermathecae, small, subesophageal, coelomic portion of duct shorter than ampulla. Diverticulum, shorter than main axis, reaching onto ampulla, with a short stalk and a slightly longer, ovoidal to ellipsoidal seminal chamber, the latter bifid on at least three diverticula. Numbers of spermathecae (left + right side); 4+5/v, 3+5/vi, 4+4/vii, 2+2/viii, 1+1/ix.

Reproduction. Seminal chambers of spermathecae contained sperm, proving that copulation had been completed. Testis sacs and seminal vesicles, as well as pseudovesicles, were filled with parasitic cysts. Testes and male funnels were not found and if present were rudimentary. The worm presumably was male sterile because of the heavy parasitic infestation. Cysts were lacking on and near the spermathecae.

If the dissected worm was female fertile, reproduction could have been amphimictic but the supposedly normal copulatory partner would have been cheated. Amphimixis is anticipated in normal worms.

Ingesta. Humus, including fibres 10-20 mm long, some with several lateral branches.

Parasites. In addition to the already-mentioned cysts, nematodes were present at least in coelomic cavities of viii-ix. Coelomic cysts reached a length of 1 mm.

Remarks. Both worms were macerated in a postclitellar region. However, presence of intestinal caeca in the macerated region is not anticipated.

Systematics. Polythecal species of *Pheretima* with spermathecal pores at 4/5-8/9 are *P. sibogae* Michaelsen, 1922, and *P. lavangguana* Gates, 1957. The first-named species is known only from a description of a macerated anterior fragment from the island of Lombok. Even though locations of the last hearts and of the testes are unknown, the species is distinguished from the New Guinea worms by the presence of genital markings and by the meroandry (instead of holandry). *P. lavangguana* is known only from the original description of a number of worms secured at Rennell I., British Solomons. The species also differs from the New Guinea worms in presence of genital markings and additionally by clitellar shortness, smaller size, paired female pores, presence of intestinal caeca, etc.

Pheretima kaironkensis n. sp.

Schrader Range, Kaironk Valley, rotten log in forest at 8,300 feet, August-September 1969, 3-0-0 (W-4258). R. Bulmer.

External characteristics. Size, 67-90 by 4 mm, the shortest worm a posterior amputee. Segments, 90, 97. Colour, white (alcoholic preservation). Prostomium, epilobous, tongue open (1 specimen), closed (1). Secondary annulations, none. Setae, present from ii, small rather closely but regularly spaced, in circles without regular gaps, retracted, tips just recognizable under high power of the binocular, vii/15, viii/17, xviii/11, 23/ii, 65/region of liii. First dorsal pore, possibly at 10/11 but certainly recognizable only from 12/13, pores small.

Spermathecal pores, minute, superficial, 5 pairs, at 4/5-8/9, quite obviously less than ½C apart. Female pores, equatorial in xiv (? in a space *ca.* 3 intersetal intervals wide). Male pores, transverse small slits at eq/xviii, *ca.* 4 mm apart, each at centre of a slightly elongated portion of xviii, male porophores not yet delineated. Genital markings, two pairs, of transversely elliptical outline, centred about at male pore levels, just behind 17/18 and just in front of 18/19.

Internal anatomy. Septa, none thickly muscular, 8/9-9/10 complete but membranous. Special longitudinal muscle band at mD, recognizable only behind 10/11. Pigment, none visible at incisions through body wall.

Gizzard, in viii. Intestinal origin, in xv. Intestinal caeca, paired, large, simple, with bluntly rounded anterior ends, from region of xxvii. Typhlosole, none.

Hearts; of ix slender and present on both sides, of x present on both sides, last pair in xii.

Metandric. Testis sacs, paired, subesophageal but not in contact with each other mesially. Seminal veiscles, vertical, in xii. Prostates, thin, flat, discoidal, at first seeming to have a transversely elliptical outline, but actually heart-shaped, one half being bent over against the other. Duct, *ca.* 1 mm long, from median notch, lumen slit-shaped in cross section.

Spermathecae, with ducts shorter than ampullae and mostly within the parietes. Diverticulum, small, from anterior face of duct, just below ampulla, berry-shaped, with 3-4 transparent chambers.

Reproduction. Although listed above as juvenile, a more accurate characterization might be early adolescent as GM rudiments were recognized after a second and more careful search under highest power of the binocular.

Amphimixis is anticipated because of absence of any evidence to the contrary.

Ingesta. Humus, including bits of wood up to 4 mm. long.

Remarks. The species is assumed to be unpigmented though some megadrile pigments are leached by alcohol.

Internal reproductive organs probably have been adequately characterized for systematic purposes. Absence of clitellate material necessitates an assumption that male pores and the genital markings will not be invaginated during further development but will remain superficial.

Systematics. Relationships are to be sought with species having paired, simple intestinal caeca from the region of xxvii, last hearts in xii, 5 pairs of spermathecal pores at 4/5-8/9 and testes only in xi. No such species has been recorded from New Guinea or elsewhere. *P. colossus* Cognetti, 1911, and *P. freesei* Ude, 1924, both from New Guinea and perhaps the most closely related, are distinguished by presence of hearts in xiii, greater soma size (in *P. colossus* reaching a diameter of 18 mm), muscularization of 8/9-9/10, etc. Spermathecae are more like those of *P. colossus,* diverticula lacking in *P. freesei.*

Pheretima schraderi n. sp.

Schrader Range, Kaironk Valley, rotten log, in forest at 8,200 feet August-September 1968, 0-1-2 (W-4257). *Idem,* on ground in forest camp at 8,300 feet, 0-0-2 (W-4259). *Idem,* "6 feet up in soil debris in pandanus palm, at 8,400 feet", 1-0-1 (W-4263). R. Bulmer.

External characteristics. Size, 235 by *ca.* 10 mm. Segments, 94, 101, 103. Colour, white (alcoholic preservation). Prostomium, deeply withdrawn into buccal cavity and seemingly prolobous (1), shape indeterminable as buccal cavity is everted (others). Setae, present from ii, regularly and fairly closely spaced, circles without regular gaps, viii/17, xvii/20, xviii/11, 13, 12, 83/region of lxxx. First dorsal pore, at 10/11 (2 tree worms), 11/12 (5 specimens).

Spermathecal pores, 4 pairs, small, transversely slit-like to crescentic, at 5/6-8/9, less than ½C apart. Clitellum, annular, brownish, dorsal pores occluded, intersegmental furrows obliterated, setae unrecognized, not quite reaching 13/14 but extending slightly into xvii (2). Female pore, at centre of a whitish area (4). Male pores, small transverse slits, each at centre of a gap in the setal circle about equal to 3-4 intersetal intervals, about 5 mm apart though seemingly not widely separated, special porophores not delineated.

Genital markings, small, transversely elliptical in outline, centred at male pore levels (5), indistinctly demarcated, greyish translucent areas, perhaps mostly in (or even confined to) xviii, seemingly crossing slightly into xvii and xix (1), most obvious on the aclitellate individual where they may be confined to xviii.

Internal anatomy. Septa, none thickly muscular, 8/9-9/10 present but membranous. Special longitudinal muscle band at mD, recognized only behind 11/12. Pigment, none distinguishable at incisions through the body wall.

Gizzard, in viii. Intestinal origin, in xv. Intestinal caeca, simple, in xxvii-xxv (3). Typhlosole, rudimentary, quite irregular.

Dorsal blood vessel, filled with blood anteriorly and traceable to its bifurcation under the brain. Hearts; unaborted dorsal portions in viii to the gizzard, in ix-x present on both sides of each segment, last pair in xii (3).

Metandric. Testis sacs, subesophageal, not in contact with each other mesially. Seminal vesicles, in xii, large, bulging 11/12 anteriorly and 12/13 posteriorly, each folded onto itself twice into a longitudinal mass, with a small primary ampulla of different colour and texture, directed dorsally just behind 11/12. Prostates, confined to xviii, compact, discoidal, with a heart-shaped outline, apices laterally. Duct, from median cleft, not slender, 1.5 mm long.

Spermathecae, medium-sized, flattened against parietes, ducts shorter than ampullae and almost confined to body wall. Diverticulum, small, from anterior face of duct just below ampulla, bifid almost to base, or with three incisions of ental margin, or even with five possible seminal chambers.

Reproduction. A few flecks of male-funnel iridescence may have indicated presence of sperm thereon. Opaque areas in the otherwise translucent content of the spermathecal seminal chambers may also have been sperm. The texture of the unusually large seminal vesicles is consistent with a massive maturation of sperm. Reproduction is expected to be amphimictic.

Ingesta. Humus.

Parasites. Fairly large cysts in xviii-xix were visible through the transparent body wall of one specimen.

Remarks. The collector provided interesting comments on this species. Colour, yellow or bright yellow. Extremely muscular and vigorous. Emitted sprays of a yellow fluid from body pores and a particularly forceful jet to a range of four feet from the anus. With a barely audible squeak. Odour, distinctive and to the native Karam, offensive.

