POSTILLA NOS. 1-50

MARCH 1950 — JUNE 1961

PEABODY MUSEUM OF NATURAL HISTORY

YALE UNIVERSITY, NEW HAVEN, CONN.

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YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 1 March 10, 1950 New Haven, Conn.

NOTES ON INDIAN BIRDS III
BIRDS FROM ASSAM

S. DILLON RIPLEY

I have recently been checking over specimens of birds from Assam, some kindly presented to me by Mr. Salim Ali, and others recorded by me on a recent survey for the Assam Government. The following notes appear worthy of setting down here.

Alcippe rufogularis

Comparison of a freshly-collected specimen of the Red-throated Tit-babbler from Gabru, Belsiri River, north Assam, on the edge of the Bhutan Duars (type locality of *rufogularis*), with a fresh specimen from Tezu, near Sadiya in the Mishmi Hills, shows that there are two races of this species as follows:

1. *Alcippe rufogularis rufogularis* Mandelli (type locality Bhutan Duars).
   Characters: brown above and paler, more gray below.
   Range: Bhutan Duars and northern Assam north of the Brahmaputra east presumably to the Dihang.
2. *Alcippe rufogularis collaris* Walden (type locality Sadiya).
   Characters: much darker on the crown and rufescent on the back. Flanks more heavily washed with brown.
   Range: northern Assam east of the Brahmaputra and Dihang, south to Manipur.

Only fresh specimens of this species are worth comparing, as is the case with some other members of the genus. I am most grateful to Mr. H. B. Usher for help in comparing my material with the types and other specimens in the British Museum.

Parus major

I have examined thirteen fresh skins from Nepal, Bengal, and Assam as well as older skins borrowed with the courteous cooperation of the authorities concerned, from the U. S. National Museum and the American Museum of Natural History. I agree with Ticehurst (Jour. Bombay Nat. Hist. Soc. *36*, 1933, p. 921) that *nipalensis* differs from *cinereus* of Java by the greater amount of white on the second outer rectrix. On the mainland there appears to be a continuous cline in color with topotypical *nipalensis* from Nepal being somewhat paler on the back than birds from Bengal or Burma.

Birds from northern Assam have a much reduced area of white on the second outer rectrix, comparable in this respect to *cinereus*, but they differ from that form in being more suffused with grayish-smokey on the flanks. I, therefore, propose:

Parus major vauriei subsp. nov.

Type: ♂ ad. (Peabody Mus. Nat. Hist. Yale No. 9334), collected December 21, 1946, by S. Dillon Ripley at Chabua, Northeastern Assam.

Diagnosis: from *nipalensis* this race differs by having reduced white patches on the second outer rectrices and a darker smokier wash on the flanks. From *cinereus* this race differs by the smokier wash on the under surface. From *ambiguus* this race differs by having somewhat more white on the second outer rectrix and by being darker, smokier on the flanks. From *decolorans* it differs by smaller size.

Measurements of type: wing 59, tail 53.5, culmen 10.5, white area on second outer rectrix (measured on inner web) 9mm.

Range: Northeastern Assam. I have not been able to determine from fresh material the extent of the range of this form into central Assam. It is possibly another of the races which attain a climax of saturation in Lakhimpur.

Remarks: it gives me great pleasure to name this race for Dr. Charles Vaurie of New York, who has been most helpful with identifications on numerous occasions.

Two new races of *Sturnidae*

Sturnus contra sordidus subsp. nov.

Type: ♀ ad. (S. Dillon Ripley Coll. No. 1802, deposited in Peabody Mus. Nat. Hist. Yale), collected November 21, 1946, by Salim Ali at Sadiya, Northeastern Assam.

Diagnosis: from *contra contra* Linnaeus, described from "India" and hereby restricted to Calcutta, Bengal, this race differs by having the streaklets on the shoulders much reduced, and quite lacking on the nape. In color these streaklets are sepia rather than vinaceous or drab. This race also differs from *contra* in the much darker underparts which are deep vinaceous-drab in tone. The thighs also are streaked with black rather than dark brown as in the nominate race.

From *superciliaris* and *floweri* this race differs as does *contra*, in not having the forehead streaked with white, in lacking the broad supercilium of those races, and in being very dark on the back.

Measurements of type: wing 120, tail 71, bill (from skull) 32.

Range: Northern Assam from Dibrugarh and Margherita north to the foothills around the Brahmaputra gorges and east through the Lohit Valley. North Cachar birds are somewhat intermediate, showing a cline in coloration between *contra* and *sordidus*, but are better placed in *contra*.

Remarks: Whistler (Jour. Bombay Nat. Hist. Soc. *36*, 1933, p. 725) expresses doubt about the race *dehrae* Baker, set up for the more western and southern population of this starling in India. I agree with him after having examined freshly-collected Indian specimens from Nepal and Central India, and suggest that *dehrae* be made a synonym of *contra*.

Acridotheres cristatellus fumidus subsp. nov.

Type: ♂ ad. (S. Dillon Ripley Coll. No. 1803, deposited in Peabody Mus. Nat. Hist. Yale), collected November 21, 1946, by Salim Ali at Sadiya, Northeastern Assam.

Diagnosis: from *fuscus* (restricted to east Bengal by Baker) this race differs by being darker, more sooty on the upper parts particularly on the rump, and darker, more smokey on the abdomen and belly. In *fuscus* this area is pinkish-ashy; in *fumidus* the pale color is much reduced in area in most specimens, and darker in tone. The thigh coverts also are blackish rather than dark vinaceous-gray as in the nominate form.

From *grandis* this race differs in the color of the bill and in the darker plumage.

Range: Assam in north Cachar and north to Lakhimpur and the Mishmi Hills.

Remarks: there is some variation in the extent of the color of the underparts in this form, but none are as pale on the abdomen as Indian specimens. The literature on this species is extensive and somewhat confusing. Much remains to be learned about the relationship of the species and its sibling, *albocinctus* in Burma.

N.B.: Previous notes in this series appeared in Journal Bombay Natural History Society 47, No. 4, August 1948, and Zoologica 33, pt. 4, December 1948.

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YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 2 March 27, 1950 New Haven, Conn.

RARE MIGRATION AND WINTERING RECORDS FROM THE YUCATAN PENINSULA

RAYMOND A. PAYNTER, JR.
Osborn Zoological Laboratory

While collecting ornithological specimens from October, 1948 to August, 1949 in the territory of Quintana Roo, on some of the islands off the east coast of the peninsula, and for a short while in the state of Yucatan, a number of wintering and migrating North American species were taken. Some of these specimens constitute new, or rare, records for the peninsula and cast additional light on the winter range and migration routes of common North American birds. The specimens referred to hereinafter are incorporated in the collections of the Peabody Museum. A comprehensive report on my Yucatan Peninsula collection is in preparation.

Numenius americanus Bechstein
Long-billed Curlew

The Long-billed Curlew has been recorded from Cozumel Island by Salvin (Ibis, 1889: 379) but never from the mainland of the peninsula. However, on March 31 while at Vigia

Chico, an abandoned village on Ascension Bay, Quintana Roo, a flock of five curlews was seen flying about a quarter of a mile off shore. On April 7, again at Vigia Chico, eight curlews were found on a sand-bar a short distance from the shore. They could be studied with binoculars with ease but were too far out to be collected.

Catoptrophorus semipalmatus inornatus (Brewster)

Western Willet

The only example of this species seen was a male which was collected in southern Quintana Roo at Xcalac on February 3. The willet has been recorded from Yucatan by Lawrence (Ann. Lyc. N. Y., *9*: 210, 1878) and on Cozumel Island by Salvin (*Ibid.*: 379). Ridgway (Bull. U. S. Nat. Mus., *50* (8): 317, 1919) has listed these records under *C. s. semipalmatus* but apparently he did not examine the specimens and merely assumed only the eastern race occurred on the peninsula. It seems probable that both races do occur there but, until the old specimens can be examined, *inornatus* is the only race definitely recorded.

Steganopus tricolor Vieillot

Wilson's Phalarope

Wilson's Phalarope has never been recorded from the Yucatan Peninsula. There are numerous records from central Mexico and the migration of the species through the lower portion of the peninsula is not unexpected. The only specimen seen was a lone male which was taken on May 19 at Laguna Chacanbacab (also called Laguna Alton), a large shallow body of water in Quintana Roo near the border of Campeche at the base of the peninsula. The date is unusually late for a bird so far south (see, *e.g.*, Bent, Bull. U. S. Nat. Mus., *142*: 28, 1927) but the specimen was exceedingly thin and may have been unable to migrate farther north.

Caprimulgus carolinensis Gmelin
Chuck-will's-widow

On April 5, at Cayo Culebra, Ascension Bay, a single specimen of this species was secured. No others were seen or heard. It has never been found on the peninsula or nearby islands and presumably does not winter there. During the first week of April the arrival of a wave of migrants composed of a number of diurnal species was noted and presumably this species was among them.

Tyrannus tyrannus (Linnaeus)
Kingbird

On April 3 we began field work on Cayo Culebra and secured two specimens of this species from the great number which was present. The Kingbird was not found on the mainland previous to this date but, upon our return on April 7, it was seen quite frequently during the months of April and May whenever we were in rather open country. Both Salvin (*Ibid.*: 362) and Boucard (Proc. Zool. Soc. Lond., 1883: 448) reported the species abundant in northern Yucatan in the same months.

✓ *Bombycilla cedrorum* Vieillot
Cedar Waxwing

A very rare species on the mainland of the peninsula. A single waxwing was seen feeding in the sea-wrack at Xcalac on February 2 and another bird was seen and collected at

Tabi (an Indian village about twenty miles northwest of Carrillo Puerto, Quintana Roo) on March 12. The only previous mainland record was a bird which was taken at Izalam, Yucatan in February, 1879 (Boucard, *Ibid.*: 442). Griscom (Amer. Mus. Novit. No. 236: 4, 1926) found the species abundant on Cayo Centro, Chinchorro Bank in January, 1926, but it was not present during my field work in February, 1949.

Vireo virescens virescens Vieillot
Red-eyed Vireo

One specimen was taken at Carrillo Puerto on April 8 and another at Chetumal, Quintana Roo on April 14. These were the only ones seen. The Red-eyed Vireo apparently passes through the Yucatan Peninsula in early April and has moved north by the time *Vireo v. flavoviridis* returns in large numbers in mid-April. Boucard (*Ibid.*: 441) records a specimen taken at Silam, Yucatan, in November by Gaumer but he notes, "No specimens sent to me." It would seem that the record is an error since no one has collected this vireo during the fall or winter months in spite of extensive collecting. The only previous record was a bird heard singing on April 3 by Cole at Chichen Itza (Bull. Mus. Comp. Zool., L (5): 136, 1906).

Limnothlypis swainsonii (Audubon)
Swainson's Warbler

A specimen taken on February 12, forty-six kilometers west of Chetumal, is the third record of this species for the Yucatan Peninsula. Although rare, it seems to occur regularly in the lower portion of the peninsula where little collecting has been done.

Helmitheros vermivorus (Gmelin)
Worm-eating Warbler

The Worm-eating Warbler has been recorded twice before from the mainland and once from Cozumel Island. The fourth record for the region was secured forty-six kilometers west of Chetumal on February 17.

Vermivora pinus (Linnaeus)
Blue-winged Warbler

Boucard (*Ibid.*: 440) reported the only previous record of this species which presumably was collected in Yucatan. On March 12, while at Tabi, a single specimen was seen and collected.

Vermivora peregrina (Wilson)
Tennessee Warbler

A male was collected on Cayo Culebra, Ascension Bay, on April 6. The few existing records for this species are from Cozumel Island. It has not yet been found on the mainland.

Dendroica tigrina (Gmelin)
Cape May Warbler

This warbler regularly winters in the West Indies. The only previous Mexican records are both from the Yucatan Peninsula. Boucard (*Ibid.*: 440) reported a bird in Yucatan and Peters collected one in Quintana Roo (Auk, XXX: 387, 1913). I secured one on Cayo Norte, Chinchorro Bank on February 4. Its presence on Chinchorro is not surprising since these small islands have great West Indian affinities, as does Cozumel Island to the north.

Dendroica caerulescens caerulescens (Gmelin)

Black-throated Blue Warbler

One specimen taken on Cozumel Island on January 12. This is the second record of this species for the island, again indicating the island's affinities with the Antilles.

Dendroica castanea (Wilson)

Bay-breasted Warbler

One of the most interesting discoveries resulting from the work on the Yucatan Peninsula was the presence of the Bay-breasted Warbler in great numbers in early May. The only other Mexican record I have been able to discover was a bird taken at Tehuantepec (Lawrence, Bull. U. S. Nat. Mus. *4*: 15, 1876). Unfortunately, I was present in Chetumal only two days during the migration of the species and my data is not so abundant as might be desired. Previous to the days in Chetumal I was in the city of Merida, and after that time in the rainforests in the middle of the peninsula. In neither locality did I see the species. However, on May 6 two specimens were taken at different localities in the low second growth outside the town of Chetumal. On the next day one specimen was taken, on a short trip to the outskirts of the town, and five more were seen mixed in with a flock of yellow warblers (*Dendroica aestiva*) and Magnolia Warblers (*Dendroica magnolia*). It would appear then, from the lack of records from central Mexico, that the species migrates through Central America and up through the Yucatan Peninsula and then across the Gulf of Mexico.

Piranga olivacea (Gmelin)

Scarlet Tanager

The Scarlet Tanager appears to be another species which migrates through the peninsula in the manner of the Bay-breasted Warbler. The first specimen seen was collected on April 1 outside of Chetumal. Field work took me to regions less suitable for the species during the month but on May 5 another specimen was taken at Chetumal. There are only a few other records for the peninsula although Boucard (*Ibid.*: 443) states it is common near Merida, presumably in the spring.

