

QH
1
S67X
NH

RT 12 MAY 1977

ISSN 0303-2515

ANNALS

OF THE SOUTH AFRICAN
MUSEUM



CAPE TOWN



INSTRUCTIONS TO AUTHORS

1. MATERIAL should be original and not published elsewhere, in whole or in part.

2. LAYOUT should be as follows:

- (a) *Centred masthead to consist of*
Title: informative but concise, without abbreviations and not including the names of new genera or species
Author's(s') name(s)
Address(es) of author(s) (institution where work was carried out)
Number of illustrations (figures, enumerated maps and tables, in this order)
- (b) *Abstract* of not more than 200 words, intelligible to the reader without reference to the text
- (c) *Table of contents* giving hierarchy of headings and subheadings
- (d) *Introduction*
- (e) *Subject-matter* of the paper, divided into sections to correspond with those given in table of contents
- (f) *Summary*, if paper is lengthy
- (g) *Acknowledgements*
- (h) *References*
- (i) *Abbreviations*, where these are numerous

3. MANUSCRIPT, to be submitted in triplicate, should be typewritten and neat, double spaced with 2.5 cm margins all round. First lines of paragraphs should be indented. Tables and a list of legends for illustrations should be typed separately, their positions indicated in the text. All pages should be numbered consecutively.

Major headings of the paper are centred capitals; first subheadings are shouldered small capitals; second subheadings are shouldered italics; third subheadings are indented, shouldered italics. Further subdivisions should be avoided, as also enumeration (never roman numerals) of headings and abbreviations.

Footnotes should be avoided unless they are short and essential.

Only generic and specific names should be underlined to indicate italics; all other marking up should be left to editor and publisher.

4. ILLUSTRATIONS should be reducible to a size not exceeding 12 × 18 cm (19 cm including legend); the reduction or enlargement required should be indicated; originals larger than 35 × 47 cm should not be submitted; photographs should be rectangular in shape and final size. A metric scale should appear with all illustrations, otherwise magnification or reduction should be given in the legend; if the latter, then the final reduction or enlargement should be taken into consideration.

All illustrations, whether line drawings or photographs, should be termed figures (plates are not printed; half-tones will appear in their proper place in the text) and numbered in a single series. Items of composite figures should be designated by capital letters; lettering of figures is not set in type and should be in lower-case letters.

The number of the figure should be lightly marked in pencil on the back of each illustration.

5. REFERENCES cited in text and synonymies should all be included in the list at the end of the paper, using the Harvard System (*ibid.*, *idem*, *loc. cit.*, *op. cit.* are not acceptable):

(a) Author's name and year of publication given in text, e.g.:

- 'Smith (1969) describes . . .'
- 'Smith (1969: 36, fig. 16) describes . . .'
- 'As described (Smith 1969*a*, 1969*b*; Jones 1971)'
- 'As described (Haughton & Broom 1927) . . .'
- 'As described (Haughton *et al.* 1927) . . .'

Note: no comma separating name and year
pagination indicated by colon, not p.
names of joint authors connected by ampersand
et al. in text for more than two joint authors, but names of all authors given in list of references.

(b) Full references at the end of the paper, arranged alphabetically by names, chronologically within each name, with suffixes *a*, *b*, etc. to the year for more than one paper by the same author in that year, e.g. Smith (1969*a*, 1969*b*) and not Smith (1969, 1969*a*).

For books give title in italics, edition, volume number, place of publication, publisher.

For journal article give title of article, title of journal in italics (abbreviated according to the *World list of scientific periodicals*. 4th ed. London: Butterworths, 1963), series in parentheses, volume number, part number (only if independently paged) in parentheses, pagination (first and last pages of article).

Examples (note capitalization and punctuation)

- BULLOUGH, W. S. 1960. *Practical invertebrate anatomy*. 2nd ed. London: Macmillan.
- FISCHER, P.-H. 1948. Données sur la résistance et de le vitalité des mollusques. *J. Conch.*, Paris 88: 100-140.
- FISCHER, P.-H., DUVAL, M. & RAFFY, A. 1933. Études sur les échanges respiratoires des littorines. *Archs Zool. exp. gén.* 74: 627-634.
- KOHN, A. J. 1960*a*. Ecological notes on *Conus* (Mollusca: Gastropoda) in the Trincomalee region of Ceylon. *Ann. Mag. nat. Hist.* (13) 2: 309-320.
- KOHN, A. J. 1960*b*. Spawning behaviour, egg masses and larval development in *Conus* from the Indian Ocean. *Bull. Bingham oceanogr. Coll.* 17 (4): 1-51.
- THIELE, J. 1910. Mollusca: B. Polyplacophora, Gastropoda marina, Bivalvia. In: SCHULTZE, L. *Zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Süd-Afrika* 4: 269-270. Jena: Fischer. *Denkschr. med.-naturw. Ges. Jena* 16: 269-270.