As in Burma this (and perhaps other) species sometimes comes to the surface in large numbers. The occurrence is regarded by the natives as an evil omen. One said to Prof. Bulmer, "If worns whose proper place is in the earth come to the surface and die, surely this means that men are going to die also." The native explanation of presence in trees might have been interesting.

Size of the adult pandanus worm, 250 by 10+ mm (without allowance for maceration), seems rather large for tree climbing, especially in absence of the adaptations shown by the smaller, truly arboricolous earthworms. Perhaps the adult reached the tree niche while a young juvenile. Size of the tree juvenile, 110 by 4 mm, already is larger than that of most arboricoles.

What is responsible for the yellow appearance of live worms, also mentioned for specimens of *P. kaironkensis* by Prof. Bulmer, remains to be determined. Softening of the anterior end, or eversion of the buccal cavity, obviated some prostomial characterizations. Segmental counts of setae usually were not attempted to avoid further handling of specimens already softened in postclitellar regions. Intestinal caeca and typhlosole were completely unrecognizable in the first dissected specimen.

Systematics. Relationships of the species are to be sought with metandric forms having spermathecal pores at 5/6-8/9, simple intestinal caeca in the region of xxvii, and the last hearts in xii. Species so characterized are: *P. queenslandica* (Fletcher, 1886), known only from Queensland, Australia. *P. spectabilis* Ude, 1932 (*non* Rosa, 1898), from an unknown locale in New Guinea. *P. versteegi* Michaelsen, 1938, known only from the original account of 3 softened specimens from Brenhef, Indonesian New Guinea. The present worms differ from the first-named species in number and location of genital markings, the single female pore, presence of 7/8, and absence of muscularization of 8/9-9/10. Differences from the second species are the characteristic heart-shape of the prostates and their confinement to xviii, absence of genital markings in xix-xxii. Differences from the third species are: smaller size, fewer setae per segment, membranous condition of septa 8/9-9/10, spermathecal shape, presence of genital markings, shorter and straight prostatic ducts.

Three further species must now be considered because of Michaelsen's failure to mention location of the last pair of hearts. From *P. bryoni* Michaelsen, 1932, known only from Bali, the New Guinea species is distinguished by larger soma size, better developed intestinal caeca, shorter spermathecal diverticula and presence of genital markings. From *P. doormani* Michaelsen, 1924, known only from specimens secured at Doormanpad, Indonesian New Guinea, the new worms differ in the larger soma, unpaired female pore, number and location of the genital markings, presence of septum 9/10. Differences from *P. vialis* Michaelsen, 1924, known only from the same locality as *P. doormani,* are; unpaired female pore, presence of genital markings, presence of 8/9, membranous condition of 9/10, undiverticulate spermathecae, seemingly with a much less muscularized spermathecal duct.

Too much importance probably should not be attributed to some septal characters reported in the past. Internal evidence in the text occasionally indicates determination of serial septal order was erroneous. The above-mentioned differences do distinguish some species of *Pheretima* from each other. Systematic values in the instances just cited require confirmation from much larger samples, more especially from better preserved material.

Other Species

Three lots of smaller earthworms were in too poor condition to determine most of the desired external characteristics. Dissection of anterior fragments enabled securing some data demonstrating existence of yet other species in the Kaironk Valley. Like the preceding all are of the same genus. To date no

reason has been found for thinking that any New Guinea endemics are not of the genus *Pheretima* as now understood.

Pheretima sp. I

Schrader Range, Kaironk Valley, dug up 6-18 inches below surface in Miscanthus fallow, 7,300 feet (W-4260). R. Bulmer.

External characteristics. Colour, white, except the dark slate of clitellar segments. Spermathecal pores, 5 pairs, at 4/5-8/9. Female pore, in xiv, at mV. Male porophores, indistinctly delimited but probably circular and reaching 17/18, 18/19. Male pores, each minute, superficial, at centre of a small circular area at middle of a porophore. Genital markings, none.

Internal anatomy. Septa, 8/9 present but membranous, 9/10 lacking, 4/5-7/8 thickly muscular. Intestinal caeca, none. Hearts, in ix on right side only, last pair in xii.

Holandric. Seminal vesicles, in xi, xii. Prostates, extending through several segments. Duct, 3+ mm long, in a U-shaped loop, ectal limb thicker and with muscular sheen. Spermathecae, small, subesophageal, ducts shorter than ampullae. Diverticulum, from median face of duct close to parietes, pear-shaped, shorter than main axis but reaching onto ampulla.

Abnormality. Clitellum and male pore of left side one segment anterior to positions on the right side.

Remarks. Spermathecal and male pores were not seen. Positions were determined from the dissection. Differences between the prostates of this species and those of the preceding taxa may prove to be of some systematic interest.

Pheretima sp. II

Schrader Range, Kaironk Valley, 4-6 feet up in soil and debris in Pandanus palm, 8,400 feet (W-4261). R. Bulmer.

External characteristics. Colour, red, lacking at segmental equators and just under intersegmental furrows. Spermathecal pores, one pair at 6/7. Genital markings, none.

Internal anatomy. Septa, 8/9 present but membranous, 9/10 lacking, none thickly muscular. Intestinal origin, in xvi. Intestinal caeca, simple, in region of xxvii. Last hearts, in xii.

Holandric. Seminal vesicles, in xi, xii. Spermathecal ducts, without sheen but not slender, longer than ampullae. Diverticulum from anterior face of duct midway between parietes and ampulla, with short, slender stalk and longer, ovoidal to ellipsoidal seminal chamber.

Reproduction. Although dissected worms are aclitellate some sperm already had aggregated on the male funnels. No iridescence was distinguishable in spermathecae (2 specimens). Right spermatheca and left prostate of one worm were lacking. Such defects in the genitalia are of the kind that develop after reproduction becomes parthenogenetic. Although sperm are present on male funnels, parthenogenesis is suspected but in absence of male sterility. If that is true, an amphimictic population may have more than one pair of spermathecae though how many should not now be guessed.

Remarks. This is the first time there has been reason to suspect parthenogenesis in a New Guinea pheretima.

Pheretima sp. III

Schrader Range, Kaironk Valley, 4-6 feet up in soil and debris in pandanus palm, 8,400 feet, (W-4262). R. Bulmer.

Remarks. The dissected fragment, white, was too young to show rudiments of spermathecae but the following data were obtained.

Septa, 8/9-9/10 present but membranous, none thickly muscular. Intestinal caeca, simple, in region of xxvii.

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A NOTE ON MARINE PISCICOLID LEECHES FROM PORT PHILLIP BAY, VICTORIA[1]

by LAURENCE R. RICHARDSON[2]

(Figure 1)

The following gives the first records for continental Australian waters of two species of marine fish-leeches recognized previously in Tasmania by Ingram (1957). One, *Branchellion parkeri,* shows an intermediate phase in the development of the colour pattern; the other, *Austrobdella bilobata,* provides a more detailed description of the somital annulation than was given by Ingram.

In preparing an annotated list of the Australian leeches (Richardson, 1968), no records were found of marine leeches from Port Phillip Bay, although such are contained in the collections of the National Museum of Victoria. In 1967, I noted 6 vials. Four hold 3-annulate pontobdellids taken between 1892 and 1902; three (G.854, G.855, G.858) noted as from the Port Jackson Shark, *Heterodontus portusjacksoni,* and two of these from Mordialloc, in the Bay. Moore (1957) identified 5 specimens of a pontobdellid taken from this host off Hobart, Tasmania, as *Pontobdella rayneri* Baird 1869, a species based originally on a single small specimen taken from *Rhinobatis* sp. at Shark's Bay, W. Australia, and described by Baird in a simple and inadequate manner. Johansson (1911) assigns to *rayneri,* another small specimen taken from the same host at Shark's Bay. Moore describes the Tasmanian specimens only as "agreeing with Johansson", i.e. a 3-annulate pontobdellid with a clitellum of 5 tuberculate annuli, and gives no further details. Llewellyn (1966) has studied Baird's type, reports the condition does not permit improvement on his description, recognizes the leech as "almost certainly a member of the genus *Stibarobdella*" and reduces *rayneri* to the status of genus et species inquirenda. Llewellyn gives no indication that he has seen Johansson's account. In brief, even at this time, the Port Jackson pontobdellid has no established zoological status.

Of the other two vials, one (G.857) contains a *Branchellion* from Mordialloc; the other (G.859), a piscicolid from *'Pleuronectes'*. These may possibly be referable to the following species.

Branchellion parkeri Richardson 1949 (Fig. 1, A.)

A single specimen, 26.0 mm. in total length, taken by Mr. T. Lewis on the Elephant Shark, *Callorhynchus milii,* Port Phillip Bay, sent to me by Dr. J. C. Pearson of the Department of Parasitology, University of Queensland. (Dep.: Nat. Mus. Vic. G.1539).