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YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 3 April 3, 1950 New Haven, Conn.

A SMALL COLLECTION OF BIRDS FROM ARGENTINE TIERRA DEL FUEGO

S. Dillon Ripley

In the spring of 1948, Mr. Stephen Sanford generously suggested that a representative of the Peabody Museum of Yale accompany his party on a brief visit to Tierra del Fuego for collecting purposes. Unfortunately the group was somewhat delayed in arrival due to difficulties with weather and planes, but in mid-April they arrived at Rio Grande on the east coast. Mr. Sanford was accompanied by his wife, Mr. Van Campen Heilner and Mr. Migdalski. The first part of their stay was at Estancia "Sara" near Rio Grande where the country was very open and treeless, but Mr. Migdalski was later able to go farther north to the Estancia of the Bridges family where there were trees in some number. During his actual collecting time April 27th to May 20th, Mr. Migdalski was able to collect 78 specimens of 35 species, a difficult assignment due to the severe autumnal weather and many of the species having already migrated north. One advantage, however, was the fact that all the birds were in fresh plumage, although an additional difficulty was the heavy deposit of fat which all specimens carried. Some species showed definite gonadal enlargement, presumably correlated with the migratory season, and heavy fat deposition.

The grateful thanks of the Museum must go to Mr. and Mrs. Sanford for assisting so generously in securing this valuable material, as well as to the authorities of the American Museum of Natural History and the Museum of Comparative Zoology for permission to examine specimens in their care. Color notes are by Mr. Migdalski.

List of the Species

Phalacrocoracidae

Phalacrocorax brasilianus brasilianus (Gmelin): Brazilian Cormorant.

A female cormorant was shot on May 16. Mr. Migdalski has noted the soft parts as: "iris brown; eyelids yellow; bill, upper mandible dorsally brown, laterally greenish-yellow, lower mandible greenish-yellow, skin of throat yellow; legs black."

This bird is in immature plumage. It measures: wing 226 mm., tail 149 mm., culmen 44 mm.

Ardeidae

Nycticorax nycticorax obscurus Bonaparte: Chilean Night Heron.

A male taken May 20 is of this dark-bellied form. Soft parts: "iris red; ocular skin greenish-yellow; bill, upper mandible brownish-black, yellowish-green at the base, lower mandible distally for 1/3 of the length brownish-black, remainder yellowish-green; legs, suffrago, posterior tibio-tarsus, anterior tibio-tarsus greenish-black; feet black, pads yellow." Wing: 349.

Threskiornithidae

Theristicus caudatus melanopis (Gmelin): Black-faced Ibis.

A single female of the ibis of Tierra del Fuego was collected

April 29. Soft parts: "iris red; bill and facial skin black; legs purplish-red."

Anatidae

Cygnus melancoryphus (Molina): Black-necked Swan.

A male Black-neck was shot on April 30. It has a wing measurement of 436. Soft parts: "iris brown; bill, upper mandible dark slate, tip fleshy gray; facial skin red; legs and webs fleshy."

Coscoroba coscoroba (Molina): Coscoroba Swan.

A male Coscoroba taken May 4 is in partial immature plumage. A few feathers on the crown and a considerable area of the upper back, a few scapulars, tertials, median wing coverts and upper tail coverts are tipped with brown. The primaries are blackish terminally. This immature plumage is very swanlike. Soft parts: "iris light brown, bill reddish purple, legs and webs pinkish-flesh." Wing: 145. Not common. Found only on inland ponds.

Lophonetta specularoides specularoides (King): Crested Duck.

The most abundant duck at this season. Three males were skinned out of a good number shot on April 28 and 29. Two males are in very worn plumage. One bird is in extremely fresh plumage indicating the closeness of the moult. Soft parts: "iris red (2), light brown (1); bill, upper mandible bluish-black, lower pinkish-orange; legs and webs brownish-gray." Wing: 257.5, 259 (worn), 275.

Chloëphaga poliocephala Sclater: Ashy-headed Goose.

A male Ashy-head weighing five pounds was taken on May 1. Normally these birds leave about the seventh of April, and Mr. Migdalski consequently found this the least common of the geese. It is in fact the least common species in the Rio Grande area. Soft parts: "iris dark brown; bill black; tibiotarsus orange with black mottling; feet, middle toe and webs black, inner and outer toes black with orange sides." Wing: 363. This bird is in worn plumage although the tail and wing feathers have been largely freshly moulted in.

Chloëphaga rubidiceps Sclater: Ruddy-headed Goose.

A pair and a young female were taken April 27 and 29. This, the second most common species in the area, is said to leave normally by April 15. They return in early September and usually begin to breed about October 24. The clutch size ranges from 4 to 11 eggs. Birds are flocking for migration by about April 10. One adult weighed 4 pounds 8 ounces.

These birds are in wing moult. They measure: wing ♂ 325, ♀ 314, im. ♀ 329. The adult female seems to be growing a new set of primaries, while the males' are being partially shed. The tarsus of these specimens measures: 66.5, 64, im. 65.

Chloëphaga picta picta (Gmelin): Upland Goose, Caiquen.

This is the most numerous species in the San Sebastian region. An adult and an immature male and an adult female were collected on May 1 and 2. These are the Barred Upland type, the predominant type in this area. Mr. Migdalski failed to find the white males during his stay. Local information claimed that most males were of the barred type, and that the pure white birds were a color phase.

This species arrives in the area in early September and seldom begins breeding before October 17. The average clutch is seven eggs which take the normal incubation period. By the end of February most of the young can fly. Migration begins the last week in April and by May 20 nearly all birds have left. Those few that stay over the winter usually suffer from frozen feet and become very thin. Local estimates report that seven to ten geese eat as much grass as one sheep.

Geese are said actually to be drawn by the sheep, as they prefer cropped grass. Thus the density of the geese is greater in the sheep grazing areas. Where they are heavily concentrated the amount of goose excrement is said to become so great that sheep are driven away. Consequently for many years now the upland geese have been a pest and a bounty is paid for their destruction, at the rate of 4 cents (Argentine) an egg, 15 cents per gosling and 50 cents for an adult bird. In 1947-8 alone the Estancia "Sara" staff at Rio Grande broke 35,000 eggs, and another nearby estancia broke 75,000 eggs. The cook and her husband on one estancia during that season collected 4,000 eggs, 900 young and 400 adults for the bounty. These specimens measure: wing ♂ 427 (worn), ♀ 392; tail ♂ 177, ♀ 156; culmen ♂ 33, ♀ 32; tarsus ♂ 84, ♀ 77. Weight ♂ 6 pounds 4 ounces, ♀ 6 pounds.

Chloëphaga hybrida hybrida (Molina): Kelp Goose.

A pair of Kelp Geese were collected at Viamonte on May 11 and 15. They were wary and difficult to approach. Migdalski never saw them farther than 60 yards from the shore, once or twice on sheltered small ponds near the beach. The "Kelpers" as they are called locally, arrive in March and leave in September in contrast to the other species. Soft parts: "iris dark brown, bill black, legs, feet and webs bright yellow; iris brown, bill fleshy, legs, feet and webs bright yellow." Wing: ♂ 381, ♀ 344. Both birds are freshly moulted and weigh: ♂ 5 pounds 12 ounces; ♀ 4 pounds 8 ounces.

Tachyeres patachonicus (King): Flying Steamer Duck.

Two females were taken May 1 and 4. One is subadult and is in moult. The reddish throat patch is prominent in this bird. Wing: ad. 296, subad. 260. Soft parts: "iris dark brown; bill (ad) greenish-yellow basally, distal half bluish-black, (im) yellowish-green, tip black; legs and feet yellow, webs grayish-black." The flightless species does not occur so far north.

Anas versicolor fretensis King: Southern Gray Teal.

A single male, taken April 29, measures: wing 219. Soft parts: "iris dark brown, bill, upper mandible black, basal half excluding culmen yellow, lower mandible bluish-gray; legs and feet greenish-gray, webs black."

Anas georgica spinicauda Vieillot: Brown Pintail.

A female was collected April 27. The tail is worn but the wings are freshly moulted and measure: 229. The bird was very fat and greasy. Soft parts: "iris dark brown; bill, upper mandible yellow, culmen and tip black, lower mandible yellow, tip black; legs and toes gray, webs black."

Anas flavirostris flavirostris Vieillot: Yellow-billed Teal.

With the Crested Duck, the commonest species at Rio Grande. Birds were taken the end of April, all fat, freshly moulted and in good condition. Wing: ♂ 179 (m), ♀ 191, 192. Soft parts: "iris dark brown; bill, upper mandible yellow, culmen and tip black; lower mandible yellow, tip black; legs and feet gray, webs black."

Anas sibilatrix Poeppig: Chiloe Widgeon.

A single male, freshly moulted, was collected April 29.

Accipitridae

Buteo polyosoma polyosoma (Quoy and Gaimard): Rufous-backed Buzzard.

Two varicolored immature birds, presumably a male and female, were secured on May 2 and 15. Soft parts: "iris creamy-brown, yellowish-brown; bill greenish-gray, black tip to upper mandible; cere greenish-yellow; legs yellow." Wings: ♂ ? 440, ♀ ? 500.

Falconidae

Milvago chimango chimango (Vieillot): Chimango.

Three females were collected at Rio Grande in late April. They are tame confiding birds. Soft parts: "iris dark brown; bill horny-gray, cere fleshy; legs bluish-gray." Wing: 283-304.

Polyborus plancus plancus (J. F. Miller): Carancho or Caracara.

A male was collected at Rio Grande May 4. Soft parts: "iris light brown; bill creamy-white, touch of light blue at the base; cere orange; ocular skin orange; legs yellow." Wing: 415.

Falco sparverius cinnamominus Swainson: Chilean Kestrel.

A female with a wing measurement of 205 was taken May 2.

Haematopodidae

Haematopus leucopodus Garnot: Magellan Oyster-catcher.

A pair were found at Viamonte May 3 and 16. They measure: wing ♂ 261, ♀ 256. Both are rather worn. Soft parts: "iris orange red; eyelids yellowish-orange; bill, upper mandible dark brown, reddish-orange at base, lower mandible basally orange red, distally dark brown; light grayish with fleshy touches."

Haematopus ater Vieillot and Oudart: Quoy's Black Oyster-catcher.

A male taken May 3 has a wing measurement of 271. Soft parts: "iris orange red; eyelids orange red; bill red; legs light creamy-flesh."

Thinocoridae

Attagis malouinus (Boddaert): White-bellied Seed Snipe.

Two males, a female and a specimen in alcohol were taken in late April and May. These birds are in fresh plumage, wing ♂ 165, 175, ♀ 172. Soft parts: "iris brown; bill dark horn; legs creamy gray."

Charadriidae

Oreopholus ruficollis (Wagler): Slender-billed Dotterel.

A male with a wing measurement of 167 was collected May 3. This is a very late date for this Dotterel. No other shore birds were taken or seen. This bird was extremely fat.

Laridae

Larus marinus dominicanus Lichtenstein: Kelp Gull.

A single male of April 27 has soft parts: "iris brownish-gray; eyelids pinkish-orange; bill yellow, distal third of lower mandible reddish-orange; legs greenish-cream."

Strigidae

Bubo virginianus nacurutu (Vieillot): Magellan Horned Owl. A female with a wing of 350 was shot at Viamonte May 11. Soft parts: "iris yellow; bill and cere black."

Picidae

Campephilus magellanicus (King): Magellan Woodpecker.

A pair were taken in a patch of forest fifteen miles inland from Viamonte on May 19. The female has slightly enlarged ovaries. Soft parts: "iris orange; bill and legs grayish-brown." Wing: ♂ 221.5, ♀ 216.

Furnariidae

Aphrastura spinicauda spinicauda (Gmelin): Thorn-tailed Creeper.

Common in the trees at Viamonte. Soft parts: "iris brown; bill, upper mandible black, lower whitish-flesh, tip black; legs greenish-brown, pads greenish-yellow." Wing: ♂ 64, 65, ♀ 60-62.

This race is more pure brown, less rufous than specimens from Southern Chile, which should be separated as *tupinieri*.

Pygarrhicus albogularis (King): White-throated Tree-Runner.

Another common spiney-tail about Viamonte. Soft parts: "iris brown, dark brown; bill, upper mandible black, lower grayish-white, dark tip (♂), light grayish-white, dark tip (♀); legs brown." Wing: ♂ 85-88, ♀ 83-85.

Tyrannidae

Xolmis pyrope (Kittlitz): Fire-eyed Pepoaza.

Two males taken May 13 and 14 were the only tyrannids seen. Soft parts: "iris red." Wing: 120, 122.5.

Muscicapidae

Turdus falcklandii magellanicus King: Magellan Robin.

Some of these thrushes, taken between May 11 and 15, are coming into breeding condition. All specimens are very fat and freshly moulted. Wing: ♂ 137.5-144, ♀ 131, 132.

Fringillidae

Phrygilus unicolor ultimus, subsp. nov: Tierra del Fuego Plumbeous Finch.

Type: ♂ ad. (Yale Peabody Museum No. 9335.) collected at Viamonte, Rio Grande, Tierra del Fuego, Argentina, on May 16, 1948, by E. C. Migdalski.

Description: similar to *unicolor* (type locality Tacna, restricted by Hellmayr) but larger, the adult females with somewhat darker, more blackish streaks. From *tucumanus* and *inca* this race differs as does *unicolor*. From *grandis* these birds differ by being lighter gray in color in the male, and in the females by being lighter, less rufescent on the back, with lighter streaking.