(continued inside back cover)

ANNALS OF THE SOUTH AFRICAN MUSEUM
ANNALE VAN DIE SUID-AFRIKAANSE MUSEUM

Volume 72 Band
May 1977 Mei
Part 12 Deel



THE VALIDITY OF *MALACORAJA* STEHMANN, 1970
(CHONDRICHTHYES, BATOIDEI, RAJIDAE)
AND ITS PHYLOGENETIC SIGNIFICANCE

By

P. ALEXANDER HULLEY
&
MATTHIAS STEHMANN

Cape Town

Kaapstad

The ANNALS OF THE SOUTH AFRICAN MUSEUM

are issued in parts at irregular intervals as material
becomes available

Obtainable from the South African Museum, P.O. Box 61, Cape Town

Die ANNALE VAN DIE SUID-AFRIKAANSE MUSEUM

word uitgegee in dele op ongereelde tye na beskikbaarheid
van stof

Verkrygbaar van die Suid-Afrikaanse Museum, Posbus 61, Kaapstad

OUT OF PRINT/UIT DRUK

1, 2(1, 3, 5-8), 3(1-2, 4-5, 8, t.-p.i.), 5(1-3, 5, 7-9),
6(1, t.-p.i.), 7(1-4), 8, 9(1-2, 7), 10(1),
11(1-2, 5, 7, t.-p.i.), 15(4-5), 24(2), 27, 31(1-3), 33

Price of this part/Prys van hierdie deel
R2,00

Trustees of the South African Museum © Trustees van die Suid-Afrikaanse Museum
1977

ISBN 0 908407 14 9

Printed in South Africa by
The Rustica Press, Pty., Ltd.,
Court Road, Wynberg, Cape

In Suid-Afrika gedruk deur
Die Rustica-pers, Edms., Bpk.,
Courtweg, Wynberg, Kaap

THE VALIDITY OF *MALACORAJA* STEHMANN, 1970
(CHONDRICHTHYES, BATOIDEI, RAJIDAE) AND ITS
PHYLOGENETIC SIGNIFICANCE

By

P. ALEXANDER HULLEY

South African Museum, Cape Town

&

MATTHIAS STEHMANN

Institut für Seefischerei, Hamburg

(With 5 figures and 1 table)

[MS. accepted 9 December 1976]

ABSTRACT

The clasper structure, neurocranial form and proportional dimensions of the first adult male of *Raja spinacidermis* Barnard, 1923 are described. On the evidence presented the recognition of the subgenus *Malacoraja* Stehmann, 1970 is substantiated. *Malacoraja* appears to be the linking subgenus between *Breviraja* and rajids of the *Dipturus/Rajella/Amblyraja/Leucoraja*-line of evolution.

CONTENTS

	PAGE
Introduction . . .	227
Material . . .	228
Morphology . . .	230
Clasper Structure . . .	230
Neurocranium . . .	234
Discussion . . .	236
Acknowledgements . . .	237
References . . .	237

INTRODUCTION

During the course of investigations on the systematics of the Rajidae of the eastern North Atlantic, Stehmann (1970) defined a new monotypic subgenus, *Malacoraja*, for *Raja mollis* Bigelow & Schroeder, 1950 on the basis of characters other than the clasper structure, since no adult male specimen had been taken. *Malacoraja* was distinguished because of the extraordinary squamation and tail coloration of the type species. Because of similarities in proportional dimensions, tooth count and spination pattern, Hulley (1970) considered *Raja mollis* to be synonymous with *Raja spinacidermis* Barnard, 1923, and later followed Stehmann in the recognition of the subgenus *Malacoraja* to include this species, although no claspers were examined (Hulley 1972a).

The Division of Sea Fisheries, Cape Town, has recently obtained the first adult male specimen of this rare species, during the course of its 1973 Hake Survey Programme, and has donated the specimen to the South African Museum. The specimen not only calls for a description of the anatomy of the clasper and the relevant taxonomic morphology, in an effort to validate the subgenus, but also calls for comment on the phylogenetic position of *Malacoraja*.

MATERIAL

One specimen, an adult male (634,0 mm total length) trawled by R/V *Africana II* at station A 6139 (5 March 1973; 33°43'S 17°21'E; 914 metres; bottom temp. 3,30°C; salinity 34,47‰; O₂ concentration 4,61 ml/litre); in the collection of the South African Museum (SAM-26879). Proportional dimensions according to Hulley (1970) are given in Table 1.

TABLE 1

Raja spinacidermis (SAM-26879). Measurements expressed in mm and as per mileage of the total length.

	mm	‰	Range (Hulley 1970)
Total length	634,0	—	—
Disc width	450,0	709	660-701
Disc length	335,0	528	515-542
Snout to greatest disc width	198,6	313	307-335
Snout to middle of vent	306,2	483	466-487
Snout to axils of pelvics	272,4	430	—
Middle of vent to 1st dorsal origin	246,3	388	379-417
Snout length	92,6	146	145-166
Preoral length	86,0	136	126-166
Prenasal length	66,5	105	106-136
Eye — horizontal diameter	17,9	28	33-37
Eye + spiracle	23,0	36	42-47
Spiracle	10,8	17	20
Interorbital distance	25,0	39	36-45
Interspiracular distance	41,5	65	64-70
Internasal distance	49,1	77	79-89
Mouth width	57,2	90	83-90
Gill slit lengths: 1st	9,3	15	13-15
3rd	12,0	19	16-17
5th	9,0	14	10-13
Distance between gill slits: 1st	88,2	139	130-147
5th	49,7	78	84-91
1st dorsal fin: height	14,0	22	22-29
base length	28,0	44	47-50
2nd dorsal fin: height	17,6	28	19-27
base length	34,3	54	42-55
Interdorsal space	0	0	0
Teeth (rows in upper jaw)	56		54-60
Vertebral count: Vtr	24		28
Vprd	63		60-65
VΣ	87		88-93