The anterior sucker is as long as wide, 2.0 mm., set off from the pregenital region which is subcircular in section, 5.0 mm. long and separated by a well-formed prepuce from the abdomen. The abdomen is 18.0 mm. long, with a maximum width of 4.0 mm; the centrally attached posterior sucker, large, deeply cupped, 4.0 mm. wide, prominently and richly clad on the ventral surface with small low attachment discs. Extended, with the annulation poorly defined on the pregenital region; but ventrally, xiii $a_1 < a_2 > a_3$, with the first pulsatile vesicle quite submarginal on a_2 which has a furrow on it dividing it into ($b_3 > b_4$); the first pair of gills on xiii a^3; xiv to xxii, 3-annulate, the annuli subequal, branchiate, and a pair of pulsatile vesicles submarginal on a_2 of each somite; xxiii, 3-annulate, each annulus with a pair of gills, but no pulsatile vesicles; so that there are 31 pairs of gills and only 10 pairs of pulsatile vesicles. Somites xxiv and xxv appear undivided; the anus at xxv/xxvi; and xxvi and xxvii, undivided.

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[1] This paper has been prepared during the course of studies on the Australian leeches assisted by a grant from the Nuffield Foundation.

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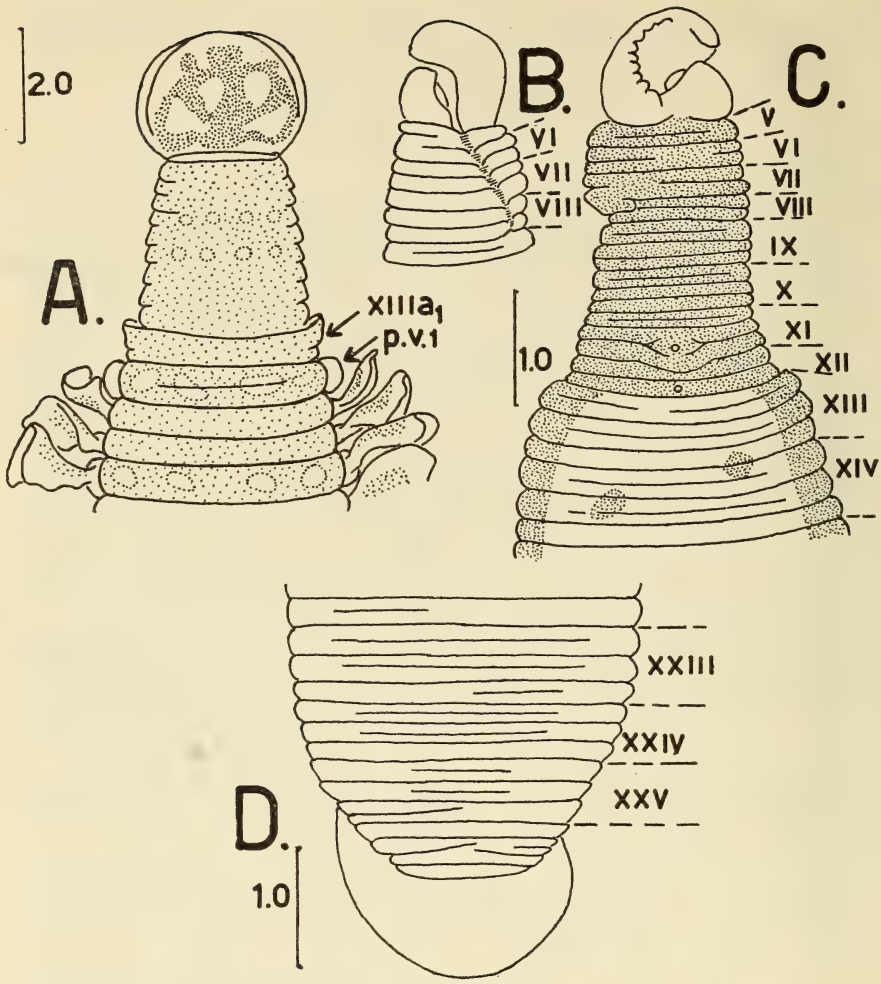

Figure 1.—A., *Branchellion parkeri* Richardson 1949. Anterior sucker and portion of body to show distribution of pigment, and pattern. Pregenital indications of annulation, non-morphological.

B. *Austrobdella bilobata* Ingram 1957. The dorsal aspect of the anterior sucker and first few somites showing division of the sucker and extent of the wound.

C. *A. bilobata.* Ventral aspect of anterior sucker, pregenital, genital and anterior abdominal somites, showing annulation, distribution of pigment, and pattern.

D. *A. bilobata.* Dorsal annulation of posterior abdominal somites. Somites indicated by roman figures; annuli, a_1, a_2, etc.; p.v. 1, first pulsatile vesicle. Scales in mm.

The dorsum of the anterior sucker shows a pattern transitional between the two simple concentric rings of smaller specimens and the large simple patch of larger specimens. There is a median longitudinal band connected anteriorly and posteriorly and by anteriorly directed oblique bands midway along its length, to a single circular band which has a median and two anterolateral marginally directed processes. The pigmented dorsum of the pregenital region carries two transverse rows each of 4 well-defined circular patches, as also on xiii a_2, and on the a^2 of somites back to xxii behind which the dorsum is plain; the dorsum and venter of the sucker and the venter of the entire body, immaculate white.

Previously (Richardson, 1968) the only information was that the types of *Branchellion lineare* Baird 1869 and *B. punctatum* Baird 1869, both from King George Sound, Western Australia, were no longer available. The descriptions were inadequate in such manner that the species could be given no zoological standing. Mr. R. W. Sims, Annelida Section, British Museum (Natural History) advises me (Pers. Corresp.) the types have been located and are in good condition.

B. parkeri is recognizable in the fauna as known, by the absence of tuberculations; the presence of transverse rows each of 4 white patches on the dorsum of neuromeric annuli; 31 pairs of gills; and only ten pairs of pulsatile vesicles, the first on xiii a_2 anterior to the first gill, the last at the base of the 27th gill, the 5th last in the series, on xxii a_2.

The species was recorded originally in New Zealand from *Squalus acanthias,* later from *Mustelus antarcticus, Dasyatis brevicaudatus; Callorhynchus milii,* (Richardson, 1949, 1953); in Tasmania (Ingram, 1957) from *Raia lemprieri, Pristiophorus sp.,* and *Dasyatis sp.*

Austrobdella bilobata Ingram 1957 (Fig. 1, B, C, D).

A single specimen taken November 16, 1969 by Mr. C. Goode on a young flounder 40.0 mm long in 9 to 12 inches of water in Port Phillip Bay at Frankston. Sent me by Mr. John Goode of Frankston. (Dep.: Nat. Mus. Vic. G.1540).

The total length, 13.0 mm; the anterior sucker, hood-like, damaged (v.i.) but apparently as long as wide, sharply set off from the subcylindrical pregenital region which is 2.3 mm long by 1.5 mm wide; the genital region, short, wider than long; a well-formed prepuce; the abdomen, depressed, flat above and below, with narrowly rounded margins, 9.5 mm long and 3.0 mm wide; the posterior sucker, circular, 2.0 mm in diameter, smooth on the ventral surface.

Strongly pigmented; the anterior sucker paler than the dark bluish grey on all aspects of the pregenital and genital regions and on the dorsum and margins of the abdomen; the venter of the abdomen with bluish grey margins, and otherwise whitish with spaced and moderately numerous medium sized bluish grey maculae; the sucker pale grey above and light below where it shows regularly spaced minute marginal pigment spots.

There are no papillae, tubercles, or obvious somital sense organs; the skin, smooth in all regions; no pulsatile vesicles.

There are no eyes or indication of annulation on the anterior sucker. The first few annuli of the pregenital region are damaged and erratic above, but below there is agreement with Ingram's description where the first 8 annuli are simple, the 9th subdivided incompletely, the 10th, simple, and following annuli subdivided.

Somital limits are uncertain for v, (possibly $a_1a_2+a_3$), as also vi; vii apparently, and viii definitely both 2-annulate; ix 3-annulate, $a_1(b^1+b_2)>a^2 = a_3$ below; x, 3-annulate, $a_1(b^1+b^2)>a_2 = a_3$; xi, 3-annulate, $a_1(b^1+b^2) = a_2<a_3$, and the male pore at a_2/a_3; xii, 2-annulate, $a_1a_2=a_3$, the female pore median in a_3, so that there are five annuli in the clitellum and two full annuli between the genital pores; xiii to xxiv, 3-annulate, with the somital limits recognizable above and below by the incomplete division of a_1 and a_2 by fine furrows lacking from a_3 which is simple, i.e. $a_1(b^1+b^2)$ subequal to a_2 $(b_3+b_4)>a^3$

which may show indications of a fine furrow in xx to xxiii but only on the dorsum and on one side or the other; xxv to xxvii, erratically and irregularly annulated with the somital limits unrecognizable.

Dissection was not attempted.

The above description differs from Ingram's in small details: both suckers are unpigmented; the venter, maculate, not plain; only the posterior abdominal somites (xxi-xxiii) show a secondary furrowing on a_3; the female pore is in a_3, not between the two annuli of xii. With more material, these differences might be found to have some minor significance.