Measurements: wing ♂ 98.5, ♀ 94.5, 95: tail ♂ 72.5, ♀ 65, 66: culmen (from skull) ♂ 13, ♀ 12.5 (2). A series of eleven birds from Chile and northern Argentina measure: wing ♂ 88-92.5, ♀ 81-88; tail ♂ 60-68.5, ♀ 59-61.5; culmen ♂ 11-12, ♀ 11-11.5.

Remarks: These birds are in fresh plumage. Soft parts: "iris brown; bill, upper mandible dark horn, lower light horn; legs brown."

Zonotrichia capensis australis (Latham): Patagonian Sparrow, Chingolo.

Two males were collected in mid-May. Both birds have considerable streaking on the crown. Wing: 78, 84.

Icteridae

Notiopsar curaeus (Molina): Chilean Blackbird.

Not uncommon about Viamonte in mid-May. One male had slightly enlarged testes. Wing: ♂ 137, 138, ♀ 129, 132.

Trupialis militaris militaris (Linnaeus): Red-breasted Starling, Pecho Colorado.

Common at Rio Grande in April and May. Soft parts: "iris brown; bill, upper mandible dark horn, lower light grayish-horn; legs slate gray (some with a brownish tint)."

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 4 May 22, 1950 New Haven, Conn.

A NEW TANAGER FROM MEXICO

RAYMOND A. PAYNTER, JR.
Osborn Zoological Laboratory

Piranga roseo-gularis tincta subsp. nov.

Type: ♂ ad. (No. 9153, Peabody Mus. Nat. Hist., New Haven), collected at Chetumal, Territory of Quintana Roo, Mexico, Nov. 12, 1948, by Raymond A. Paynter, Jr.

Diagnosis: Compared with typical *roseo-gularis* the male differs in being more saturated gray above, grayer on the breast, and washed with buffy on the abdomen. Compared with *cozumelae* it is equally dark above but with a reddish tinge, slightly deeper pink on the throat, and faintly streaked with pink on the breast and upper abdomen. The tail is shorter than in either race.

The female of this form is more buffy below than *roseo-gularis* and lighter on the pileum than typical *cozumelae*.

Immature specimens of both sexes are highly variable and are inseparable from *roseo-gularis* and *cozumelae*.

Measurements: Ridgway (Bull. U. S. Nat. Mus. *50* (2):99) states that *cozumelae* has a longer tail and a shorter wing than *roseo-gularis*. However, in my series of specimens, the difference between the mean tail length of the males of *tincta* and the means of the other two races is the only statistically significant interracial difference in external measurements. $P < .02$.

		Adult Males			Adult Females		
Character	Race	No. Specimens	Mean	Standard error of mean	No. Specimens	Mean	Standard error of mean
Tail	*tincta*	8	64.81 mm.	±.58 mm.	7	63.00 mm.	± .60 mm.
	roseo-gularis	12	67.08	±.71	6	62.75	±1.40
	cozumelae	4	67.25	±.69	2	63.75	± .25

Three adult males of *tincta* collected in Chetumal during November and December had a mean weight of $24.83 \pm .21$ grams, whereas two males of the same race from Carrillo Puerto taken in March weighed $22.90 \pm .40$ grams. The difference between the two means is statistically significant. $P < .02$. A female collected in January at Chetumal weighed 22.00 grams.

The only weights available for *roseo-gularis* are two males taken at Xcan and Kantunil Kin in April which weighed 23.40 and 22.60 grams, and two females from Tabi and Kantunil Kin, taken in March and April, which weighed 23.20 and 20.70 grams.

A male and female of *cozumelae*, taken in January, weighed 22.30 and 22.90 grams respectively.

Range: The more humid regions of the central and southern portions of the Yucatan Peninsula including Campeche and Quintana Roo. The range of *roseo-gularis* should be amended to include only the more arid portion of the peninsula, roughly consisting of the entire state of Yucatan and the northern tip of Quintana Roo.

Material Examined: 54 specimens of all races.

roseo-gularis: 26 specimens from Chichen Itza, Yuc., Xocempich, Yuc., Xbac, Yuc., "Yucatan," Kantunil Kin, Q. Roo, Xcan, Q. Roo, and Tabi, Q. Roo.

tincta: 19 specimens from Chetumal, Q. Roo, Carrillo Puerto, Q. Roo, Acomal, Q. Roo, Palmul, Q. Roo, Chunyaxche, Q. Roo, and Pacaitun, Camp.

cozumelae: 9 specimens from Cozumel, Q. Roo.

Discussion: The specimens from Pacaitun, Campeche, approach *roseo-gularis* clinally in the coloration of the back but they have been placed with *tincta* because of their shorter tails.

The variations in the weights of the males of *tincta* are extremely interesting. Greater weight is possibly an additional racial character of *tincta*. From the few available data the birds from Chetumal are definitely more heavy than those from Carrillo Puerto. It may be that Chetumal is an area where the racial characters are most strong and Pacaitun, Carrillo Puerto, etc., are areas which show a gradation toward *roseo-gularis*. Variations in color and tail length seem to support this hypothesis. Weight variation may be seasonal but examination of the gonades indicates that it is not correlated with the development of these organs.

I wish to thank the authorities of the Museum of Comparative Zoology, the Chicago Natural Museum, and the American Museum of Natural History for permitting me to examine material in their care.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 5 December 29, 1950 New Haven, Conn.

A LARGE PYCNODONT FROM THE NIOBRARA CHALK

JOSEPH T. GREGORY

Among the fossils collected on the Yale Scientific Expedition of 1872 are fragments of the skull and dentition of a large pycnodont fish. These were found by O. C. Marsh in the Cretaceous chalk exposures along the Smoky Hill River in Kansas on November 6, 1872. They are of particular interest as an example of extreme reduction of the dentition in an aberrant member of this family of durophagous fishes, and also because of their unusually large size. The specimens confirm the distinctness of a genus described by Leidy from the Cretaceous of Mississippi. It is quite fitting that the species should be named for their discoverer.

CLASS PISCES (OSTEICHTHYES)

Order Pycnodontoidea

FAMILY PYCNODONTIDAE

Hadrodus marshi new species

Type: Premaxillary, left and part of right splenials, and fragments of skull roof of one individual, Y.P.M. Catalogue of Vertebrate Palentology, no. 1950.

Type locality: "South side Smoky Hill River, 2 miles east of North Fork." This places it in Logan Co., Kansas, about five miles west of Russell Springs.

Formation and age: Probably upper Niobrara Chalk, early Senonian.

Diagnosis: Two-thirds the size of *Hadrodus priscus* Leidy, premaxillaries shorter and much higher than in that species and not excavated anteriorly; anterior prehensile tooth smaller than posterior. Splenials with 4 rows of irregularly oval teeth, some of which bear apical cusps; teeth of the lateral row slightly larger than the others; 4 to 5 teeth in each row.

DESCRIPTION

Premaxillary: A left premaxillary lacking the dorsal extremity is tall and short, of fairly stout proportions, more similar to *Gyrodus* (Hennig, 1906, pl. X) than to such forms as *Proscinetes* [*Microdon*]. There is no trace of a horizontal process along the border of the mouth. It is about twice the size of that of the large specimen of *Gyrodus circularis* Agassiz figured by Hennig. The median surface is straight and bears throughout its length a suture for the opposite premaxillary; these bones must have been closely united throughout their length, in a normal fashion, not diverging as they have been restored in *Gyrodus* (Hennig, 1906, p. 148, pl. X). On its posterior margin is a large oval, vertically elongate depression, its upper end merging with the lateral surface of the bone. Two large, bicuspid, prehensile teeth are ankylosed to the oral margin. These differ from those of *H. priscus* figured by Leidy (1873, pl. 19, figs. 17-20) in somewhat greater disparity in size, and in the less distinct groove separating the cusps on the outer surface of the crown. They lack the posterior concavity characteristic of most pycnodont "incisors." The premaxillary bone itself differs markedly from Leidy's figure in its relatively greater height—which may be due to incompleteness of that specimen—and in the absence of an excavation in the anterior border. Leidy (1873, p. 294) interpreted the excavations above the roots of the teeth as spaces for developing replacement teeth. In the opinion of most students of the pycnodonts (cf. Woodward, 1895, p. 194) there was no tooth replacement. Neither the form of the cavity in the premaxillary of *Hadrodus* nor its remoteness from the dentigerous border suggests that it was an alveolus; however, Saint-Seine (1949, p. 121) has observed unworn replacement teeth in just this position in *Proscinetes* [*Microdon*] *sauvanausi* Thiollière. Hence Leidy's inference may be correct, although the mechanism of replacement and ankylosis of the teeth to the premaxillary remains an enigma. A more plausible interpretation is offered by Smith-Woodward (1895, p. 193) who suggests that the excavation lodged the nasal capsule.

Measurements of the Premaxillary

	mm.
Maximum length, anteroposterior	26.0
Height as preserved, including teeth	66.0
Length of first tooth	10.1
Width of first tooth	7.3
Length of second tooth	12.4
Width of second tooth	8.7

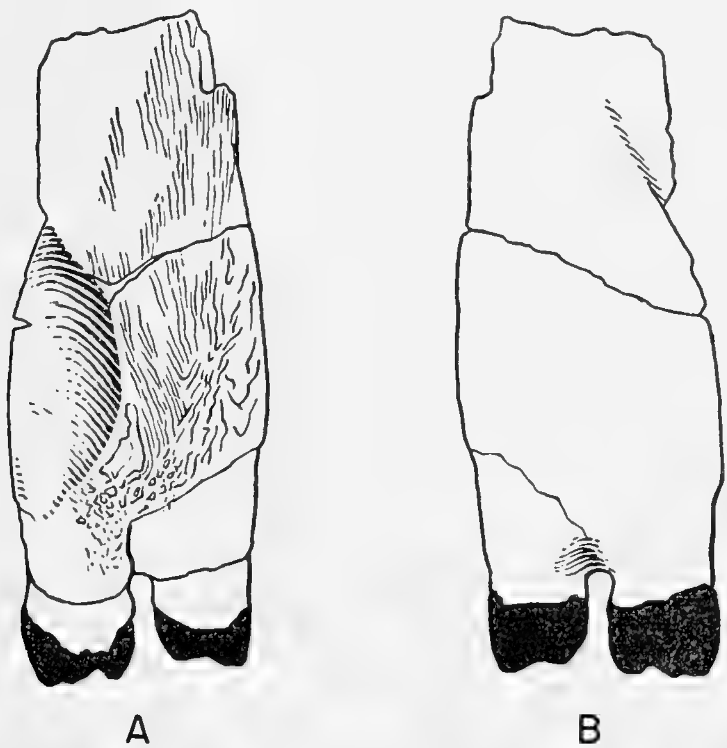

Figure 1. *Hadrodus marshi,* n. sp. Type specimen, Y.P.M. 1950. A. Medial view of premaxillary showing interpremaxillary suture and pocket for olfactory capsule in posterior border. B. Lateral aspect of premaxillary. x 1.

Splenials: A large left splenial with extremely deep anterior symphysis and only moderate coronoid process, and the posterior part of its left homologue show that the lower jaw of this genus differed in detail from other pycnodonts. It is only slightly longer than that of *G. circularis*, but much deeper, especially anterior to the front teeth where it reaches its maximum depth. The symphysial area is short, deep, with a straight posterior boundary. Its lower fourth forms a nearly round facet separate from the remainder of the denticulate suture. Possibly this small area met the opposite splenial, and the coarser suture was with the dentary. If so, the latter bone was further reduced than in *Mesturus* (Woodward, 1895, pl. 15; Saint-Seine, 1949, p. 107, fig. 38) or *Gyrodus* (Hennig, 1906, pl. X and Weitzel, 1930, p. 93), but perhaps no more than in *Proscinetes* [*Microdon*] (Saint-Seine, p. 112, fig. 41). There is no indication of contact with the dentary on the lateral surface of the splenial, except possibly at the extreme front. This is a characteristic pycnodont condition and supports the reference of *Hadrodus* to this Order in spite of considerable differences in dentition.

The large size of the upper prehensile teeth suggests that lower incisors should likewise have been prominent. It is possible that the dentary was larger than suggested above and the lower jaw as a whole about twice the size of that of *Gyrodus circularis*, with proportions similar to that species.