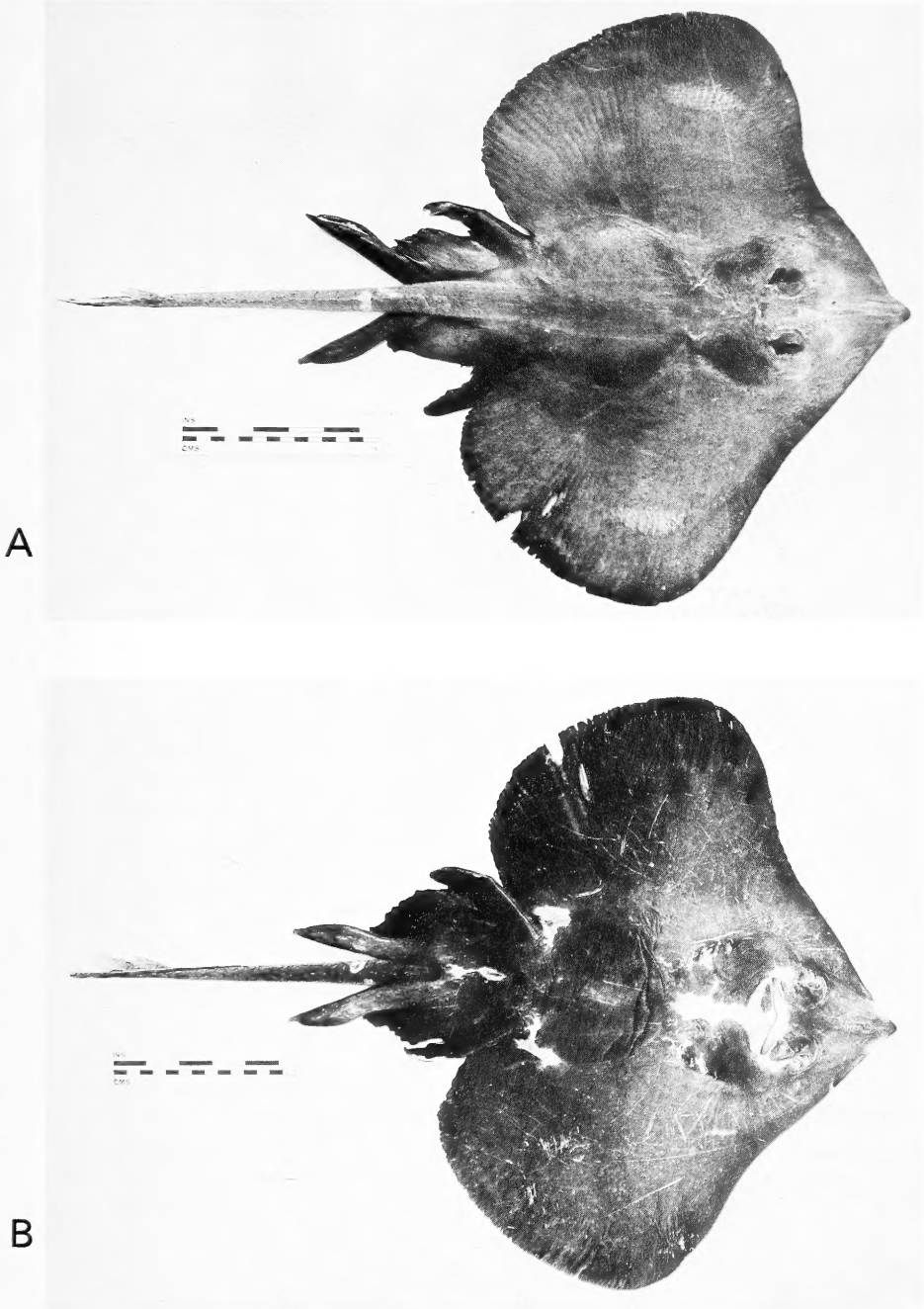


Fig. 1. *Raja* (*Malacoraja*) *spinacidermis*. SAM-26879. A. Dorsal view. B. Ventral view. Scale in cm and in.

MORPHOLOGY (Fig. 1A–B)

The specimen fits the published descriptions of the species and gives some additional information concerning general morphology:

1. Its squamation confirms the original definition of the subgenus, since the upper surface of the disc and tail is completely devoid of thorns and is entirely covered with spinules. A small patch of larger spinules (not typical thorns) is situated in front of the left eye. Malar and alar spines are well developed (Fig. 1A). The ventral surface is naked, except for a small patch of spinules on the tip of the snout, small bands of spinules along the anterior margins of the disc to about half the distance from tip of snout to level of nostrils and the distal half of the tail, which is almost completely covered with spinules.