The anterior sucker and dorsum of somites v to viii have been damaged by a wound commencing slightly to the left of the mid-dorsal line at the margin of the sucker which is divided to the base into two separate parts, the right the larger, and the wound continuing obliquely over the dorsum of v to viii. The cut edges of the sucker and the wound on the anterior somites have healed.

The sucker damaged to this degree could not serve as an organ of attachment in the manner recognized as essential for the insertion of the proboscis, and feeding; but the indications are that the leech is in good condition and that there has been no interference with its nutrition.

The species is recognizable in the simple form; absence of eyes, tentacles, tubercles, pulsatile vesicles; the secondary, incomplete furrowing of the annuli; the plain dark bluish grey of the dorsum, and of the venter of the pregenital and genital regions; the dark margins, and white venter of the abdomen. The colour and pattern are unusual and possibly highly distinctive.

A. bilobata is known (Ingram, 1957) previously from flounders, *Rhombosolea tapirina,* at Pittwater, Tasmania.

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I would thank Dr. J. C. Pearson, and through him Mr. T. Lewis; Mr. John Goode, and through him Mr. C. Goode, for the opportunity to study these specimens; and the Science & Industry Endowment Fund for the loan of microscopic equipment.

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A CONTRIBUTION TO THE HISTORY OF THE AUSTRALIAN MEDICINAL LEECH[1]

by LAURENCE R. RICHARDSON[2]

The authoritative 'New Dictionary of Arts and Sciences' in the 2nd edition of 1764, refers to phlebotomy, bleeding by venesection, as "not only one of the most useful, but one of the most ancient operations in surgery", details at length the many procedures, and describes as equally ancient the use of the leech in bleeding. Venesection began a decline in popularity toward the end of that century. Recourse to bleeding continued, with the application of the leech progressively displacing the scalpel. Moquin-Tandon (1846) records 3,000,000 leeches used in Paris in 1825; 20 to 30 million annually in France; estimations of 363,000 litres of blood removed in one year with the use of 12 million leeches; and of the great industry developed to provide these quantities of leeches. With natural supplies falling below demand, leech farms were established. Horse trains transported leeches in panniers over distances of 200 miles and more to the leech markets at Hamburg, Stettin, and Bordeaux. Customs records show imports into France of nearly 500 million leeches between 1827 and 1844; and exports to England (5 milion in 1824, retailing at 1/- to 2/- each); to Africa; the West Indies; North America; etc.

The use of the leech was gaining popularity in Europe during the early years of medicine in Australia. There is no known record of an export to this country. The discovery and use of large Australian sanguivores would have been early, for such leeches were, and still are available in the vicinity of Sydney, Melbourne, Perth, and in the inland river systems. The leech literature has no records of leeches in Australia during the first period of settlement. Evidence of the use of the Australian medicinal leech in that period has been kindly supplied to me by Mr. Gilbert P. Whitley, as follows:

> Fresh leeches wanted by John Nielson,
> Surgeon, Hunter Street, Sydney.
> *The Australian,* Nov. 17, 1835.
>
> LEECHES. To be had at Mr. Burke's, Surgeon,
> George-Street, South, corner of Liverpool-
> Street, Sydney.
> *Sydney Gazette,* Dec. 15, 1835;
> also Jan. 5, 1836.
>
> Fine Healthy Leeches at J. B. Bossley's.
> *The Australian,* July 20, 1838.
>
> Tenders for leeches for the Benevolent
> Society will be received on or before
> December 21st, 1840.
> *The Australian,* Dec. 12, 1840;
> repeated to the same effect in 1842.

I do not have the opportunity to follow these indications further, but there is sufficient here to show that the medicinal virtue of the Australian leech was fully established at an early date. This strengthens the probability that the leech obtained in Sydney about 1855 and named *Hirudo quinquestriata* by Schmarda in 1861, was purchased from a surgeon or pharmacist, a probability suggested by Schmarda's note that the leech is not unusual in the Cook's

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[1] Prepared during the course of studies on Australian leeches conducted with the aid of a grant from the Nuffield Foundation.

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River and in waterholes at the foot of the Blue Mountains, and brought into Sydney and other places in New South Wales. The note has the quality of over-the-counter hearsay.

The very capable pioneering pharmacist, Dr. Joseph Bosisto, was President of the Pharmaceutical Society of Melbourne when he read a paper before the May meeting in 1858 of the Philosophical Institute of Victoria, giving the results from his 5 years of study on "the best description of the medicinal leech in this country—found in the river Murray and its tributaries, and in no one instance have I met with, from these rivers, any description but that of *Hirudo australis*." Bosisto (1859) briefly described the leech, which was figured by Becker, and as I now find has not been recognizably described again since then. They also described a horse-leech which has only recently been rediscovered (Richardson, 1970).

Bosisto described the small cocoon, deposited in May, containing 3 or 4 small red leeches. This still remains the only published knowledge of the reproduction of this and the other aquatic sanguivores in Australia. The recommended method of keeping the European leech was in wooden or earthenware vessels half-filled with water, and with a layer of turf, moss and charcoal on the botom. Bosisto found this 'entirely fails' with *H. australis* which he established could be successfully kept in fine clay moistened to the consistency of mud. In terms of the increasing demand and diminishing supplies in Europe, Bosisto made out the case for an export trade. He estimated that 1,000 dozen leeches could be successfully transported in a wooden half-cask, 3 feet in diameter, packed with 8 inches of clean clay, moistened occasionally to prevent hardening. Here, Bosisto had discovered the ability of the Australian leech to survive dry conditions by burrowing into wet mud, a habit with such leeches elsewhere which, if known, was certainly not a matter of general knowledge. The paper is short, filled with fresh and useful information, and practical.

There is evidence that an export was initiated. Baird (1869) describing leeches held in the collections of the British Museum, foot-notes: "A cargo of leeches was lately imported into England from Australia; but the demand for leeches being now much restricted owing to the disuse of blood-letting by medical men in this country, it appears that they were almost all thrown into the Thames. Three or four specimens were saved from the mass, and kindly sent to the British Museum by Mr. Morson of Southampton Row." Baird identified these leeches as *Hirudo quinquestriata*. This cannot now be accepted as reliably indicating that they came from Sydney, and not Melbourne; but with recent knowledge, the origin might be determined. There is no later record of the Australian leech in the Thames (Richardson, 1968).

From here on, other than descriptions in the pharmacopoeias in the 1880's and later, with directions for the care and use of *Hirudo quinquestriata*, there is so far as I have seen, a complete gap in the recorded history of the Australian medicinal leech until Boardman (1933), who refers to a sign displayed in the window of a chemist's shop in Sydney, 'Leeches sold here', and notes that the proprietor found there was still a limited demand for leeches. This was the final decade for the leech.

Recollections extending back to 1903, from senior pharmacists, are assembled below to give a picture of the medicinal leech in Australia from the beginning of this century, a picture probably quite representative of the last 20 or so years of the previous century. No information came from South Australia where Bosisto's leech would be available locally, and the picture is probably much the same as elsewhere; nor from Queensland, where the readily available sanguivores of the coastal freshwater systems are small and of such limited capacity as to be hardly suitable for blood-letting. Larger and suitable leeches were available but less accessible in inland systems.

The wholesaler Rocke, Tompsitt & Co. of Melbourne, provided selected leeches in lots of 25 as required. Stock came from the Murray River, where collectors pegged the skin of a freshly killed sheep on the bottom in suitable

localities, with the wool-side uppermost. The leeches attached to the lower side of the skin. This Australian collecting technique was probably discovered in the use of skins pegged down in this manner to catch fine alluvial gold. Leeches were placed in containers with mud, half-filled with water. Felton Grimwade were supplying leeches around 1913 at a wholesale price of 35/- per 100, and interstate.

Otherwise, the pharmacist arranged his own supply. There was a casual supply from boys who waded bare-legged in the swamps at one time common in the vicinity of Sydney and Melbourne. These received up to threepence and sixpence a leech; but everywhere this source was considered haphazard, erratic, and undependable. Regular dependable, older suppliers served probably more than the one pharmacy.

The pharmacist in Perth was fortunate. Mr. Harris, an aborigine of North Perth, contacted by post, would supply 300 leeches at a time. He kept secret the locality, but as he borrowed a horse, this was believed to be Bibra Lake. His technique was to strip, wade into the water, in time come out and transfer the leeches into beer bottles (a container causing obvious difficulties). He claimed "Leeches no bite black man". He received one penny per leech.

Some pharmacists waded swamps for their own stock of leeches. There was one difficulty. At certain periods in the summer, venomous snakes became so dangerous that collections were not made at these times. No data were given on the collecting rate. In my own field work, I find the large sanguivores average about one to the square yard. They are capable swimmers, and can overtake a slowly moving person; attach rapidly; are relatively slow to bite, rarely commencing a bite in under 30 seconds; and when anticipated, the presence of the leech can be sensed, and the leech removed from the leg without difficulty. Moving slowly, the collection rate is more than one a minute.