Four rows of irregularly oval teeth with one to three cusped crowns are present. Unlike other pycnodont genera, the lateral row contains the largest teeth; they are subequal in size, about 9 mm. in their long diameters, separated by spaces of about 1 mm. The most posterior bears three cusps in a straight line along its crown; the second from the front bears an obscure single, laterally placed cusp. In the second and third rows the teeth are slightly smaller and more variable in shape. A single large tooth with two apical cusps forms the fourth, innermost row. Variability in both number and shape of the teeth is indicated by the fragment of the right splenial in

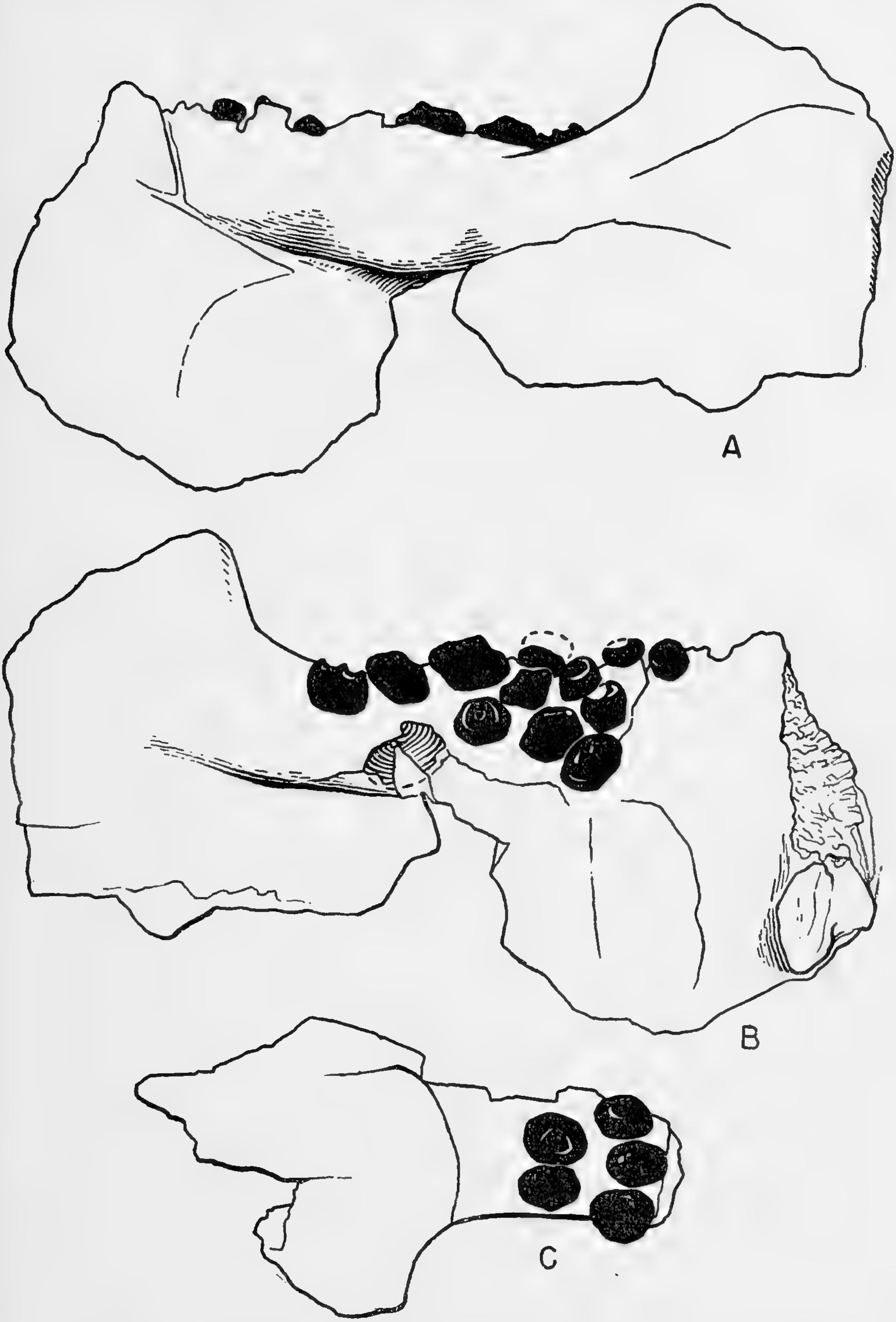

Figure 2. *Hadrodus marshi,* n. sp. Type specimen, Y.P.M. 1950. A. Left splenial, lateral aspect. B. Left splenial, medial aspect. C. Right splenial, dorsomedial aspect. x 1.

which the posterior tooth of the lateral row, as displayed on the left side, is absent, and the teeth of the second row are nearly as large as those of the lateral row.

The crowns of the teeth are smooth except for the papilla-like tubercles at the apex. In this they differ markedly from *Gyrodus* and are more similar to *Gyronchus* [*Mesodon*] or *Proscinetes* [*Microdon*]. There is no trace of the tendency toward transverse broadening of the teeth seen in *Coelodus* or *Anomoeodus*. Similar papillae are present on the crowns of tritoral teeth of *Acrotemnus faba* Agassiz. That species, however, differs from *Hadrodus* in the much greater transverse width of its tritoral teeth, in the presence of a marked transverse ridge along their crowns, and in having a group of papillae adjacent to but not upon this ridge line. In *Hadrodus* the papillae are upon the ridge, if any is present, and tend to be oriented anteroposteriorly if more than one papilla occurs.

Measurements of the Splenials

	mm.
Anteroposterior length (reconstructed from both)	120
Depth in front of crushing teeth	48
Anteroposterior length dental battery	47

Roofing bones: Several fragments of thick skull bone ornamented by closely but irregularly spaced, rounded tubercles are present. Most probably they are portions of opercular bones, although insufficient borders remain to determine their exact position. None shows traces of canals of the lateral line system. Some fragments show a lower radiating type of sculpture near the thin margins such as Hennig (1906, p. 161) describes on the preoperculum of *G. circularis*. The thick tuberculated layer of ganoine above extremely cancellous bone is characteristic of pycnodonts; *Hadrodus* shows coarse tuberculation commensurate with its large size. Such strong sculpture is found in *Gyrodus* and in *Gyronchus* [*Mesodon*] *hoeferi*, the earliest appearing pycnodont; other members of the family are said by Hennig (*Ibid.*, p. 179) to have considerably weaker tuberculation.

DISCUSSION

Dr. David H. Dunkle has called my attention to the resemblance of this specimen to certain semionotids. Bifid prehensile teeth are characteristic of *Dapedium*, whereas the incisors of pycnodonts have single crowns, concave internally. *Dapedium* also has crushing palatal teeth. However the shape of the premaxillary of *Hadrodus* differs greatly from that of *Dapedium* in its great vertical and short horizontal extent, and also in the absence of surface ornamentation. Conceivably the premaxillary of *Hadrodus* could be derived from that of the early Jurassic *Dapedium* by shortening and dorsal extension, but as *Dapedium* had already attained a deep body and relatively high, short skull without vertical elongation of the premaxilla, it seems unlikely that such a change would have occurred. Aside from the form of the incisors, there is no reason to postulate this relationship.

The form of the splenial teeth, particularly the development of one or a few papillae on the crown, is not unlike that of some species of *Lepidotes* such as *L. mantelli* Agassiz. Wide and irregular spacing of the splenial teeth, and lack of differentiation of these teeth into rows of small and large tritors are most unlike normal pycnodonts and far more like *Lepidotes*. Also, the deep anterior portion of the splenial is suggestive of that genus. No trace of tooth succession can be found, however, and the shape of the premaxillary bone is very unlike *Lepidotes* in which there is a well-developed alveolar ramus along the oral margin and a slender ascending process arising from the anterior end (Saint-Seine, 1949, p. 138, fig. 161, p. 140). Nor is there any trace of a separate coronoid bone such as occurs in the semionotids. The splenial alone forms the major portion of the lower jaw and its coronoid process, as in other pycnodonts. Thus the resemblances lack detail indicative of relationship and may reasonably be ascribed to convergence.

Only one other species of pycnodont is known from the Niobrara formation, *Micropycnodon kansensis* (Hibbard and Graffham). This is a small fish, scarcely one-third the size of *Hadrodus marshi,* which may readily be distinguished by its more typically pycnodontid splenial dentition, with two rows of small teeth lateral and one row internal to the principal row of enlarged crushing teeth. *Coelodus streckeri* Hibbard from the underlying Carlisle shale of Kansas is also of Turonian age. Pycnodonts are more numerous in the lower Cretaceous of the Gulf of Mexico embayment, several genera having been reported (Williston, 1900, Gidley, 1913).

The type locality and horizon of *Hadrodus priscus* Leidy are uncertain; Columbus, Mississippi, is on the Eutaw formation but only a short distance from the base of the Selma Chalk. The horizon may well be equivalent to the Niobrara and close to that of *H. marshi.* Whether the characters here used to seperate these species are valid remains to be determined by future discoveries of more complete material from these and other localities. Differences in the form of the premaxillary seem sufficient for specific distinction of the two forms.

Although it is difficult to estimate the size of the fish from such fragments as are available, especially when the proportions of the genus are not accurately known, it seems worthwhile to point out that *Hadrodus* may well have been the largest of the pycnodonts. If its proportions were similar to those of *Gyrodus circularis,* it may have exceeded a meter in length. The premaxillary is twice the size of that of a large specimen of *G. circularis* described by Hennig, and the splenial exceeds those of that species by 30 to 50 per cent.

Hadrodus shows the most reduced and specialized dentition thus far known among the pycnodonts. Reduction in number of teeth, increase in size of the external row and corresponding decrease in importance of the next to innermost row of the splenial teeth, and development of a diastema between teeth of the dentary and splenial are all divergent from the general trend of pycnodont evolution, and separate *Hadrodus* sharply from all other described genera. Closest resemblances, in dentition, appear to be with *Gyronchus* [*Mesodon*] and certain species of *Proscinetes* [*Microdon*], in which the crushing teeth are irregular in size and distribution. It is interesting to note that the dental evolution of the pycnodont line leading from *Gyronchus* to *Hadrodus* parallels that of the placodont reptiles from *Paraplacodus* through *Placodus* and *Cyamodus* to *Henodus* (von Huene, 1936).

Four main types of dentition have evolved among the pycnodonts. *Eomesodon*, the earliest form, and *Gyronchus* [*Mesodon*] have smooth crowned crushing teeth arranged in irregular rows and uneven in size. In *Mesturus* and *Proscinetes* [*Microdon*] the teeth attain regular arrangement in longitudinal rows; their crowns are smooth or with apical pits. This type of dentition persists into the Eocene *Pycnodus*. *Gyrodus* has similar rows of teeth, but the crowns are ornamented with concentric rings of mamillary papillae. *Coelodus* shows divergence in the transverse broadening of the enlarged teeth, beginnings of which may be observed in some species of *Proscinetes*. *Anomoeodus* may represent a further development of this line, with degeneration of the lateral rows of teeth. Finally, *Hadrodus* has greatly reduced the number of teeth and shifted emphasis from internal to external rows. It will be most interesting to discover the vomerine dentition which accompanied this modification.

ACKNOWLEDGMENTS

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Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 6 February 28, 1951 New Haven, Conn.

NOTES ON INDIAN BIRDS IV*

SOME RECENTLY COLLECTED BIRDS FROM ASSAM

S. DILLON RIPLEY

During a collecting trip this autumn and winter in Assam's eastern Naga Hills and Manipur, a number of interesting specimens were secured which seem to warrant preliminary description prior to further publication. The localities of all these forms are within the Naga Hills District or the Chief Commissioner's District of Manipur (formerly Manipur State), and will be dealt with in detail in a later paper. I am most grateful to the authorities of the British Museum, the United States National Museum, and the American Museum of Natural History for allowing me to examine comparative material in their care.

Arborophila torqueola interstincta, subsp. nov.

Type: ♂ ad. (Yale Peabody Museum No. 12006) collected November 30, 1950, by S. Dillon Ripley on Mt. Zephu, 93 miles east of Kohima, eastern Naga Hills, Assam.

Diagnosis: from *torqueola* of the Sikkim Himalayas this race differs by being more heavily and distinctly barred on the back and inner wing coverts in both male and female

* Previous papers in this series have appeared in the JOURNAL, BOMBAY NATURAL HISTORY SOCIETY *47*, 1948, p. 622; ZOOLOGICA *33*, 1948, p. 199; and POSTILLA, 1950, No. 1.

plumage. The lower parts in both sexes are richer and darker chestnut, and richer and darker rufous-buff on the thighs and upper under tail coverts.

Compared to *batemani* of Mt. Victoria and the Chin Hills, this form differs as does *torqueola,* lacking the greater degree of chestnut on the sides of the neck and the greater area of chestnut on the scapulars. From *griseata* of Tonkin this population differs in having richer, darker chestnut streaking on the flanks with more pronounced and distinct white drops on the centers of the feathers, and with the black central patch on the feathers of the under tail coverts much reduced in extent.

Measurements (mm.):

	wing	tail	culmen (from skull)
4 ♂ ♂	144.5-156	53-62	19-21
♀	150	56	19

Range: Upper Chindwin River drainage area in eastern Naga Hills of Assam and Burma.

Indicator xanthonotus fulvus, subsp. nov.

Type: ♂ ad. (Yale Peabody Museum No. 12001) collected December 11, 1950, by S. Dillon Ripley at Pfutsero, eastern Naga Hills, Assam.

Diagnosis: from *xanthonotus* of the Himalayan Range this race differs by being darker, more blackish on the upper parts and darker, more blackish on the abdomen, thighs and under tail coverts. The streaking of the abdomen though blackish, is less in extent, thus less prominent. On the forehead the golden patch extends somewhat less far back on the crown, and the edging to the feathers of the back and scapulars is reduced.

Soft parts: iris brown; bill yellowish-horn, distal half of upper mandible and lower mandible brown; feet grayish-brown.

Weight: 29 grams.

Measurements (mm.):

	wing	tail	culmen
♂	90	57	11
♀	86	56	10

Range: Naga Hills, Margherita (?) Assam, and Myitkina District, north Burma.

Remarks: An opportunity to examine the material in the British Museum showed at once the existence of a dark eastern race of the Yellow-backed Honeyguide. The only specimen from Burma is the one recorded by Smythies (Ibis, *91*, 1949, p. 645) with which my type agrees. An additional character of this race may be slightly smaller size, but more material would be needed. I include Margherita in the range of the form as Stuart Baker's sight record (Fauna Brit. India *IV*, 1927, p. 132) presumably refers to this form.

My male specimen is moulting out the feathers of the nape. Both near Pfutsero, 28 miles east of Kohima at 6000 feet altitude, and on the slopes of Mt. Japvo, 10 miles southeast of Kohima at 7000 feet, we found cliffs abounding in wild bee nests, and both were investigated for Honeyguides. Birds were present, but the height of the nearby trees and the thick vegetation as well as the comparatively short duration of our stay made collecting very difficult. The Angami Naga name is "Mephi Tsu Kelie Para." The body of the type is preserved in alcohol.

Dendrocopos darjellensis fumidus, subsp. nov.