2. The ventral surface of the disc and tail is uniformly dark brown (Fig. 1B), except for small white areas at the corners of the mouth and between the gill slits, at the axils of the pelvics and at the base of the tail. This coloration does not correspond with the subgeneric and specific diagnostic character of dark ventral tail colour, distinctly marked off from a predominantly white disc, a character based only on juvenile specimens.

3. The teeth of the adult male are in close-set parallel rows, with those in the middle part of the jaws having long, slender, sharply-pointed tips. The teeth of the outer parts of the jaws have low, conical tips.

As far as the ventral coloration is concerned, *Raja spinacidermis* follows a line of development which is well known for most deep-water rays. Juveniles and adolescent specimens bear a few small thorns in the orbital, nuchal and scapular regions and sometimes some enlarged spinules along the midline of the back and tail; the ventral surface of the disc is usually white, with grey or brown markings of varying extent. Thorns on the dorsal surface are almost completely lost in adults, which furthermore show a change in the ventral coloration of the disc to predominantly dark with small white markings in certain areas.

CLASPER STRUCTURE (Figs 2–4)

Claspers moderately long, reaching to about 40 per cent of tail length from axils of pelvics; rather slender, with terminal region barely broadened, distal end pointed and somewhat fimbriate; dorsal and ventral surfaces without dermal denticles; pseudosiphon absent; inner dorsal lobe with longitudinal proximal cleft, upper end of which is covered by a transverse slit; inner ventral lobe with well-developed shield, extending from above level of hypopyle to about four-fifths the length of the glans, with pleated epithelia over most of its surface and with cutting outer edge; insertion of the long rhipidion at level of proximal tip of shield, its distal third fan-shaped and with porous surface; sentinel well developed and slightly S-shaped, covered with fleshy

integument; spike blunt and hardly projecting from midline of clasper, placed below tip of sentinel; dike well developed along midline of distal half of glans, rising in 90° angle from inner edge of shield and covered with thin integument; medium-sized funnel below distal end of dike, formed as obtuse tip covered

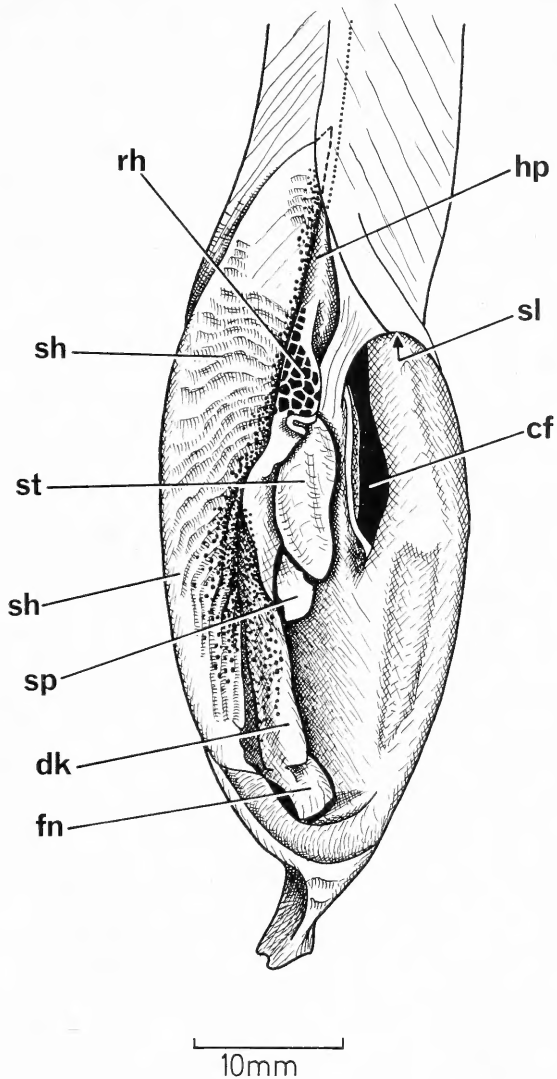


Fig. 2. *Raja (Malacoraja) spinacidermis*. Lateral view of left clasper, opened to show structural features of the glans.

cf—cleft; dk—dike; fn—funnel; hp—hypopyle; rh—rhipidion; sh—shield; sl—slit; sp—spike; st—sentinel