Leeches were held in the pharmacy in the manner of Bosisto, with about 2 inches of clay in the bottom of a 5-gallon wooden cask three-quarters filled with water, closed over with a tightly fitting fine wire mesh; in an earthenware jar containing water, closed over with linen or a double layer of gauze, tied down securely; in tall glass cylinders, 18 inches high, 6 in diameter, closed with linen; and large spherical glass containers with a closely fitting glass lid. A feautre of the container was that the mouth must pass the closed hand. It was well recognized that the leech is a determined and expert escaper. Water would be changed once a week in cool weather, daily or twice daily in summer, and as indicated by the deposition of a black slime. In very hot periods, the glass containers would be wrapped in toweling which would be kept wet. The anticipated life was 2 to 3 months. With stocks ranging up to 1,000 and more leeches, loss could be significant.

During the last century, all indications for venesection were equally indications for the application of the leech, with increasing preference for the leech, and application of the leech as the treatment of choice for the swollen black eye and other subcutaneous vascular congestion. In the later years, the leech became the treatment of resort in pleurisy, pericarditis, meningitis, appendicitis, etc. These and other uses did not immediately depart from medical practice with the turn of the century. East and Bain (1931) discussing the role of venesection in the relief of congestion of the great veins in acute cardiac failure, drew attention to the genuine relief of venous engorgement of the liver by the application of six leeches along the right costal margin, noting that the relief is not related to the amount of blood which is removed, and that the patient welcomes the application of the leech.

It appears that the greater number of leeches were supplied to ophthalmic surgeons, some of whom used large numbers; or applied by the pharmacist in the treatment of bruises such as incurred during sporting events, and in the treatment of the black eye for which there was much demand following the closing of hotels on Saturday nights.

Leeches were dispensed for immediate use in willow chip boxes, with a wet plug of the best absorbent cotton wool in warm weather; for suburban delivery, in a 2 oz. glass jar, 2/3rds full of water and with sufficient cotton wool to absorb this; or as in Perth for shipment by rail to Kalgoorlie, as for suburban delivery but with the jar packed in wet sawdust or newspaper, labelled perishable and urgent, and placed on the train at the last moment. Leeches shipped in this manner were seldom lost in transit.

Retail prices varied according to cost. When bought from individual suppliers, less than 1/-; generally 1/- to 2/- when bought from supply houses; and even occasionally up to 3/-. It might require 4 leeches to reduce a badly swollen black eye.

Application varied. The leech might be placed in the lid of the chip box; in the tray of a partly open match box; or in a small test-tube; and brought to the skin which had been cleaned with soap and water. The leech reluctant to bite was encouraged by the application of a drop of milk rubbed onto the location chosen for the leech. It was important that the leech be kept under observation by the operator, particularly so when used near the mouth, nose or other apertures. The leech might be allowed to feed to repletion, when it would drop off, a matter of twenty minutes; or the treatment terminated as desired with a sprinkle of sodium chloride, and the leech then washed. Forcible removal was avoided from a danger of leaving teeth in the incision.

Persistent haemorrhage did occur; was cause for concern; and presented some difficulties as shown in reference to the use of: pressure; collodion; tincture of Fe cl_3; alum block; borax crystals; adrenalin; puff ball; and even the hare-lip needle with a figure-8 of thread. There is comment that treatment for haemorrhage was not always successful. The terrestrial leeches were avoided as producing quite uncontrollable haemorrhage.

The fed leech was encouraged to disgorge, which it might do when sprinkled with salt; placed in camphor water, or a soap solution. It was then washed, moved into distilled water, and was usable again after two days.

Dispensing of the leech in Australia appears to have quietly terminated in the later 1930's, ending here the ancient practice of general therapeutic bleeding; with the leech long outlasting the scalpel; and the application of the leech continuing for one hundred years from that period when it held major status in pharmacy and medicine.

The leech is no longer in the pharmacopoeia, where even hirudin now has no place; but recourse to the leech is still open to medical prescription, with the active agent described as an 'acid mucopolysaccharide of an organo-heparinoid nature', a disguise concealing that this is no other than the refined application of the leech.

The leech remains an animal of interest in fundamental researches in physiology, biochemistry, and pharmacology, the readily accessible rapidly responsive large smooth muscle cells being suitable for the bioassay of cholinergic, adrenergic, and similar substances (Mann, 1962), with the difficulty that leeches of cold temperate regions do not give preparations which are fully reliable at mammalian temperatures. Current zoological studies show an Australian sanguivorous fauna of at least 12 aquatic species (4 and possibly 5 were dispensed as *H. quinquestriata*) and some 9 terrestrial species. These warm temperature species retain normal activity at temperatures of 40°C promising physiological reliability over a wide temperature range including mammalian levels (Richardson, 1967).

This fauna gives the opportunity for comparative studies such as are not possible with the very limited European and North American faunas. As one example, in preserving Australian sanguivores in 70% ethyl alcohol, these immediately yield strong tinctures, reddish and yellowish brown from aquatics; greenish and brownish yellow from terrestrials; the quality related to the species; the strength varying seasonally but always far exceeding any in my experience with leeches elsewhere. A preliminary examination of a

incture from a terrestrial species demonstrated the presence of flavine, ribose, and a third substance, indicating the probable parallel to the demonstration by Rindi and Ferrari (1952) that the skin of aquatic leeches in Europe, varying with the species, contains at unusually high levels for animal tissue, riboflavine (up to 23.6 mg/100 grm in the macrophagous *Haemopis sanguisuga*) and niacinamide (up to 5.88 mg./100 grm). The differences in quality in tinctures from the Australian species, point to the substances as being products of leech metabolism, a possibility supported also by the strength of the tinctures which indicate quantities above levels obtainable from blood, the sole nutriment of these leeches.

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A NOTE ON BDELLASIMILIS BARWICKI AND AN INDICATION OF A SECOND SPECIES (TURBELLARIA: TRICLADIDA)

by LAURENCE R. RICHARDSON[1]

(Figure 1).

Since the original account (Richardson, 1968) based on specimens from a lake near Griffith, New South Wales, on the Murray System, specimens of *Bdellasimilis barwicki* have been obtained from a turtle on the flood-plain of the Lower Clarence Valley, the Northern Rivers region, New South Wales, 500 miles north of the original location. These showed external ciliation and the presence of an accessory ciliary feeding mechanism. Bdellasimilid egg capsules were taken from a turtle captured in the Raglan River, Gladstone, Queensland, 400 miles north of the Lower Clarence. These capsules differ so markedly from those of *barwicki* as to indicate a second species.

In general form and morphology, *B. barwicki* is unique among freshwater triclads in having its closest affinities within the Maricola. So long as it was known only in the one area, it might be regarded not as necessarily paludicolous, but more possibly a marine triclad which associated with turtles in the euryhalous conditions of the lower Murray and had become adapted to the freshwater environment in relatively recent biological time. The ozobranchiform leech, *Bogabdella diversa* Richardson 1969, on freshwater turtles in the Murray River could be regarded as neotenous and equally interpreted as a biologically recent adaptation to freshwater since the Ozobranchidae is essentially marine.

The two new locations for bdellasimilids are both freshwater but in the region of tidal waters and close to brackish water which is entered by the host turtle on the Lower Clarence. If bdellasimilids existed in only the one area, the limited distribution would favour the possibility of a euryhalous maricolous triclad. This would be unique in the Maricola. The distribution now given and the indication of a second species are more suggestive that the bdellasimilids have been part of the Australian freshwater fauna for a relatively long period of biological time. This coupled with the difficulties in systematizing the bdellasimilids within the present framework for the Tricladida, point more to the possibility suggested by Professor P. de Beauchamp (pers. corr.) that the bdellasimilids may require a new suborder in the Tricladida.

During the past five years I have examined over a hundred *Emydura macquari* and a smaller but still considerable number of *Chelodina longicollis* in the Lower Clarence Valley, turtles taken at different times in the year moving overland from creeks and waterholes diminishing in dry periods. All have been negative for bdellasimilids, as also the few turtles I have examined on branches of the Namoi, Castlereagh, and Macquarie Rivers of the Darling system.

On the 28th of December, 1968, Mr. J. Cann took four *E. macquari* and several *C. longicollis* from a freshwater section of the Upper Swan Creek, Ulmarra, on the flood-plain of the Lower Clarence. Of these, one *macquari* was infested with placobdellid leeches; a second, with placobdellids also yielded 5 adult *B. barwicki*; the others, negative. Owing to an emergency, the *barwicki* were placed in a dry jar.

Air temperatures were above 36°C. The jar was left in the full sun for some fifteen minutes. The *barwicki* did not obviously dessicate under these conditions and became immediately active when supplied with water three hours later. These specimens agreed with *barwicki* in size and morphology.

[1] 4 Bacon St., Grafton, New South Wales, 2460.

They add nothing further to the morphology as known. Ovaries could not be detected and all were assessed as approaching male maturity. No egg capsules were found. The pigment was not arranged into a pattern.

Supplied with water, the *barwicki* exhibited the euglenoid movement seen before, trailing the paired posterior suckers (which were quite distinct and each separately pedunculate), behind the body with the adhesive surfaces posteriorly directed. This was observed previously but the note was overlooked in the preparation of the original account where it is suggested that these suckers might actually be only a single adhesive organ, an impression gained from the sectioned individual.