Type: ♂ ad. (Yale Peabody Museum No. 12002) collected November 9, 1950, by S. Dillon Ripley on Mt. Japvo, Naga Hills, Assam.

Diagnosis: from *darjellensis* this subspecies differs by being darker, more smoky on the underparts, particularly the lower throat and breast and with a more richly colored vent patch. The nuchal patch also is darker. There appears to be a tendency in these birds to heavier streaking below, although I am not sure whether this character would hold in a large series. Specimens of *fumidus* are smaller also than typical *darjellensis,* although Burmese examples, which in color represent *darjellensis,* are also small.

Measurements (mm.):

	wing	tail	culmen
♂	126.5	83.5	32
2 ♀	123, 126	76	31, 32

Range: higher hills in Cachar, Naga Hills and Manipur from 5000 to 9000 feet.

Spelaeornis chocolatinus nagaensis, subsp. nov.

Type: ♂ ad. (Yale Peabody Museum No. 12004) collected November 12, 1950, by S. Dillon Ripley on. Mt. Japvo, Naga Hills, Assam.

Diagnosis: compared to *chocolatinus* this race is much more olivaceous-brown, less rufous above, the lores, cheeks and sides of the head grayish-brown rather than reddish-brown. The throat is white, the breast pale brownish-white, narrowly spotted, with terminal blackish edgings to the feathers. There is dimorphism in this subspecies, females being much more rufescent below, in this approaching the two existing unsexed specimens of *chocolatinus* although by no means matching them. The type and paratype of *chocolatinus* may thus both be females. In any case the fine spotting on the underparts and the white throat at once distinguish this race from the nominate form.

From *oatesi* this race differs by being more grayish-brown about the head, and the spots and terminal edgings on the feathers of the lower surface being strikingly different, much finer and more delicate in pattern and form.

From *reptatus* this subspecies differs by having a white throat and far more pronounced spotting below.

Measurements (mm.):

	wing	tail	culmen
4 ♂ ♂	49-52	41-44	13-14
2 o o	49, 52.5	42(2)	12.5, 13
♀	48	41.5	12.5

Range: Naga Hills.

Remarks: In my review of this genus (AUK. *67*, 1950, p. 390) I had no material from the Naga Hills. Thus it may be now supposed that *longicaudatus* must occur from the Khasia Hills southeast across southern Cachar without entering the eastern Barail Range, for it apparently does not occur on Mt. Japvo.

Phylloscopus fuscatus mariae, subspec. nov.

Type: ♂ ad. (Yale Peabody Museum No. 12005) collected October 19, 1950, by S. Dillon Ripley at Moirang, Manipur.

Diagnosis: upper parts dark olive brown, rump hair brown, a distinct supercilium varying in tone from cinnamon-rufous to ochraceous-buff, lores and ear coverts blackish-brown, cheeks and sides of throat ochraceous-buff mixed with hair brown, the latter becoming predominant on the sides of the breast. Throat and center of breast whitish to pinkish-buff. Flanks and thighs cinnamon brown, under tail coverts and under wing coverts ochraceous-buff. Outer edges of tail feathers tinted with olive green. Rictal bristles three extending nearly to end of nasal groove. Nasal hairs extending nearly to end of nasal groove.

Measurements (mm.):

	wing	tail	culmen
3 ♂ ♂	57.5-63.5	50-55	10.5-11
♀	57	43(m.)	10

Wing formula: 2 = 8. Sixth primary emarginate on the outer web. First primary exceeds the coverts by 12-14 mm. Third, fourth or fifth primary longest.

Soft parts: (different labels note varieties in color) iris brown; bill, upper mandible brown, dark brown, black; lower mandible basally yellow, distally brown, yellowish-brown, brown tip, yellowish horn; feet brownish-yellow, light brown, greenish-brown; pads yellow.

Weight: ♂♂ 7-8.5 grams; ♀ 8 grams.

Range: four specimens were taken at Kanglatongbi and Moirang in Manipur.

Remarks: This form is closest to *Phylloscopus fuscatus* from which it differs in darker coloration, a richer, more ochraceous-buff tone to the cheeks, sides of the under parts, and under wing and tail coverts, a shorter bill, and, presumably, a slightly different wing formula, the third primary equalling or exceeding the fifth and fourth primaries.

The subspecies may have been overlooked in collections due to the difficulty of identifying willow warblers in general, and foxing. The specimens collected by us were in low bushes and long grass in swampy areas, behaving rather like *Phylloscopus subaffinis* in this respect. They were often near cultivation. It is undoubtedly a wintering bird and should be looked for in similar situations in the northern plains of Assam.

It gives me great pleasure to name this subspecies of willow warbler after my wife who worked tirelessly as a member of the recent Yale-Assam Expedition.

Horeites flavolivaceous alexanderi, subsp. nov.

Type: ♀ ad. (Yale Peabody Museum No. 12003) collected November 21, 1950, by S. Dillon Ripley on the Phek-Meluri Road, 60 miles east of Kohima, Naga Hills, Assam.

Diagnosis: from *flavolivaceous* of the Himalayas this race differs by being much darker below, more olive buff with dark buffy breast and flanks. Compared to *weberi* of Mt. Victoria this race is richer, more olive buff on the breast and flanks. Compared to both preceding races, this form is darker above and intermediate in size apparently, the bill larger than *weberi.*

From the Shan form, *intricatus,* these birds may be distinguished by being much darker, more buffy below and darker above.

Measurements (mm.):

	wing	tail	culmen
♀ ♀	48, 51	53.5, 54	12, 12.5

Soft parts: iris brown; bill black, base of lower mandible pinkish-horn; lower mandible yellowish, tip brown; feet flesh, pale brown.

Weight: 6, 7 grams.

Range: eastern Naga Hills.

Remarks: This is a difficult species to collect, skulking in high grass and light second growth scrub. The call is a wren-like "tsick." The area where we found this race is in the Chindwin drainage, so it may well extend into the Naga Hills of Burma.

This form is named for my friend Horace Alexander, the well-known field student of Indian birds who accompanied me on part of my journey into the eastern Naga Hills.

Postilla
YALE PEABODY MUSEUM
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NEW PASSERINE BIRDS FROM THE INDO-CHINESE SUBREGION*

H. G. DEIGNAN

I.

Aware of my interest in the races of the babbling thrush, *Pellorneum ruficeps* Swainson, Dr. Dillon Ripley has sent for my examination five specimens of this bird recently collected by him in the hill country of eastern Assam. Three of them, from the Naga Hills District, prove to agree very well with *P. r. chamelum* Deignan and serve to extend northeastward the range of this form, which is otherwise known from the Garo Hills, Khasi Hills, and Cachar Districts. The remaining two, from Manipur, are the first I have seen from that District, and are apparently sufficiently distinct from all other described populations of Assam and Burma to justify the erection of yet another subspecies, which, at Dr. Ripley's kind invitation, is named below.

For the loan of material for comparison with that in the Yale Peabody Museum and the United States National Museum, I am indebted to Dr. Dean Amadon and the authorities of the American Museum of Natural History.

* Published with permission of the Secretary of the Smithsonian Institution.

Pellorneum ruficeps vocale, subsp. nov.

Type: ♂ ad. (Y.P.M., No. 12007) collected at Kanglatongbi (*ca.* lat. 24°59′N., long. 93°54′E.), elev. 2933 ft., Chief Commissioner's District of Manipur (formerly Manipur State), October 19, 1950, by S. Dillon Ripley (original number 33).

Diagnosis: while inseparable by characters of the under parts from *P. r. chamelum* (Cachar District), the new form differs from *chamelum* by having the forehead, crown, and nape chestnut (rather than rufous); the blackish-brown centers to the feathers of the uppermost back obsolescent (rather than sharply defined); the olivaceous brown of the remaining upper parts deeper in tone.

From *P. r. hilarum* (Pakkoku District, Burma), it differs in having the forehead, crown, and nape chestnut (rather than rufous); the blackish-brown centers to the feathers of the uppermost back more clearly defined; the olivaceous brown of the remaining upper parts much deeper in tone; the under parts more strongly washed with buff, and with the central streaks of the feathers of the breast and sides of the abdomen broader and more numerous.

Range: the valley of central Manipur.

Remarks: I have given detailed comparisons of the new race only with the two that occur nearest its range, one to the west and northwest of Manipur, the other to the southeast. From such more distant forms as *ripleyi* (Lakhimpur District south of the Brahmaputra) and *stageri* (Myitkyina District, Burma), it is immediately separable by its obsolescent (not well-defined) dark centers to the feathers of the uppermost back, as well as by other characters.

II.

I have for some time been aware that the population of *Oligura castaneo-coronata* (Burton) inhabiting Szechwan and northwestern Yunnan could not properly be combined with either of the recognized races, the nominate one from the Himalayas or *O. c. abadiei* (Delacour and Jabouille).

Again I am indebted to the authorities of the Yale Peabody Museum and the American Museum of Natural History for the loan of comparative material that enables me to define the characters of the new form.

Oligura castaneo-coronata ripleyi, subsp. nov.

Type: ♂ ad. (U.S.N.M., No. 296605) collected in the Likiang Mountains, Yunnan Province, China, in June 1923, by Joseph F. C. Rock (original number 584).

Diagnosis: from *O. c. castaneo-coronata* separable by significantly greater length of wing and tail (see measurements below) and the slightly paler and brighter orange-rufous of the pileum.

From *O. c. abadiei* distinguishable by slightly greater length of wing and tail and the distinctly paler and brighter orange-rufous (without brownish cast) of the pileum, which is, moreover, sharply defined from the olive green of the mantle, rather than insensibly intergrading with it.

Measurements (mm.):

O. c. castaneo-coronata (16 specimens)

Wing:	45-50	(avg.	16	spec.:	47.25)
Tail:	21-26	(avg.	12	spec.:	23.5)

O. c. ripleyi (7 specimens)

Wing:	52-57	(avg.	7	spec.:	55.4)
Tail:	28-32	(avg.	7	spec.:	30.3)

O. c. abadiei (4 specimens)

Wing:	50-53	(avg.	4	spec.:	51.5)
Tail:	27-29	(avg.	4	spec.:	28)

Remarks: Delacour (Ibis, *84*, 1942, p. 515), removing this species from the genus *Tesia*, has established for it the new generic name *Chlorotesia* (there misspelled *Chorotesia;* but see *ibid.* the seventh line below), in the belief that *Oligura*, like *Tesia*, has *Tesia cyaniventer* Hodgson for genotype. This is, however, not the case.

Oligura of Hodgson first appeared in Gray's Zoological Miscellany, 1844, p. 82, as a *nomen nudum*, with mention of *Oligura* (*Tesia*) *cyaniventer* and *O. flaviventer*.

The genus was first properly diagnosed in Proceedings of the Zoological Society of London, *13*, 1845, p. 25, with reference to the same two species, in reverse order.

In The Genera of Birds, *1*, 1849, p. [156], G. R. Gray affirms that *T*[*esia*]. *castaneo-coronata* (Burton), of which *Tesia flaviventer* Hodgson is listed as a synonym, is the genotype of *Oligura* Hodgson, as he does again in Catalogue of The Genera and Subgenera of Birds Contained in The British Museum, 1855, p. 31 (where, for the first time, he treats *Oligura* as a valid genus). Thus, since 1849, *Sylvia? castaneo-coronata* Burton has been the genotype of *Oligura* Hodgson, by subsequent designation of G. R. Gray.

Having shown that *Oligura* Hodgson is properly applied to *Sylvia? castaneo-coronata* Burton, I must now discuss its homonym, *Oligura* Rüppell. The former first appeared in August 1845, the latter in "1845," and it is not possible to prove that Hodgson's name has priority of publication.

The genotype of Rüppell's name is *Troglodytes micrurus* Rüppell = *Sylvietta brachyura micrura* (Rüppell), a mere sub-species of *Sylvietta brachyura* Lafresnaye, the genotype of *Sylvietta* Lafresnaye, 1839. Rüppell's name never achieved wide currency and can almost certainly never in the future be brought into use; Hodgson's, on the other hand, has been employed by authors for a century. In the circumstances, it seems best simply to *assume* that Hodgson's name antedates Rüppell's (as I have done above), and to consign Delacour's *Chlorotesia* to its synonymy.

Postilla

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BASSARISCUS IN MIOCENE FAUNAS AND "*POTAMOTHERIUM LYCOPOTAMICUM* COPE"

JOSEPH T. GREGORY AND THEODORE DOWNS

INTRODUCTION

Cope described a fragment of the lower jaw of a small carnivore from the "Loup Fork of Cottonwood Creek, Oregon," as *Lutrictis ? lycopotamicus* (1879, p. 67). The type has been lost, but was figured (Cope - Matthew, 1915, pl. 119c, figs. 5 and 5a). Matthew (1904, p. 254) corrected the generic reference to *Potamotherium* (as Cope himself also had done at the time the plate was prepared), and noted the loss of the type and absence of other specimens. He considered it a small species and later (1915, *loc. cit.*) suggested that it was related to *Sthenictis*. Also, in 1915, he gave the locality as Pawnee Creek, Colorado, a *lapsus calami.* In 1922 Thorpe referred two specimens in the Yale Peabody Museum collections to this species. Although these are from the Niobrara River fauna of Nebraska, they may well contain the key to the identity of the Oregon form.