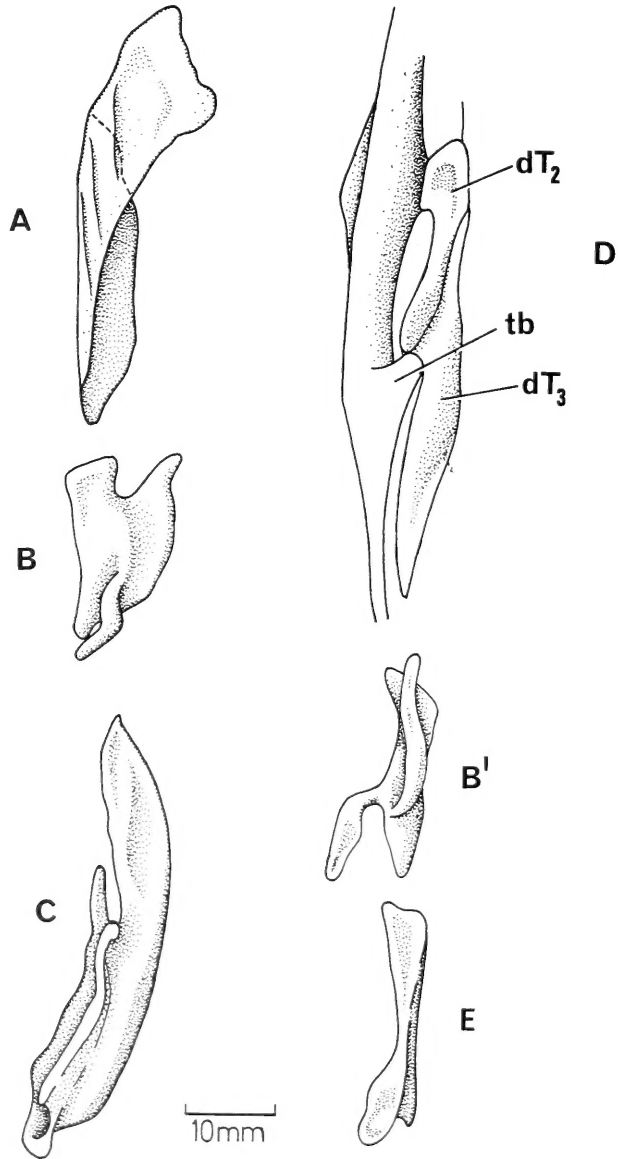


Fig. 3. *Raja (Malacoraja) spinacidermis*. Cartilages of the terminal group of the right clasper. A. Dorsal terminal 1 (dorsal view). B. Accessory terminal 1 (dorsal view). B'. Accessory terminal 1 (lateral view). C. Ventral terminal (dorsal view). D. Dorsal terminal 2 and dorsal terminal 3 (dorsal view). E. Accessory terminal 2 (dorsal view).

dT₂—dorsal terminal 2; dT₃—dorsal terminal 3; tb—terminal bridge.

with fleshy integument. Entire inner edge of shield darkly pigmented to level of proximal end of dike, becoming diffuse laterally and distally on shield and distally on dike.

Axial cartilage slender distally, but with slightly spatulate tip; dorsal marginal with short distal extension, ventral marginal arched; dorsal terminal 1 cartilage large, twisted and connected distally with distal tip of ventral terminal cartilage, without shelf for insertion of *M. dilatator*, but with 3 longitudinal

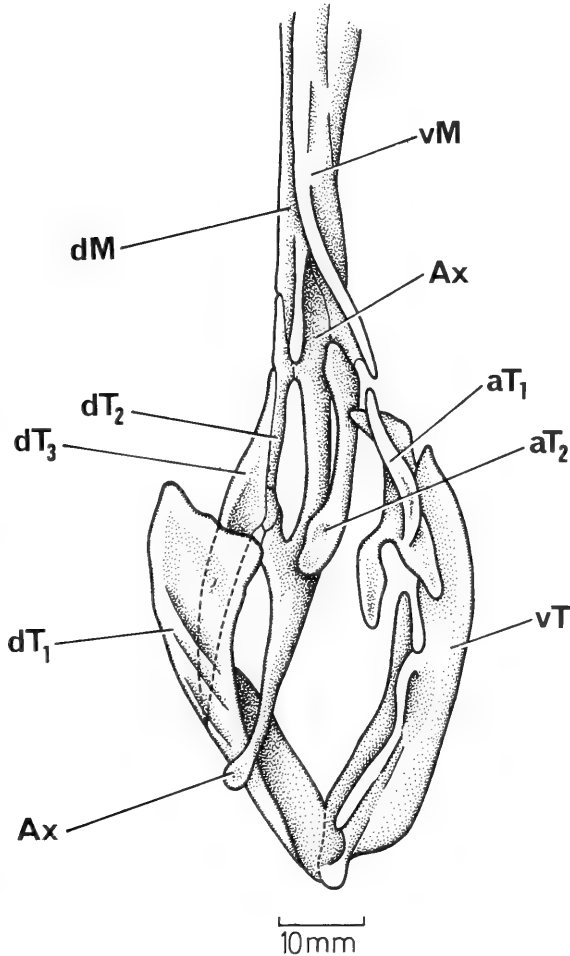


Fig. 4. *Raja (Malacoraja) spinacidermis*. Cartilages of right clasper (exploded).

Ax—axial; aT₁—accessory terminal 1; aT₂—accessory terminal 2; dM—dorsal marginal; dT₁—dorsal terminal 1; dT₂—dorsal terminal 2; dT₃—dorsal terminal 3; vM—ventral marginal; vT—ventral terminal.

ridges; dorsal terminal 2 and 3 cartilages simple, forming framework of dorsal lobe, with dT_2 and dT_3 making contact with a well-developed terminal bridge, which is an offshoot of the Ax; dT_2 and Ax bordering proximal cleft; ventral terminal cartilage large, with outer lateral margin forming the shield, with dorsal crest the dike, with distal tip the funnel, and with anterior notch linked with aT_1 ; accessory terminal 1 cartilage somewhat U-shaped proximally and with well-developed lateral projection forming the sentinel; accessory terminal 2 simple, with spatulate distal extremity, closely attached to the Ax proximally and distally, but free medially.