The Ulmarra specimens were incapable of swimming. With the water level lowered in the jar, they utilized and moved across the surface film in the typical 'planarian' manner, giving evidence that they are externally ciliated, a point which could not be established previously.

Also, with these specimens there was no difficulty in establishing the presence of an accessory ciliary feeding mechanism. With the body raised in the feeding posture, a definite flow of water in beneath the anterior end of the preocular region was clearly seen.

Early in February, 1970, Mr. Cann supplied me with bdellasimilid egg capsules taken from *Elseya dentata* captured in the Raglan River west of Gladstone, Queensland, by Mr. R. Weigand of Mount Larcom. The location is freshwater excepting in the highest tides.

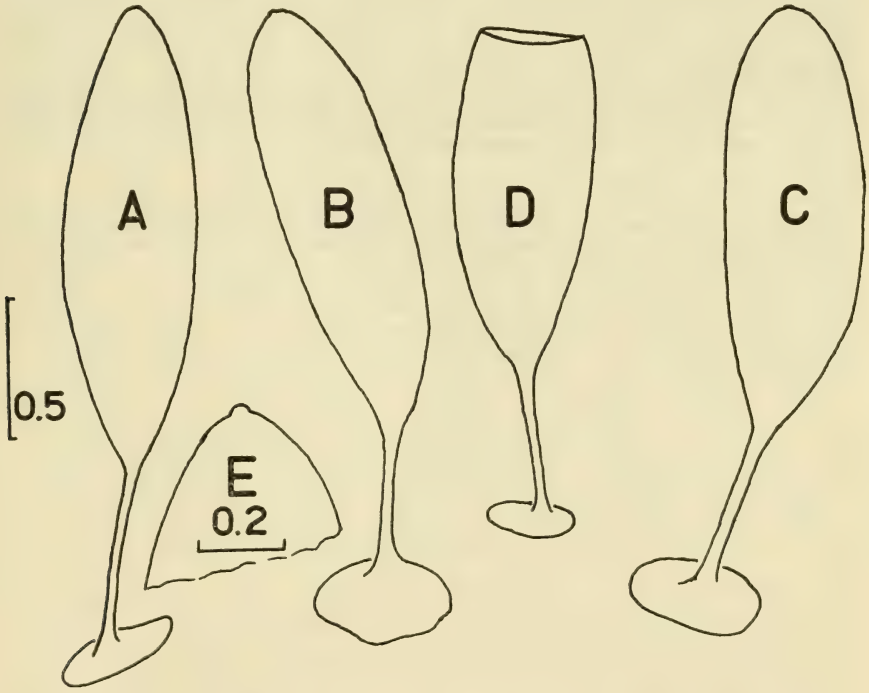

Figure 1.—Bdellasimilid egg capsules from *Elseya dentata,* Raglan River, Queensland. A, B, C, complete capsules. D. Capsule after eclosion. E. Distal end of capsule to show boss. Outlines drawn by camera lucida. Scales in mm.

These egg capsules (Fig. 1) are dark brown to almost blackish brown; the wall of the capsule so nearly opaque as to conceal the contents which are detectable with difficulty and without detail. There are 34 capsules, of which 13 are complete. The attachment disc is thin with nearly regular margins, almost neatly circular in outline, and equal to or just slightly exceeding the maximum diameter of the capsule. The dark brown stem is relatively thin; the length greater than the maximum diameter of the capsule and about ¼ of the total length; solid. The capsule itself is smooth, thin-walled, circular in section, the greatest diameter less than ¼ of the length of the capsule; the whole, elongate tapering cylindroid, to elongate subovoid; the proximal end tapering acutely to the stem; the distal end either acutely tapering or more commonly obtusely rounded. In some, there is a low rounded boss on the distal end, so small as to be detectable with difficulty. In the others the distal end is smoothly rounded and plain.

The complete capsules range in length from 1.95 to 2.25 mm; the stem, from 0.5 to 0.6 mm in length with a width of 0.04 to 0.05 mm; the capsule, 1.45 to 1.55 mm long with a maximum diameter of 0.42 to 0.48 mm.

The heavy pigmentation and opacity of the wall of the capsule, the narrow stem and general overall slender form, the presence of a low boss, distinguish these capsules on sight from the pale brown capsule of *barwicki* which is sufficiently transparent that the contents are visible in some detail, with an obtusely rounded distal end armed with a short acute spike, and a relatively thick and short stem.

The differences are such as to indicate a second species at the Raglan River.

Acknowledgements:

I am most grateful to Mr. J. Cann of Yarra Bay, N.S.W., for the material reported here. The Science and Industry Endowment Fund has assisted by the loan of microscopic equipment.

Reference:

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OBITUARY

SIR EDWARD HALLSTROM (1886-1970)

(Plate XIII.)

The Royal Zoological Society of New South Wales lost a staunch supporter by the death, on 27th February 1970, of Sir Edward Hallstrom, Kt., K.C.N.S. (Sweden), O.L. 2nd (Belgium), F.R.Z.S., F.Z.S., R.A.O.U. He joined our Society in 1933, became a Life Member in 1937 and in 1945 generously became our one and only Endowment Member; he was elected a Fellow and later became Vice-Patron. He presented the Society with a set of Neville Cayley's paintings of all the species of Australian parrots and helped us in other ways. In 1953, Sir Edward led the delegation from the Royal Zoological Society of New South Wales to the Fourteenth International Congress of Zoology at Copenhagen, where he showed films and read a paper.

Edward John Lees Hallstrom was born at Coonamble, New South Wales, on 25th September 1886, the son of William C. Hallstrom, an English migrant; his grandfather was a Swedish captain. He left school before his teens, moved to Sydney (characteristically with a pet cat and a cage-bird) and worked at a furniture factory of which he became the manager at the age of eighteen. He was a self-made man, interested in mechanics and engineering, and had a lifelong association with Sydney's zoo. Hallstrom was an early Australian aviator: in 1909 he was associated with George Augustine Taylor at Narrabeen, New South Wales, in the first Australian glider flights in a motorless biplane 28 feet long. In this, he ascended 45 feet, fifteen years after Lawrence Hargrave had launched himself into the air, using four large box-kites at Stanwell Park, and only six years since the Wright brothers' powered flight in America.

Hallstrom founded his own widely-known and lucrative business making ice-chests and refrigerators. He gave large sums of money towards research into cancer, tuberculosis and heart disease; to hospitals, clinics, libraries, homes for children and other causes too numerous to mention. Other gifts went towards publication of a handbook on birds, the erection of memorials to Sir Joseph Banks and for the publication of the Banks papers, and the establishment of a sheep-breeding station in New Guinea. He was a sometime Councillor of the Royal Australian Historical Society and was Benefactor and Patron of many sporting and charitable organisations. He purchased ten paintings by Audubon which had unexpectedly been discovered in Australia and presented them to President Truman of the United States of America. Other paintings were donated to the library of Parliament House, Canberra. Sir Edward Hallstrom was the friend of many celebrities: Alfred Hitchcock gave him a skeleton of the extinct sabre-toothed tiger (since presented to the Australian Museum) and President Sukarno of Indonesia provided Taronga Zoo with its Komodo Dragons. As a hobby, he collected hats which had belonged to famous men. Dozens of these had been given to him, including hats from Sir Winston Churchill and Presidents Truman and Eisenhower. His limousine bore the number-plate ZO-000.

Sir Edward never retired. Even in advanced age, he worked at his Willoughby office, surrounded by zoological books and seated in a huge wooden chair carved in the form of a bear. Queries about refrigerators and animals were given pride of place, even over very important visitors who were obliged to wait while these priorities received attention. By trial and error he developed techniques for caring for and breeding many rare animals. From about 1947 onwards he gave hundreds of animals as well as buildings and plant to the zoo, and he became Chairman (President) of the Taronga Zoological Park Trust. This zoo had one of the finest collection of Birds of Paradise in the world through Sir Edward's efforts, and he was also pleased with his success in building up the stocks of rhinoceroses and giraffes in Australian

zoos. He was amused at finding behind a door some torn bits of an old newspaper which indicated that a live rhinoceros had been exhibited in Sydney as early as 1877. This was the circus-menagerie specimen mentioned in the *Sydney Morning Herald,* 7th May, 1877, p. 5 and 26th Nov. 1877, p. 2.

In the late 1940's, Sir Edward sponsored the Sydney radio programme, *Nature Speaks,* on which a panel of naturalists not only broadcast answers to questions from the public but strongly advocated conservation of Australia's fauna. In 1954 Hallstrom acquired a fine collection of Papuan butterflies. He instituted a sanctuary for koalas at Avalon, New South Wales, maintained many animals in the garden of his home on the shores of Middle Harbour, Sydney, and had another collection of living animals in the Western Highlands of Papua.