Restudy of the specimens described by Thorpe and examination of additional material from the Niobrara River fauna and of fragments from the Crooked River region in Oregon lead us to the conclusion that they belong to a genus of procyonid carnivores, which is inseparable from the living *Bassariscus* Coues on the basis of lower jaws and teeth alone. A maxillary, described below, which appears referable to the same species, differs markedly from the Recent form, however, and suggests that were more known of these animals, a distinct genus might be indicated. *Potamotherium* Geoffroy, of which *Lutrictis* Pomel is a synonym, is a European otter distinguishable from *Bassariscus* (and from these fossils) by its larger size, stouter jaw, more anteriorly placed single mental foramen, much shorter M_2, more posteriorly situated metaconid of M_1, and characters of skull and upper dentition too numerous to mention here.

Bassariscus parvus Hall from the Niobrara River Fauna

Direct comparison of the specimens described by Thorpe (1922, pp. 444-445: Y. P. M., Nos. 12825, 12834) and an additional lower jaw (from locality V3218, U. C. M. P., No. 33147) [see Stirton and McGrew, 1935, p. 127], with *Bassariscus astutus* (Lichtenstein) shows close agreement in such important features as the straight and slender horizontal ramus of the lower jaw; four premolars, the first single rooted; presence of two mental foramina situated beneath P_2 and P_3; and the form of the lower carnassial with a high trigonid, including a well developed metaconid, and a basined heel. The form of the premolars in Yale Peabody Museum No. 12825 also agrees with *Bassariscus*. These specimens differ from *B. astutus* and agree with the type of *B. parvus* from Cedar Mountain, Nevada, in the greater crowding of the premolars and relatively shorter trigonid of M_1. One specimen from locality V3218, University of California Museum of Paleontology No. 29225, shows as much crowding as the type of *B. parvus*. None of the 13 specimens of *B. a. raptor* (Baird) in the Museum of Vertebrate Zoology which were examined show this condition. Niobrara River specimens are below the average length of *B. astutus*, although within the range of variation of the recent species, as shown by the following tabulation. The length of M_1 in the type of *B. parvus* is less than in any of the recent specimens, although the deviation is not significant.

Measurements in Millimeters

Length of M_1

	Number Specimens	*Observed Extremes*	*Mean*	*Standard Deviation*	*Coefficient of Variability*
B. astutus (Hall, 1927)	40	6.9-8.0	7.49 ± 0.04	0.265 ± 0.030	3.54 ± 0.40
B. parvus, type			6.8		
B. parvus, Niobrara River	2	7.0-7.3	7.15		

Length talonid M_1

	Number Specimens	*Observed Extremes*	*Mean*	*Standard Deviation*	*Coefficient of Variability*
B. astutus (Hall, 1927)	40	2.4-3.0	2.70 ± 0.02	0.150 ± 0.017	5.56 ± 0.62
B. parvus, type			2.7		
B. parvus, Niobrara River	2	2.4-2.5	2.45		

Errors are standard errors.

A maxillary with P^3 - M^2, U.C.M.P. No. 31983, from locality V3218, Niobrara River fauna, (fig. 1) occludes so well with U.C.M.P. No. 33147 that it may have come from the same individual. It differs from a series of 13 specimens of *B. astutus raptor* in: P^4 crowded by P^3; P^4 with relatively larger parastyle, with smaller protocone, and without hypocone; M^1 with somewhat stronger parastyle; M^2 with parastyle more prominent and hypocone deflected more posteriorly; infraorbital foramen more elongate dorsoventrally. The number and height of cusps and general shape of the teeth otherwise resembles *B. a raptor*. This maxillary bears considerable resemblance to that of foxes in the absence of a cusp posterior to the protocone of the upper carnassial, in the strong parastyles on M^1 and P^4, and in the vertical enlargement of the infraorbital foramen. It differs from that of the kit fox, *Vulpes macrotis arsipus* (Elliot) (4 specimens from Yuma Co., Arizona, in M.V.Z.) in: more crowded P^3-P^4; shorter carnassial shear; more prominent parastyle and less developed hypocone of M^1, the latter cusp not so deflected posteriorly; protoconule and metaconule less developed on M^1; M^2 proportionately shorter and with less developed cingula and hypocone.

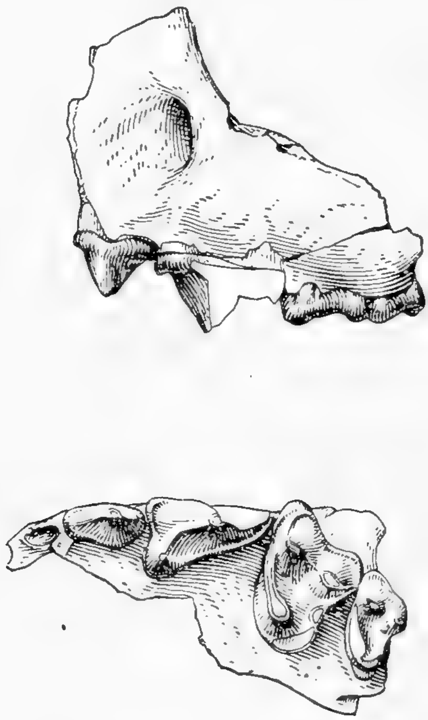

Figure 1. *Bassariscus parvus* Hall. Left maxillary, U.C.M.P. No. 31983, x 2. Drawing by Owen J. Poe.

As McGrew pointed out (1938, pp. 326-327) the principal distinctions between *Bassariscus* and the primitive fox, *Pseudocynodictis*, lie in the presence of a posterointernal cusp and more anterior protocone on the upper carnassial, relatively larger metaconule of M^1, and greatly reduced cingula and absence of hypocone on M^2 in the former genus. The specimen here described resembles *Pseudocynodictis gregarius* (Cope) in the absence of a posterointernal cusp on P^4, large parastyle of M^1, narrow anteroposterior diameter across the protocone of M^1, somewhat vertical infraorbital canal, and nearly similar size; it differs in the relatively lesser width across the protocone of P^4, weaker hypocone of M^1, and undeveloped inner cingulum (smaller hypocone) of M^2. *Nothocyon lemur* (Cope) differs more markedly in having a still more prominent metaconule and larger hypocone on M^1 (thus approaching *Procyon*) and greater anteroposterior length of the inner part of M^2.

If correctly associated with the *Bassariscus*-like jaws, this specimen reveals that the late Miocene *B. parvus* retained a primitive, essentially canid pattern in the upper dentition although the lower jaws are scarcely distinguishable from the recent *B. astutus.* Two other procyonid genera, *Cynarctus* and *Cynarctoides,* (McGrew, 1938) lack the postero-internal cusp of the upper carnassial, but these have progressed much farther from the primitive condition typified by *Pseudocynodictis* in their molar pattern. Confirmation of the association of these specimens would probably justify erection of a new subgenus for *Bassariscus parvus* and related forms in which the upper carnassial lacks a fourth cusp, but material here described does not warrant proposal of a new name. The distinctness of *B. parvus* from *B. astutus,* not demonstrable on features of the lower jaw alone, is supported by the tentative association of this maxillary dentition with its unique character combination.

? Bassariscus lycopotamicus (Cope) from Oregon

As figured by Cope the type jaw was slender and straight like that of *Bassariscus,* and contained four premolars in life. Cope described the trigonid of the carnassial as low, and the illustration shows it worn down almost to the level of the talonid. It is difficult, especially in the absence of the type specimen, to judge whether this wear could have been produced on a *Bassariscus* tooth with its tall trigonid, or whether the tooth was originally lower crowned as in *Sthenictis.* The type of *Bassariscus antiquus matthewi* (Merriam), U.C.M.P., No. 12539, is a heavily worn specimen and the trigonid and talonid of M_1 are worn to nearly the same level. Although P_4 of this specimen is broken at the crown it still shows less wear than M_1. A similar difference in relative wear is apparent in the figure of *Potamotherium? lycopotamicum,* so it seems possible that the type of that species could have been a *Bassariscus.* Unfortunately the number of molars behind the carnassial cannot be determined as the specimen is broken off directly behind M_1.

A specimen from Paulina Creek, Oregon, in the collection of Yale Peabody Museum, No. 14313, bears much resemblance to *Bassariscus.* Its ramus is straight and slender but broken off in front of the greatly defaced M_1. M_2 is absent. The talonid of M_1 is preserved and has a basin with distinct entoconid and hypoconid. Although somewhat smaller than the *B. parvus* specimens from Nebraska there is little in this fragmentary material to distinguish it from them. Paulina Creek is in the Crooked River region and could be either a Mascall (Miocene) or Rattlesnake (Pliocene) locality. The locality data given by Cope for *P. ? lycopotamicum* likewise is inadequate to identify the source formation. No other specimens have been found to verify the location and even in 1907 Merriam and Sinclair (p. 195) pointed out that mixture of material from the Mascall and Rattlesnake formations is easily possible.

It thus seems that "*Potamotherium*" ? *lycopotamicum* is probably referable to *Bassariscus,* and may have come from either Miocene or Pliocene. The limited material available is insufficient to demonstrate its affinities with other species.

Other Miocene occurrences of Bassariscus

Fossil cacomistle remains have been found in the Lower Snake Creek fauna (*B. antiquus* Matthew and Cook), the

Virgin Valley fauna (*B. antiquus matthewi* Merriam), and Cedar Mountain fauna (*B. parvus* [Merriam] Hall). *B. antiquus* was distinguished from the Recent *B. astutus* by its larger paraconids on M_1 and M_2, and by the slightly wider heel of M_2. Merriam (1911, p. 246) sought to establish a new genus, *Probassariscus*, on these characters, but Hall (1927, p. 438) has pointed out that the variability within the Recent genus is such that the fossils should not be accorded more than subgeneric distinction. *B. antiquus matthewi* was not satisfactorily distinguished from the Snake Creek species, and Hall (*loc. cit.*), although recognizing the possibility that better material might reveal differences, maintains that the fossils can not even be shown to be subspecifically distinct. *B. parvus* Hall (*B. nevadensis* Merriam, 1916, *non* G. S. Miller, 1913) was considered by Merriam to be nearly indistinguishable from the Recent "miners cat" of California, and Hall based most of his distinctions from *Bassariscus astutus* on the crowding of the premolars and size of trigonid of M_1. The material here described suggests that the species may be valid.

At present then, the following extinct species of *Bassariscus* can be recognized:

B. antiquus Matthew and Cook, Lower Snake Creek, Virgin Valley

B. parvus Hall, Cedar Mountain, Niobrara River

? *B. lycopotamicus* (Cope), Mascall or Rattlesnake

All are founded upon lower dentitions and differ only in minute characters from the living *Bassariscus astutus* (Lichtenstein). The lower teeth of this genus have undergone extremely little change since Oligocene time. The upper molars also are conservative, the principal distinction from *Pseudocynodictis* being a reduction of M^2, but the upper carnassial has become modified in the Recent genus through addition of a postero-internal cusp and greater development of the internal cingulum on P^4. A specimen from the late Miocene Niobrara River fauna suggests that this feature had not been acquired at that time.

Other American species referred to Potamotherium

Potamotherium still appears in some faunal lists of North America* so it seems advisable to point out that those American fossils which have been identified with this European otter are not at all related to it. *Brachypsalis pachycephalus* Cope was referred to *Potamotherium* by Hay (1902, p. 768); it is a far larger and stouter animal than *P. valetoni* (the genotypic species) and the type of a now well-known American genus of Mustelinae (not Lutrinae). *Potamotherium lacota* Matthew from the Pliocene of South Dakota is likewise larger and referable to *Brachypsalis;* it appears close to *B. modicus* Matthew. As shown above, *Potamotherium ? lycopotamicum* Cope is probably not a mustelid at all but *Bassariscus.*

Acknowledgements

We are grateful to Dr. R. A. Stirton for assistance and permission to examine pertinent specimens in the University of California Museum of Paleontology, and to Dr. Alden H. Miller for access to comparative material in the Museum of Vertebrate Zoology. Valued comments concerning the material or manuscript have been received from Donald E. Savage, Robert W. Fields, Wann Langston, and Walter Wheeler. Owen J. Poe, artist of the University of California Museum of Paleontology, prepared the illustration.

* Not, however, in Simpson's Classification of Mammals.

Measurements in Millimeters

Lower jaws

	B. parvus Hall				? *B. lycopotamicus* (Cope)		*B. antiquus*
	Niobrara River fauna			Type, Cedar Mountain	Type	Paulina Creek	Virgin Valley
	U.C.M.P. No. 33147	Y.P.M. No. 12834	Y.P.M. No. 12825	U.C.M. P. No. 19768		Y.P.M. No. 14313	U.C.M.P. No. 12539
P_2 greatest length ...	...	...	3.4	...	...	...	...
P_2 greatest width ...	...	...	1.5	...	...	...	...
P_3 greatest length ...	4.1	...	3.8	3.3	...	...	...
P_3 greatest width ...	2.1	...	1.8	2.1	...	...	...
P_4 greatest length ...	4.7	...	4.2	4.6	4.5	...	5.1
P_4 greatest width ...	2.5	...	2.1	2.3	...	...	...
M_1 greatest length ..	7.0	7.3	...	6.8	6.6	6.3	7.0
width at trigonid ..	3.7	3.5	...	3.3	4.0	...	3.6
width at talonid ..	3.3	3.4	...	3.3	...	...	3.7
approx. length talonid	2.5	2.4	...	...	2.4	...	2.6
Depth of ramus at P_3	7.5	6.0	6.9	...	...	...	...
Depth of ramus at P_4	8.1	6.5	7.5	...	...	...	7.9
Depth of ramus at M_1	8.1	7.1	...	...	...	6.5	...
Depth of ramus at M_2	7.5	...	...	...	...	6.6	...
Thickness ramus at M_1	4.3	3.1	4.0	...	...	3.4	...

Measurements in Millimeters

U.C.M.P. No. 31983, upper dentition

	Greatest anteroposterior diameter	*Transverse diameter*	*Anteroposterior diam. across protocone*
P^3	4.2	2.1	...
P^4	6.5	4.0	...
M^1	5.2	7.3	3.7
M^2	3.2	4.9	2.2

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Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 9 May 10, 1951 New Haven, Conn.