With regard to the external components of the glans, *Malacoraja* is characterized by:

- (i) very few structures on the inner dorsal lobe, but particularly a single, deep, proximal cleft combined with a transverse slit,
- (ii) a very long, prominent shield, covered with laminate epithelia and combined with a dike and funnel at its distal end,
- (iii) a sentinel and spike located rather far proximally in the glans,
- (iv) a medium-sized rhipidion and the absence of a pseudosiphon.

Diagnostic characters of the clasper skeleton include:

- (i) the extraordinary shape of the aT_1 cartilage, which is unparalleled among investigated *Raja* species,
- (ii) the terminal bridge is neither formed by separate cartilages nor by dT cartilages attached directly to the Ax, but is a massive offshoot of the Ax itself.

NEUROCRANIUM (Fig. 5)

Neurocranium typically guitar-shaped and markedly constricted across the orbital region, with well-developed post-orbital processes, short otic region, and moderately-developed jugal arches; nasal capsules massive and directed obliquely forward to about 55° to median axis, with ethmoidal nerve foramen at leading edge; maximum width 60,6 per cent of total length of skull; rostral cartilage projecting from cranium to tip of snout as strong but tapering rod, without a segment; length of rostrum 53,8 per cent of total length of skull; rostral appendices fused throughout their entire length to rostral bar and extending posteriorly slightly more than two-thirds the distance from tip of snout to level of anterior fontanelle or extend backward 60,6 per cent of length of rostrum; radial cartilages of pectoral fin extending anteriorly, but falling well short of tip of snout; anterior fontanelle extending forward to 15,5 per cent of the length of rostrum, without anterior grooving and separated from posterior fontanelle by narrow epiphysial bridge; orbito-nasal canal foramen comparatively small, optic foramen situated well forward; anterior cerebral vein foramen well above level of optic foramen and situated close to internal foramen of ophthalmic nerve; external foramen of ophthalmic nerve large and positioned comparatively more posteriorly, at about level of antorbital processes.

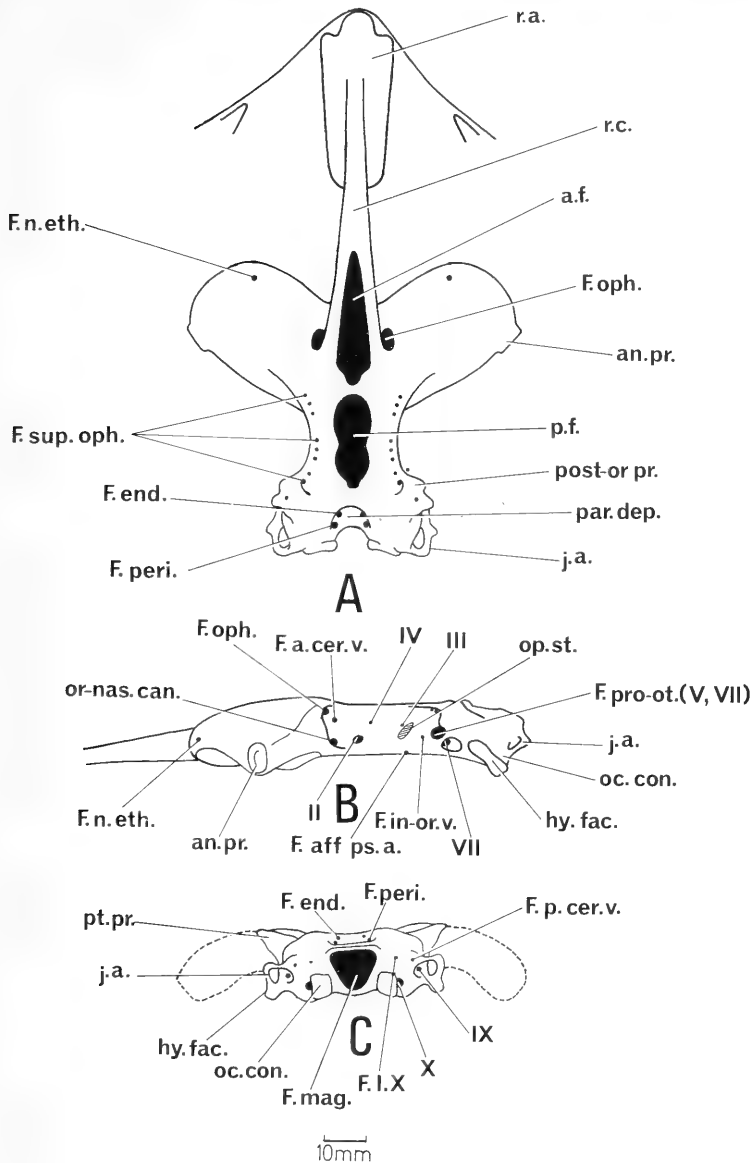


Fig. 5. *Raja (Malacoraja) spinacidermis*. Neurocranium. A. dorsal view. B. lateral view. C. posterior view.