Sir Edward Halltsrom was knighted in 1952. The King of Sweden awarded him the Swedish Order of the North Star (K.C.N.S.) and he received a Belgian decoration and the Gold Medal of the Royal Zoological Society of Antwerp. He was made Honorary Life Director of Taronga Zoo in 1960, later Director Emeritus of Taronga Zoological Park Trust; he was an Honorary Fellow, Zoological Society of London; Life Vice-President of the Zoological Board of South Australia; and member of the Zoological Society of New York as well as of other natural history and other bodies. He presented valuable specimens to the Australian Museum, Sydney, in whose galleries the Hallstrom Theatre commemorates his name. He travelled extensively for business reasons and in the interests of the causes to which he subscribed. His son, Mr. John Hallstrom, also visited many countries to obtain shipments of exotic fauna for Taronga Zoo. Sir Edward's zoological work was mainly concerned with the care of animals in captivity, especially as regards their breeding. He was keen on obtaining albinos of mammals and birds and he tried to "re-create" the Paradise Parrot, an almost extinct species, by cross-breeding from three other kinds of similar birds, and he sought to stem the decline of that dwindling species, Przhvalsky's horse. He introduced sheep (by air), brown trout and bees to the Western Highlands of Papua.

A genus of Petrels was named *Hallstroma* in his honour by G. M. Mathews (in Mathews & Hallstrom, *Notes on the Order Procellariiformes,* 1943, p. 37). A native dog from the Papuan Highlands was named *Canis hallstromi* by Troughton (*Proc. Roy. Zool. Soc. N.S.Wales,* 1955-56 (1957), p. 93). Two subspecies of New Guinea birds bear his patronymic: a Ground Parrot, *Psittacella modesta hallstromi* and an Enamelled Bird of Paradise, *Pteridophora alberti hallstromi,* both named by Mayr & Gilliard (*Amer. Mus. Novit.,* 1524, June 1951, pp. 1-16); also the present writer named a tropical catshark *Hemiscyllium hallstromi* in the *Australian Zoologist,* 14(2), 1967, p. 178.

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1957b. Breeding Results in the Hallstrom Collection. *Avicultural Magazine,* 63 (6), Nov.-Dec. 1957, pp. 197-199.

1959. Some Breeding Results in the Hallstrom Collection. *Avicultural Magazine,* 65 (3), May-June 1959, pp. 77-80.

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The author acknowledges, with thanks, the assistance of Lady Hallstrom and Mr. Ronald Strahan (Director of Taronga Zoo) in preparing this memorial notice.

—G. P. Whitley.

BOOK REVIEWS

"A Natural History of Australia: 1. Tropical Queensland", by Stanley and Kay Breeden. Sydney: William Collins, August 24th, 1970, 12 x 9½ inches, 262 pages with 70 coloured illustrations & 280 photographs and drawings. Price $13.50.

This is a real *natural history*. It starts from the ground up, taking a large segment of tropical Queensland and concentrating on the rainforests there, describing their development and evolution, the organic growth and intricate interrelationships of trees, plants, fungi and animals over long periods of time and their natural replacement after gradual decline. The variety of wildlife in Queensland's rainforests is unparalleled by that of any other Australian region and the authors, husband and wife, are alarmed (as all of us should be) at the destruction and inroads being made in these unique regions. Open woodland, streams, lagoons and mangrove areas are more briefly dealt with.

Great patience and skill have been shown in obtaining the breathtakingly beautiful photographs, many of them of species of animals which have not been photographed before. All are *alive* so we see butterflies in flight, birds feeding their young, bats, frogs, moths, to name but a few. Much of the country dealt with is inaccessible to many Australians who should be indebted to the authors for the care with which they have penetrated its difficult terrain, to spend many days and nights, under all weather conditions, to make their invaluable observations. The text is clearly written so that even children can profit from this fascinating introduction to zoology and botany. It is no dry catalogue with keys and technicalities, but full of vitality, and can be highly recommended to all students and lovers of nature. Scientific names are supplied for the 'ologists.

Chapter II, on Conservation, is horrifying. The illicit slaughter of Torres Strait Pigeons by shooters in speedboats supplied with freezers makes one wonder if this lovely bird is likely to follow the Passenger Pigeon to oblivion. Orchid hunters have laid waste areas by ruthlessly cutting down trees with chainsaws. The freshwater crocodile is virtually shot out, the bird smugglers violate the law, wallabies are being poisoned by chemicals and fruit pigeons are shot in National Parks. "Steps must be taken", say the Breedens, "to ensure that this corner of Australia, richest in wildlife, does not ultimately deteriorate into a monotonous wasteland of sugar cane and beef pasture."

The Government and people of Queensland must pay heed to the pleas in this excellent forerunner of what promises to be a magnificent series of volumes. —G.P.W.

"Small Birds of the New Zealand Bush", by Elaine Power (Auckland: William Collins), May 18, 1970, 44 pages, coloured and b/w illustrations. Price $2.80.

A Maori legend on birds introduces this book which illustrates, against appropriate botanical backgrounds, some twenty species of the smaller bush birds of New Zealand. Clearly the result of patient and loving observation, the drawings of these small birds are particularly good, notably those in flight, and in all details of legs and feathers. Scientific names of the birds are not given, only the English and Maori names with field notes on the characteristics of the species. —T.I. & G.P.W.

"Some garden birds of south-east Australia", by Tess Kloot and Ellen McCulloch (Sydney: William Collins), August 24, 1970, pp. 1-140 with six coloured plates and many black-and-white figures by Rex Davies. Price $2.50.

This book affords a useful means for recognizing both introduced and native garden birds for the nature-lover. For good measure, gulls and cormorants are included, the term garden being taken to include urban parks. Interesting questions, and suggestions on what to note for further study, are supplied and the best methods indicated for collecting information of ornithological value. In addition to the main descriptions, there are notes on attracting birds to your garden, pesticides, banding, recording, etc. which can be followed by hobbyists anywhere between Sydney and Adelaide and beyond. —G.P.W.

A CELEBRATION FOR THE 250TH ANNIVERSARY OF GILBERT WHITE

Naturalists and conservationists all over the world revere Gilbert White's *Natural History and Antiquities of Selborne,* first published in 1789. We have received from Mrs. W. Goater of Chandlers Ford, Hampshire, some accounts of the celebrations on July 18th 1970 at Selborne of the 250th anniversary of Gilbert White's birth. Mrs. Goater writes:

We visited *The Wakes,* once the home of Gilbert White and now a commemorative Selborne-White Museum. The first room was given to showing some of the outstanding natural history discoveries made by Gilbert White and I noted three of the flowers which distinguished him as a botanist, illustrated by pictures—Green Hellebore, Foetid Hellebore and *Daphne mezereum,* the two first-named still to be found where he discovered them, but *Daphne* disappeared many years ago, being much dug up for gardens. It does still occur in a wood near Newtown Vallence, not far away. The three Leaf Warblers, Chiff-Chaff, Willow Warbler and Wood Warbler, were separated by White and are still heard and seen at Selborne and these, too, were illustrated by pictures. The Black Grouse, here a stuffed specimen, used to occur in Hampshire but was already becoming scarce in Gilbert White's time. Illustrations of House Cricket and Field Cricket, with notes of his observations, Noctule Bat and Harvest Mouse all showed his discoveries and his studies of Swift, Swallow, House and Sand Martins were also shown. He was the first naturalist to note animal coloration related to camouflage, bird territories and the habits of earthworms, which he extensively studied. We went into the garden of *The Wakes* which is being extensively restored, as far as possible, to the condition in which Gilbert White made it; and a lecture on the naturalist, by James Fisher, was in progress. The original ha-ha, or ditch, has been cleared and the beautiful brick wall revealed, and the old sundial still stands where it has been since his time. From this point there is a magnificent view of the famous Hanger, and the Zig Zag which he and his brother cut still provides the easiest way to climb it. A new seat in the garden near the ha-ha was presented by the Oxford University Press today and has this fact and the date, July 18th, 1970, carved on the back.

From *The Wakes* we went to see the Art Exhibition for which my paintings of Green Hellebore, Fragrant Orchid and Bee Orchid had been accepted. Most of the pictures depicted scenes of Selborne, with a few of birds, but there were no others of single flowers. The Children's Art Competition entries were fascinating and the competitors' ages ranged from four years upwards. There were pictures of nature subjects, books about Gilbert White, Nature Walk notebooks and nature scrapbooks. The prizes were to be presented by Alvar Lidell of the British Broadcasting Corporation.

Our next stop was the Plestor, the original village green, on which now were placed the old stocks and where the Selborne Society caravan stood, inviting membership, and where Selborne guidebooks could be bought. We visited the church (of which White had been the Curate) and noted the one-handed clock on the Tower, almost hidden by the huge Virginia Creeper whose main stems I could not span with my two hands together. Gilbert White's grave, with its small, simple headstone inscribed only G.W. 26th June 1793, as he wished, today had an arrangement of flowers placed upon it. The beautiful stained glass window depicting Gilbert White's birds was attracting much attention. An Engrailed Moth was at rest on a branch of the ancient yewtree near the churchyard gate. There was a Red Admiral butterfly in the carpark and Nettle-leaved Bellflower was flowering on the Hanger near the Zig Zag. Many butterflies were on the wing, including Meadow Browns, Ringlets and Small Skippers, two White Plume moths were put up, and a Scorpion Fly was caught. We continually raised Large Yellow Underwing moths which dashed away in characteristic manner to bury themselves again deep down

among the herbage. One Cinnabar was seen. Two Grasshoppers were caught and identified as *Omocestus viridulus* and *Charthippus parallus,* as soon as we emerged from the wood on to the sunny top of the chalky hill where Marbled Whites, Ringlets, Small Tortoiseshells, Small Heaths and Small Skippers were flying about and Five-spot Burnet moths resting among the flowers.