BIRDS COLLECTED AND NOTED ROUND DHAHRAN, SAUDI ARABIA, AND BAHREIN ISLAND

S. DILLON RIPLEY

During the past summer of 1950 my wife and I spent from July 16-27 on a visit to Dhahran and its vicinity, and the following two days on Bahrein Island. We were the guests of the Arabian-American Oil Company and the Bahrein Petroleum Company. Both organizations were extremely cordial and cooperative to us and we have been most grateful for their generous hospitality. The weather at this season is hot around Dhahran but fairly dry with moderate winds from the north and northwest. Midday temperatures ran up to 110°F. in the shade. On Bahrein the temperatures were slightly lower but the humidity much greater, reaching close to saturation point at times.

Due to complications too numerous to detail here, my collecting facilities were limited during my stay. I was fortunately able to borrow guns from the authorities of the Oil Companies, although my ammunition was unsuitable for these weapons. But at least I could thus secure some specimens for positive identification. My list of species collected or observed is fragmentary compared to that of the only previous paper on the area by Ticehurst and Cheesman (IBIS, 1925, pp. 1-31), but it may be interesting from the fact that my observations were made during the summer whereas Cheesman's were made during the winter months, and also the fact that considerable transformations have occurred in the desert areas along the east coast of Saudi Arabia around Dhahran. In Cheesman's time (1923) the area was largely unmapped and untraversed by a European. Today there are roads, and a railroad inland to Hofuf, and towns have sprung up along the coast such as Al Kobar, and Dhahran farther inland, with surrounding gardens and vegetation which are attracting birds and creating countless favorable opportunities for them to nest and linger over the hot summer season. Such a garden is the Imhoff garden below Dhahran town where treated organic wastes have been used to fertilize the desert and create a lush small oasis. Here is a transitional stage in a succession from desert to fertile land with shade and water, and already a number of species have become adapted to a summer residence there.

I am most grateful to the authorities of the United States National Museum and to the American Museum of Natural History for the loan of specimens in their care. My list follows.

[*Struthio camelus syriacus* Rothschild: Arabian Ostrich.

I am greatly indebted to Mr. Thomas Barger of Arabian-American Oil Company for presenting an egg of this form to the collection of the Peabody Museum at Yale University. It had been purchased in the market at Hofuf in 1947 and is very weathered, but shows the smooth characteristics and remnants of the gloss mentioned by Rothschild (BULL. BRIT. ORNITH. CLUB, *39*, 1919, p. 82). It measures 141 x 110 mm. Oil officials assured me that the ostrich has not been seen since 1939 along the pipeline route through northern Saudi Arabia to Jordan. In that year a bird was shot by Arabs working on the pipeline survey. Local Arab rumors are that a very small population, perhaps 20 may exist in the center of the great Nafud desert north of Hail.]

Phalacrocorax nigrogularis: Socotra Cormorant.

This species was seen sitting in small groups of less than a dozen individuals along the shore below Al Khobar, and individual birds flying in the Gulf were observed from the launch on the way over to Bahrein Island. No information was obtained on their breeding.

A large heron (*Ardea purpurea* ?) was seen in flight July 22 near the oasis of Qatif along the coast.

Haliaëtus albicilla: White-tailed Sea Eagle.

An immature bird with brownish tail flew over our launch not far from Bahrein on July 27.

Coturnix coturnix coturnix (Linnaeus): Common Quail.

A female in emaciated condition was brought to me by an Arab boy at Qatif.

Haematopus ostralegus: Oyster-catcher.

A pair circled over our launch near Bahrein the same day.

Charadrius alexandrinus: Kentish Plover.

Kentish Plovers were seen commonly along the coast, and there were young birds just on the wing at the Imhoff garden during our visit.

Charadrius mongolus: Lesser Sand-plover.

A single bird with reddish-buffy breast and a collar round the nape was seen along the strand at Al Khobar July 20.

A number of flocks of possible Redshank (*Tringa totanus*) were seen in the distance flying along the coast at this time.

Numenius phaeopus: Whimbrel.

These big curlews had arrived by July 21 and were in great numbers (up to 200 in an individual flock) all along the coast from Ras Tanura south below Al Khobar.

Limosa lapponica: Bar-tailed Godwit.

Seven godwits were seen along the shore, pairs or individuals among the flocks of curlews on July 21.

Cursorius cursor cursor (Latham): Cream-colored Courser.

Adults and possible young were seen at the Imhoff gardens and an adult collected on Bahrein. Birds were mostly in pairs and on the desert but always near trees, water or cultivation. Soft parts: iris dark brown; bill black, base of lower mandible flesh; legs white, pads yellowish. Weight 125 grams.

Larus argentatus: Yellow-legged Herring Gull.

I was surprised not to see Slender-billed or other gulls. Birds seen at Dammam and Ras Tanura all seemed to be large pale Herring Gulls.

A few Caspian Terns (*Hydroprogne caspia*) were seen along the beaches.

Sterna repressa: White-cheeked Tern.

White-cheeked Terns were found breeding on a sand spit near the causeway at Ras Tanura on July 22. Eggs were found in small numbers, and juvenile birds well-feathered were also seen. Possibly these eggs represented a second clutch, or perhaps the first clutch of young birds of the previous season.

Sterna anaethetus: Bridled Tern.

The race *fuligula* of the Bridled Tern breeds along the Gulf. Numerous birds swooped over us at Ras Tanura on the sand spit, and well-feathered young were noted.

"Qatar" birds *(Pterocles senegallus ?)* were heard calling in the early morning on the desert south of Awali on Bahrein. It is thought that the Sandgrouse may breed there as well as on the near-by Qatar Peninsula on the mainland.

The Rock Dove *(Columba livia)* and the Little Brown Dove *(Streptopelia senegalensis)* were both seen near gardens and cultivation at Dhahran and Ras Tanura.

The Bee-eater *(Merops apiaster)*, Roller *(Coracias garrulus)* and Hoopoe, "Hudhud" *(Upupa epops)* were all seen on Bahrein, and the latter two species were found in the date gardens and at the Imhoff garden on the mainland.

[A specimen of the Desert Woodpecker *(Picoïdes dorae,* [*Desertipicus* auct.]) was presented to us by Mrs. William A. Eddy. It had been collected at Taif, and is unknown so far from the eastern part of the Arabian Peninsula.]

Alaemon alaudipes doriae (Salvadori): Bifasciated Lark.

In the desert fringe about the gardens young birds were on the wing at the time of our visit, some already in the post-juvenal moult. Although noted very scatteringly on the desert the vast majority of Bifasciated Larks were seen by us near or even occasionally in the gardens.

A male measures: wing 129.5, tail 89, culmen 28 mm. Birds of the year were also collected. Soft parts: iris light brown, eyelid yellow; bill brownish-white, upper mandible grayish or whitish horn, tomium whitish, lower mandible gray, pinkish-gray at base. The gape is orange-yellow in juvenile birds, yellow in first year birds. Legs dirty white, pads yellow. Weight, adult ♂ 46.5 grams.

Ammomanes deserti insularis, subsp. nov.

Type: ♂ ad. (No. 2005, S. Dillon Ripley Coll.) collected on Bahrein Island, July 28, 1950, by S. Dillon Ripley.

Diagnosis: This form belongs to the group of *deserti* in which the outer edges to the wing coverts and the upper tail coverts are tinged with rufous. The upper plumage when freshly moulted is of a composite color. The bases and the areas along the shafts of the feathers tend to be hair brown with a broad outer margin of vinaceous-buff thus giving an "ecru" or vinaceous tone to the outer parts of the feathers. The type is in a partial moult. It is thus possible to see that the old worn back feathers are paler, approaching pinkish-buff.

The scapulars and secondaries are externally margined with vinaceous-buff, the inner sides of the feathers dark olive-brown. The outer edges of the primaries are creamy-buff for most of their length, the inner edges and tips drab. The freshly moulted tail feathers approach clove brown with vinaceous-buff edging. The worn tail feathers are lighter, nearer sepia. Below, this specimen is pale whitish-creamy in color washed on the breast with vinaceous-buff. There are a few indistinct streaks on the feathers of the throat and upper breast, which are dark clove brown in color.

From the above description it will at once be seen that this bird bears no resemblance to *azizi*, the "Hamra" or Desert Lark of the near-by Arabian mainland, a very pale pinkish-white bird. From *parvirostris*, this form differs by being more tinged with vinaceous above and paler below. It is paler than *phoenicuroides* or *iranica*. It is a much paler bird than *saturatus* but approaches its vinaceous tone.

Measurements: type, wing 94, tail, 60, culmen 14 mm.

Soft parts: iris dull light brown; bill greenish-yellow basally, yellowish-gray distally; legs yellowish-white. Weight, 26.5 grams.

A small flock of these birds was encountered July 28 in a stone-filled wadi five or six miles into the desert south of Awali on Bahrein. I heard them first, a series of faint twittering calls and walked over from our car to investigate. The birds had hopped down into a small ditch where water was seeping from an abandoned pipeline, part of the first construction put in by the Petroleum Company. I noted, in contrast to what has been said of this species previously, that the birds were drinking or at least dipping their bills into the water of the rivulet. The flock flew off and I had a chance to secure only one specimen. After that they kept a long distance from me on flat ground.

Galerida cristata magna Hume: Crested Lark.

A scattering of these birds was seen on the desert near Dhahran and Ras Tanura and at Awali on Bahrein. Mostly they favored the vicinity of gardens presumably for water and shade. We often saw these and other larks panting with bills agape in the shade of tamarisk trees. Birds were in heavy moult at this season with fully fledged young on the wing.

Eremopteryx nigriceps sincipitalis (Blyth): Finch Lark.

The Finch Lark was seen only in and near gardens during our stay. Some specimens were in breeding condition. Young birds were on the wing. Males were still displaying, and this with their condition indicates that a second nesting occurs in this species. The male displays by a fluttering flight at a low height over the ground. The females sit below. Evidently the blackish lower plumage shows off to advantage in this way. At the same time, by being on the lower surface the heavy dark color is of no advantage to predators.*

* In this connection I agree with Armstrong (IBIS, 1951, p. 314), who suggests that in flight such a dark ventral surface is correlated with display, *contra* Meinertzhagen.

Measurements: wing ♂ 82, 85.5, ♀ 80.5; tail ♂ 48 (moult), 53.5, ♀ 46; culmen ♂ 12, 12.5, ♀ 12 mm. Weight ♀ 17.5 grams.

These birds seem slightly paler above, more tinted with vinaceous than birds from Aden and Southern Arabia, but this is probably due to the stage of the moult.

A swallow, rather greenish-black above and white below was seen about the office buildings at Dhahran and at Awali on Bahrein. I never had a good look at the birds. Could this be the House Martin *(Hirundo urbica)?*

Pycnonotus leucotis dactylus, subsp. nov.

Type: ♂ ad. (No. 2014, S. Dillon Ripley Coll.), collected at Dammam (near Dhahran), Saudi Arabia, July 24, 1950, by S. Dillon Ripley.

Diagnosis: From *mesopotamiae* this form differs by being paler, less smoky on the breast with a touch of drab. Ticehurst and Cheesman (*loc. cit.*, p. 15) writing of the series collected around Hofuf note that the birds are larger and grayer than the Indian race *leucotis* and with a yellow eyelid. Larger, they are (wing 86-94 versus 79-86 in *leucotis*) with proportionally longer tail and larger bill, but they are almost as pale on the lower surface as the typical Indian race. This at once sets them apart from *mesopotamiae*, which is also large, has a yellow eyelid, but is darker, smoky-gray below. In his "Birds of Mesopotamia" (JOURN. BOMBAY NAT. HIST. SOC., *28*, 1922, p. 383), Ticehurst comments that he is not sure that this character of darker underparts holds good for *mesopotamiae*, and that Basra birds may be suffering from industrial melanism. Amara specimens agree with Basra birds in being dark, and I am inclined to think that this is a valid character. Nor does it seem to me likely that the Bulbul may be an introduced bird in eastern Saudi Arabia and Bahrein as Ticehurst and Cheesman also suggest (*ibid.*

p. 15). Unless some concrete proof is put forward in regard to these two suppositions, I would prefer to believe the evidence of the specimens which would seem to indicate that three populations recognizable by size, presence or absence of a yellow eyelid, and color of underparts are involved. The Iraq and Arabian birds are larger than the Indian form and have a yellow eyelid, and they may be distinguished from each other by the southern, Arabian bird being paler. Intergrades may well occur in intervening areas, and I have not examined specimens from Bahrein unfortunately, but they presumably fit into *dactylus.*

Soft parts: iris reddish-brown, eyelid yellow; bill black; legs grayish-black. Males were in breeding condition.

The Bulbul was seen only in the date gardens, where pairs were feeding young just out of the nest. Other pairs were singing and giving evidence of a second nesting. From local reports these birds apparently enter the newer settlements like Dhahran during the winter season, but remain in the date gardens during the summer. Dahran's growth of tamarisks and other trees is not yet heavy enough to give sufficient shade, or perhaps the lack of date palms means that the area is still deficient in insects.

Erythropygia galactotes syriaca (Hemprich and Ehrenberg):

Rufous Chat.

Pairs were seen in the date gardens at Qatif, Dammam, and on Bahrein. Nest building and singing were actively going on. Nests were being constructed in date palm fronds about five feet off the ground. All specimens were in moult and one juvenal was collected in heavy moult. The males had enlarged gonads. The only note heard was a *Prinia*-like, "tsee, tsee, tsee." One bird, alarmed, made a rather hissing, sibilant chatlike note, flying up to a low branch from the ground, and flicking its reddish tail as it landed.