a.f.—anterior fontanelle; an.pr.—antorbital process; F.a.cer.v.—anterior cerebral vein foramen; F.aff.ps.a.—afferent pseudobranchial artery foramen; F.end.—endolymphatic foramen; F.in-or.v.—interorbital vein foramen; F.l.X—foramen of lateralis branch (X); F.mag.—foramen magnum; F.n.eth.—ethmoidal nerve foramen; F.oph.—ophthalmic foramen; F.p.cer.v.—posterior cerebral vein foramen; F.peri.—perilymphatic foramen; F.pro-ot.—pro-otic foramen; F.sup.oph.—superficial ophthalmic foramen; hy.fac.—hyomandibular facet; j.a.—jugal arch; oc.con.—occipital condyle; or-nas.can.—oro-nasal canal; op.st.—optic stalk; p.f.—posterior fontanelle; par.dep.—parietal depression; post-or.pr.—postorbital process; pt.pr.—pterotic process; r.a.—rostral appendix; r.c.—rostral cartilage; II—optic nerve foramen; III—oculomotor nerve foramen; IV—pathetic (trochlear) nerve foramen; VII—foramen of hyomandibular branch (VII); IX—glossopharyngeal nerve foramen; X—vagus nerve foramen.

Diagnostic characters are:

- (i) an anterior fontanelle clearly marked off on all sides,
- (ii) a rostral cartilage longer than the neurocranium,
- (iii) the maximum width of the skull more than 50 per cent of its total length,
- (iv) the rostral appendices more than half the length of the rostral bar, fused with the latter over their entire length.

DISCUSSION

There is no doubt that the spination pattern of the disc and tail and the complete absence of large thorns along the midline of the back and tail is unique in *Raja spinacidermis*. The coverage of the dorsal surface by close-set spinules is a character shared by species of *Breviraja* (*B. stehmanni* off South Africa), of *Bathyraja* (*B. smithii* off South Africa) (Hulley 1972a, 1972b), and rarely of *Raja* (e.g. *R. senta* in the north-western Atlantic), but these species either have specialized snout conditions and/or possess at least midline thorns on the dorsal surface. While the enormous size of the nasal capsules appears to be correlated mainly with depth distribution, e.g. *Raja radiata* and *R. robertsi* (Hulley 1972a), the length of the rostral cartilage and especially its appendices, is rather extraordinary among short-snouted *Raja* species. Both the rostral cartilage and the appendices are typically rajid in form, but their characteristics can be interpreted as an ancestral condition, which approximates *Dipturus* and single species of other subgenera, e.g. *Raja fullonica* (Stehmann 1970: 146, pl. 22).

The anatomy of the clasper of *Raja spinacidermis* shows a number of similarities to that of *Breviraja*-species (Hulley 1972b; Stehmann 1976): the position and general form of the sentinel and spike (aT_1 and aT_2); the arrangement of the dT_2 and dT_3 and their connection with a well-developed terminal bridge; and the form of the vT , which distally is firmly bonded to the tip of the dT_1 . The form of the aT_1 cartilage in *Raja spinacidermis* is unique among *Raja*-species that have thus far been investigated. The form of the dT_1 , the association of dT_2 , dT_3 and the terminal bridge, the form of the vT (resulting among others in the formation of a prominent shield), and the lack of an external pseudosiphon, point to a closer association with species of the subgenus *Dipturus* (Hulley 1972a). *Malacoraja* also shows a relation to *Amblyraja*, *Leucoraja* and *Rajella* in the general form of the dT_1 and vT , especially in the position of the anterior notch of the latter (Hulley 1972a: 38), and furthermore in the bonding of the distal extremities of both these cartilages (cf. Stehmann 1970, pls 11–12).

In summary then, *Malacoraja* is also confirmed as a separate and valid subgenus of *Raja* by conditions of clasper and skull, which are the most important characters in modern rajid taxonomy. It possesses a true rajid condition of the clasper and skull, but shows characteristics in both, which are intermediate between *Dipturus* and *Breviraja*-species. It may therefore be interpreted as the subgenus linking the genera *Breviraja* and *Raja*. With regard to *Raja*, *Malacoraja* is closely associated to the evolutionary line of the subgenera

Dipturus/Rajella/Amblyraja/Leucoraja. A strict application of Vprd values would indicate a common ancestry for *Malacoraja* and *Breviraja* rather than a direct lineage and would point to an origin from some ancestral *Dipturus*-species. Further, the depth distribution pattern in *Malacoraja* would support the hypothesis that *Breviraja*-species represent an early split from the rajid condition, which penetrated abyssal regions, but which retained the neotenus condition of the snout as an increased advantage in grubbing.

ACKNOWLEDGEMENTS

The authors would like to express their thanks to the Director and Staff of the Sea Fisheries Branch, Department of Industry, Cape Town for the donation of the rajid material taken during their Hake Surveys and especially to Mr L. Botha of that institute. They would also like to thank Mr S. X. Kanne-meyer, Department of Marine Biology, South African Museum and Mr V. Branco for their assistance.