We returned, unfortunately, too late to see the children dancing round the maypole but the Church bells were pealing again. The festivities continued with nature films shown in the village hall; music as enjoyed in Gilbert White's time was performed in the Great Parlour at *The Wakes* in the evening; and a Barn Dance followed, but we had now to return home and call it a day—an exciting and memorable one.

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Members or their friends having duplicate or unwanted back issues of the *Australian Zoologist* or the *Proceedings* are urgently requested to inform the Honorary Secretary, Mr. Graham Settle (telephone 929-9733, or at Taronga Zoo), as stocks of some parts are depleted and it is becoming impossible for the Society to fill orders for sets or to maintain exchanges.

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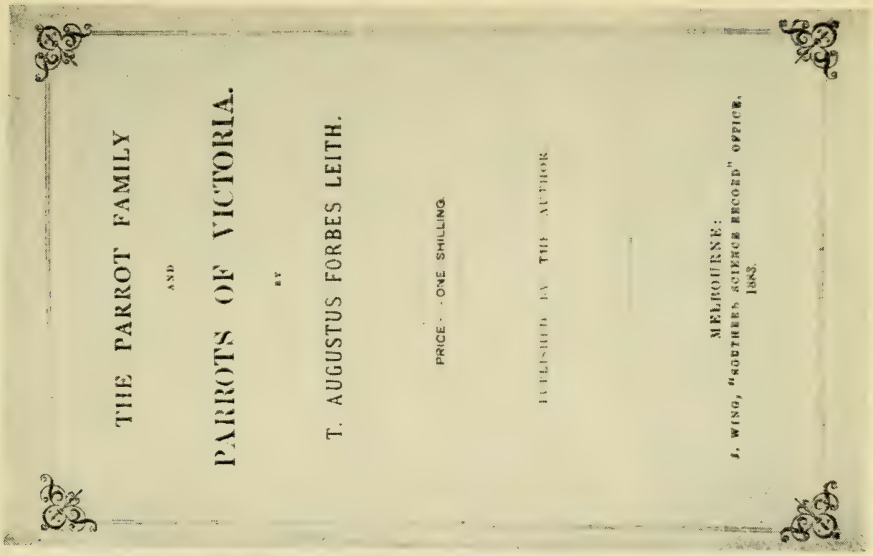


THE PARROT FAMILY

AND

PARROTS OF VICTORIA.

BY

T. AUGUSTUS FORBES LEITH.

PRICE - - ONE SHILLING.

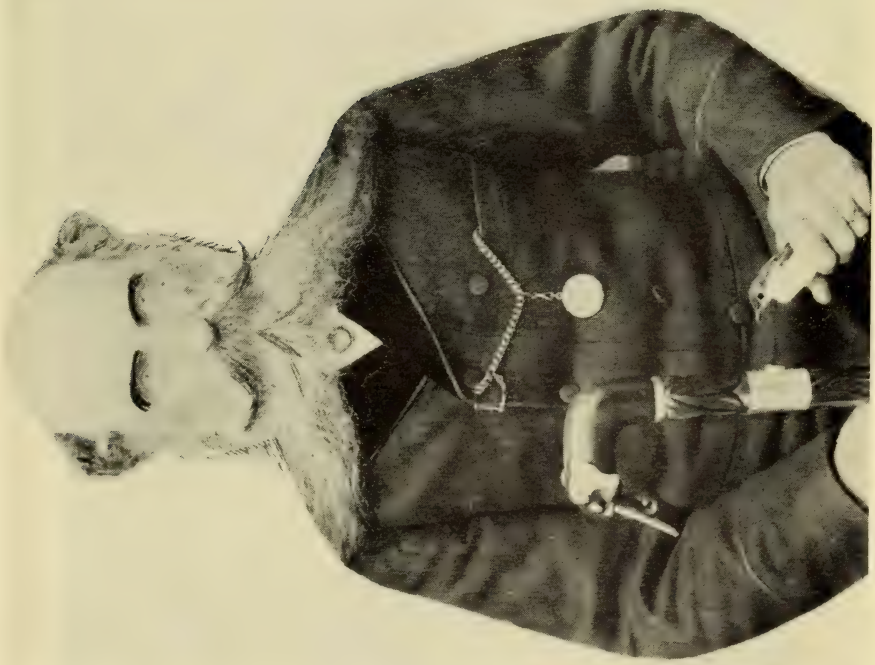
PUBLISHED BY THE AUTHOR.

MELBOURNE:

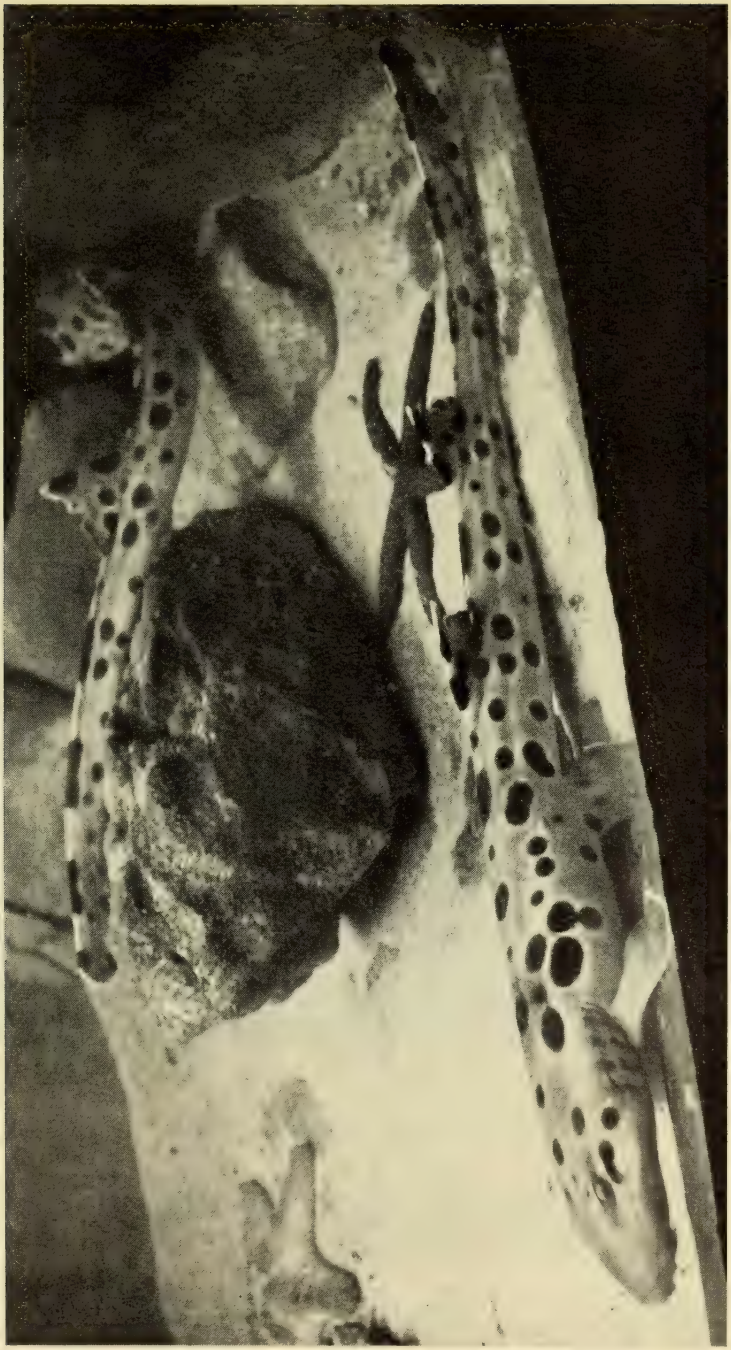
J. WISE, "SOUTHERN ACTIVE RECORD" OFFICE.

1883.

Title-page of Leith's "Parrots".



T. A. Forbes Leith, aged 53 years



Catshark, *Hemiscyllium hallstromi*.

Photo by courtesy of the *Sun-Herald*, Sydney.

Sir Edward Hallstrom

Photo by courtesy of Australian Consolidated Press, Sydney.

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"Revision of the New South Wales Turridae", by C. F. Laseron, 1954.
"The published writings of Tom Iredale, with an index of his new scientific names", by D. F. McMichael and G. P. Whitley, 1956.
"A reclassification of the Order Odonata", by F. C. Fraser, 1957.
"Dragonflies of Australia", by F. C. Fraser, 1960.
"A Catalogue of the Psocoptera of the World", by C. N. Smithers, 1967.
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"Early history of Australian Zoology", by G. P. Whitley, 1970.

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