REFERENCES

- BARNARD, K. H. 1923. Diagnoses of new species of marine fishes from South African waters. *Ann. S. Afr. Mus.* **13**: 439-445.
- BIGELOW, H. B. & SCHROEDER, W. C. 1950. New and little known cartilaginous fishes from the Atlantic. *Bull. Mus. comp. Zool. Harv.* **103**: 383-408.
- HULLEY, P. A. 1970. An investigation of the Rajidae of the west and south coasts of southern Africa. *Ann. S. Afr. Mus.* **55**: 151-220.
- HULLEY, P. A. 1972a. The origin, interrelationships and distribution of southern African Rajidae (Chondrichthyes, Batoidei). *Ann. S. Afr. Mus.* **60**: 1-103.
- HULLEY, P. A. 1972b. A new species of southern African brevirajid skate (Chondrichthyes, Batoidei, Rajidae). *Ann. S. Afr. Mus.* **60**: 253-263.
- STEHMANN, M. 1970. Vergleichend morphologische und anatomische Untersuchungen zur Neuordnung der Systematik der nordostatlantischen Rajidae (Chondrichthyes, Batoidei). *Arch. FischWiss.* **21**: 73-164.
- STEHMANN, M. 1976. *Breviraja caerulea* spec. nov. (Elasmobranchii, Batoidea, Rajidae); eine neue archibenthale Rochenart und zugleich ein Erstnachweis ihrer Gattung im Nordostatlantik. *Arch. FischWiss.* **27**: 97-114.

6. SYSTEMATIC papers must conform with the *International code of zoological nomenclature* (particularly Articles 22 and 51).

Names of new taxa, combinations, synonyms, etc., when used for the first time, must be followed by the appropriate Latin (not English) abbreviation, e.g. gen. nov., sp. nov., comb. nov., syn. nov., etc.

An author's name when cited must follow the name of the taxon without intervening punctuation and not be abbreviated; if the year is added, a comma must separate author's name and year. The author's name (and date, if cited) must be placed in parentheses if a species or subspecies is transferred from its original genus. The name of a subsequent user of a scientific name must be separated from the scientific name by a colon.

Synonymy arrangement should be according to chronology of names, i.e. all published scientific names by which the species previously has been designated are listed in chronological order, with all references to that name following in chronological order, e.g.:

Family Nuculanidae

Nuculana (Lembulus) bicuspidata (Gould, 1845)

Figs 14–15A

Nucula (Leda) bicuspidata Gould, 1845: 37.

Leda plicifera A. Adams, 1856: 50.

Laeda bicuspidata Hanley, 1859: 118, pl. 228 (fig. 73). Sowerby, 1871: pl. 2 (figs 8a–b).

Nucula largillierti Philippi, 1861: 87.

Nucula bicuspidata: Nicklès, 1950: 163, fig. 301; 1955: 110. Barnard, 1964: 234, figs 8–9.

Note punctuation in the above example:

comma separates author's name and year

semicolon separates more than one reference by the same author

full stop separates references by different authors

figures of plates are enclosed in parentheses to distinguish them from text-figures

dash, not comma, separates consecutive numbers

Synonymy arrangement according to chronology of bibliographic references, whereby the year is placed in front of each entry, and the synonym repeated in full for each entry, is not acceptable.

In describing new species, one specimen must be designated as the holotype; other specimens mentioned in the original description are to be designated paratypes; additional material not regarded as paratypes should be listed separately. The complete data (registration number, depository, description of specimen, locality, collector, date) of the holotype and paratypes must be recorded, e.g.:

Holotype

SAM-A13535 in the South African Museum, Cape Town. Adult female from mid-tide region, King's Beach, Port Elizabeth (33°51'S 25°39'E), collected by A. Smith, 15 January 1973.

Note standard form of writing South African Museum registration numbers and date.

7. SPECIAL HOUSE RULES

Capital initial letters

- The Figures, Maps and Tables of the paper when referred to in the text
e.g. '... the Figure depicting *C. namacolus* ...'; '... in *C. namacolus* (Fig. 10) ...'
- The prefixes of prefixed surnames in all languages, when used in the text, if not preceded by initials or full names
e.g. Du Toit but A. L. du Toit; Von Huene but F. von Huene
- Scientific names, but not their vernacular derivatives
e.g. Therocephalia, but therocephalian

Punctuation should be loose, omitting all not strictly necessary

Reference to the author should be expressed in the third person

Roman numerals should be converted to arabic, except when forming part of the title of a book or article, such as

'Revision of the Crustacea. Part VIII. The Amphipoda.'

Specific name must not stand alone, but be preceded by the generic name or its abbreviation to initial capital letter, provided the same generic name is used consecutively.

Name of new genus or species is not to be included in the title: it should be included in the abstract, counter to Recommendation 23 of the Code, to meet the requirements of Biological Abstracts.



P. ALEXANDER HULLEY & MATTHIAS STEHMANN
THE VALIDITY OF *MALACORAJA* STEHMANN, 1970
(CHONDRICHTHYES, BATOIDEI, RAJIDAE)
AND ITS PHYLOGENETIC SIGNIFICANCE