Measurements: wing ♂ 82, 83.5, ♀ 81.5; tail ♂ 62, 64, ♀ 62; culmen (3) 16 mm. Weight ♂ 21 grams.

These birds are a richer, darker brown than *familiaris* from India, Transcaspia, Kenya, and Arabia and match *syriaca* from farther to the north tolerably well in color.

Prinia gracilis anguste, subsp. nov.

Type: ♂ ad. (No. 2010, S. Dillon Ripley Coll.) collected on Bahrein Island, July 28, 1950, by S. Dillon Ripley.

Diagnosis: This race belongs to the group of Streaked Wren-Warblers with sharp black subterminal bands on the tail, unlike *lepida* and *irakensis*. It differs markedly from its nearest geographic representative *hufufae*, however, by being darker and more brownish-gray above than that form, with narrower shaft streaks. The tail feathers are similarly broad and barred as in *hufufae*. From *yemenensis* this form differs by having narrow shaft streaks on the upper surface, approximately 1 mm. in width in contrast to the streaks of 1.75—2 mm. in width of the southwest Arabian subspecies. It also seems to lack the rufous tone to the plumage of the forehead found in that population. Otherwise in general coloration the upper-parts are similar to *yemenensis*. Below, *anguste* seems to be clearer white on the throat and upper breast, however.

Measurements: wing 46, tail 60, culmen 11 mm.

Soft parts: iris buffy-yellow; bill black; legs pinkish-brown. Weight 7 grams. Gonads enlarged.

I should have hesitated to describe this single bird were its characters not so different from its geographical neighbors. It is interesting that the bird of Bahrein should be so unlike *hufufae* of the adjacent mainland. Although I searched for this species in Qatif and the coastal date gardens I failed to find it. In contrast I saw several in the date gardens on Bahrein, although the birds were shy.

Passer domesticus hufufae Ticehurst and Cheesman: House Sparrow.

Common in the gardens and the newer oil settlements around Dhahran. A male with enlarged gonads was taken July 21. The soft parts were: iris brown, bill black, legs yellowish-brown. This bird and the swallow were the only two species seen in and around these settlements except for a solitary bewildered-looking Roller, which blundered into the backyard of a house at Abqaiq during a windstorm.

Corvus corax ruficollis: Brown-necked Raven.

An odd pair were seen along the roads leading to the different oil communities on the mainland and a pair in the desert south of Awali. They frequently perch on the telephone poles or wires. They have a single low raven-like croak.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 10 November 1, 1951 New Haven, Conn.

THREE BIRDS FROM THE MOUNTAINS OF MUSCAT

S. DILLON RIPLEY

Dr. W. Wells Thoms, a resident of Muttrah in Muscat, has been kind enough to send me several specimens of the flora and fauna from the Jebel Akhdar Mountains which lie within the territory of the Sultanate of Muscat and Oman in southeastern Arabia. Three bird specimens taken among the fruit trees near the village of Seik at 6300 feet above sea level are most interesting as affording the first recorded specimens from this mountain range.

Streptopelia senegalensis cambayensis (Gmelin):
Indian Little Brown or Laughing Dove.

A single female dove proves to be somewhat dark in plumage tone, but indistinguishable from south Indian examples of this subspecies. The record is an unusually interesting one as the brightly colored typical *senegalensis* of Africa has always been considered the resident form of Arabia. If this specimen represents the valid breeding population of the Jebel Akhdar (as indeed there is no evidence to indicate that it is not), it is another link between the fauna of Muscat and the Indian subregion, similar in kind if not in degree, to the presence of a Tahr (*Hemitragus jayakari*) in these isolated southeastern Arabian mountains.

Galerida cristata thomsi, subsp. nov.:
Green Mountains Crested Lark.

Type: ♀ ad. (No. 2021, S. Dillon Ripley Coll.) collected at Seik, Jebel Akhdar, Muscat, July 1951, by W. Wells Thoms.

Diagnosis: this is a dark Crested Lark which bears no relation in its coloration to *magna* from the lowland deserts of adjacent Saudi Arabia. It is nearest that form in the smallness of the streaklets on the upper breast. Similarly the inner edges of the primaries are pinkish buff as in *magna*, but darker. In tone of coloration, however, this form is near *imami* of the Yemen highlands, but altogether darker, more blackish on the upper surface, the back, wings, and tail. Below, the streaklets on the underparts are much finer than in *imami*, not wider than approximately 1-1.5 mm., compared to 2-4 mm. for the latter form.

Measurements: wing 98.5, tail 61.5, exposed culmen 16.5 mm.

This single bird is so noticeably darker than equally worn specimens of *magna* or *imami* that it would seem to require a name. In its response to the isolated montane environment of the Jebel Akhdar it seems to parallel *imami*, but its dimensions and characteristics show a relationship to *magna* indicating that it is an offshoot of that widely dispersed form.

It gives me great pleasure to name this Green Mountains Crested Lark for its discoverer, Dr. Thoms.

Anthus similis arabicus Hartert:

Arabian Long-billed or Rock Pipit.

The third species collected by Dr. Thoms proves to belong to this form, not previously recorded from Muscat.

Postilla

YALE PEABODY MUSEUM
OF NATURAL HISTORY

Number 11 March 26, 1952 New Haven, Conn.

GEOGRAPHICAL VARIATION IN *GARRULAX SANNIO* SWINHOE *

H. G. DEIGNAN

Garrulax sannio was described by Swinhoe in 1867, from Fukien, and *Garrulax albo-superciliaris* by Godwin-Austen in 1874, from Manipur. In "The Annals and Magazine of Natural History," (4) *17*, 1876, p. 34, the latter author indiscreetly published the following: "I take the earliest opportunity in this paper to suppress the species (*Garrulax albosuperciliaris*) figured in the 'Journ. Asiat. Soc. Bengal,' 1874, and described by me in the 'Proc. Zool. Soc.' for 1874. It is, I find, the same as *G. sannio*, Swinhoe. The only variation I noticed in the single specimen with which I have compared it was a slight difference in the shade of coloration of the upper surface; this is one often seen in birds taken on the extreme limits of their range."

Despite the fact that but one specimen of each form was compared, and despite the improbability of any *Garrulax's*

* Published with permission of the Secretary of the Smithsonian Institution.

ranging unchanged from southeastern China to Assam, all subsequent writers on Indian birds have taken Godwin-Austen's remarks at full value. But the loan to me by Dr. Dillon Ripley of three recently taken skins of *G. albo-superciliaris* (one virtually a topotype) in the collection of the Yale Peabody Museum of Natural History has shown that Godwin-Austen's bird is perfectly distinct from Swinhoe's. Moreover, the loan of 51 specimens from China, Laos, and Tongking kindly sent me by the authorities of the Chicago Natural History Museum, and the further loan of seven specimens from Laos (David-Beaulieu Collection), again by courtesy of the Yale Peabody Museum, to be added to the already long series from China in the United States National Museum have indicated that there are, in addition, two unnamed subspecies in the territories intervening between Manipur and Fukien.

Mayr (*Ibis*, 1941, pp. 58-59) has commented on this species as follows: "The only character that varies geographically . . . is the colour of the postocular stripe. It is pale brown . . . in Yunnan birds, blackish in a series of birds from Wanhsien, eastern Szechwan. In view of the intermediate position of specimens from the type-locality . . ., it seems best not to recognize any races."

This statement is but partially true. First of all, the Manipur-Naga Hills form is immediately separable from all others by its very distinct color tones. Among Chinese populations, variation appears not only in the color of the postocular stripe, but also in the purity of color of the supercilium and in the intensity of color in the general plumage. The extremes of variation appear, a) in northwestern Yunnan and southeastern Sikang, and b) in Szechwan. Despite the fact that two very different races divide southwestern China between them, no intergradation is apparent in this region, but rather, as was indicated by Mayr, in the southeastern provinces of China.

In order more clearly to discuss the geographical variation of *Garrulax sannio*, it will be necessary first to name the two extremes of the Chinese series of populations, as follows:

1. *Garrulax sannio comis,* subsp. nov.

Type: ♂ ad. (U.S.N.M., No. 296636) collected on the Likiang Plain, elev. 8200 ft., northwestern Yunnan Province, China, August 18, 1923, by Joseph F. C. Rock (original number 1060).

Diagnosis: separable from *G. s. sannio* (Fukien) by having the postocular stripe light rufescent brown (not blackish brown or brownish black), and by having the white or creamy supercilium suffused with rufescent brown just above and behind the eye (not unsullied white or creamy).

Range: Sikang and western Yunnan, elev. 6,000-14,000 ft. Populations of the Shan States, Laos (south to Chiang Khwang), and northwestern Tongking (valley of the Black River), found at elevations between 2,000 and 4,900 feet, are either inseparable from topotypical *comis* or represent *comis* > *sannio.*

2. *Garrulax sannio oblectans,* subsp. nov.

Type: ♂ ad. (U.S.N.M., No. 277649) collected near Ipin [Suifu], elev. 1400 ft., southwestern Szechwan Province, China, November 22, 1923, by David C. Graham.

Diagnosis: separable from *G. s. sannio* (Fukien) by having the several browns of the pileum, mantle, rectrices, throat and breast, belly, and under tail coverts more saturate and strongly rufescent (not olivaceous).

From *G. s. comis* (Yunnan), it differs in the same characters as from *G. s. sannio,* but also by having the postocular stripe brownish black (not light rufescent brown) and by having the supercilium unsullied white or creamy (not suffused with rufescent brown above and behind the eye).

Range: Chinese province of Szechwan, elev. 1,000-6,000 ft., and northern Kweichow.

Remarks: *Garrulax sannio* may be considered an autochthon of southern China, which probably originated as a species in northwestern Yunnan or southeastern Sikang, where is found a race (*comis*) that shows in the adult certain characters (such as the light rufescent-brown postocular stripe) that appear in other races only in the immature plumage. From this center it has pushed out in two directions: westward across northern Burma as far as Manipur and adjacent parts of Assam (*albo-superciliaris*), where it is rare, and southeastward along the rivers as far as the Southern Shan States, northern Laos, northernmost Annam, and Tongking, in all of which it is common at elevations from 2800 to 4900 feet.

Specimens from these southeastern regions represent populations of individuals variably intermediate between topotypical *comis* and topotypical *sannio* (Fukien), which therefore cannot definitely be named. The majority, however, from localities west of the Black River-Red River divide (western Tongking) are nearer *comis,* while the majority of those from east of the divide are nearer *sannio;* this line might then, simply for convenience, be considered the boundary between the two forms.

It may be supposed that the species next advanced northeastward through the southeastern provinces of China, where, as the race *sannio,* it now occupies the hills of Kwangsi, Kwangtung, Fukien, Kiangsi, and northeastern Hunan (Yoyang [Yochow]).

Having reached the valley of the Yangtze in Kiangsi and Hunan, and by now accustomed to elevations much lower than those of the ancestral homeland, the species readily advanced westward up the great river into the lowlands of Szechwan, here to give rise to the race *oblectans* (birds from southwestern Hupeh are already *oblectans* > *sannio*).

Thus, while the ranges of *comis* and *oblectans* are contiguous, it may be seen that these two are farthest apart in distance traveled from the original home, and, by the same token, of all Chinese populations farthest apart in external characters. Interbreeding of the two races, with consequent masking of their differences, is inhibited by the fact that they occupy distinct altitudinal ranges. That the geographically distant *G. s. sannio* should be the intermediate between them is accounted for by the history of specific expansion I have hypothesized above.

So far as is now known, the range of *G. s. albo-superciliaris* is wholly isolated from those of its Chinese cousins and, as might be expected, this is a very distinct form by the deep (scarcely rufescent) brown of its pileum, the cold dark olivaceous brown of its mantle, and the strong vinaceous wash over its entire under parts. Its postocular stripe is blackish brown in the adult.

Since the birds of this genus are subject to alteration of color by wear, I should mention that my diagnoses have been based wholly upon fresh-plumaged adult specimens. The possibility of post-mortem change has also been considered and discounted, since skins of *G. s. comis* taken twenty-nine years ago do not differ significantly from one collected in 1945, and the oldest specimens of each race are roughly equivalent in age and should therefore have altered to the same degree. For the record, I should state that I have examined 40 examples of *comis* from Yunnan and Sikang, taken in 1923, 1928, 1929, 1930, and 1945; three of *sannio* from Fukien, taken in 1923 and 1930; forty of *oblectans* from Szechwan, taken in 1921, 1922, 1923, 1924, 1925, 1928, 1929, 1931, 1932, 1933, and 1934; three of *albo-superciliaris*, taken in 1950. Of the birds of Laos and Tongking, intermediate between *comis* and *sannio*, I have had 36, collected in 1924, 1929, 1930, 1938, 1939, and 1941.

Postilla

YALE PEABODY MUSEUM
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A NEW GENUS OF THRUSH FROM EASTERN AFRICA

S. DILLON RIPLEY

In connection with a revision of the thrushes, I have examined specimens of *Turdinus stictigula* Reichenow through the courtesy of the authorities of the American Museum of Natural History. This rare and seldom observed species found only in the hills in parts of Tanganyika was described as a babbler and placed in *Illadopsis* by W. L. Sclater (*Systema Avium Æthiopicarum*, 1932:363). In his revision of the babblers (*L'Oiseau*, 1946, 16:13) Delacour has pointed out that the Spot-throat is certainly a thrush and not a babbler in the lengthening of its narrow bill, and its long and slender tarsus and toes. M. Delacour placed the species provisionally in *Cossypha*, noting that it bore a slight resemblance to *anomala* and *archeri*.

Virtually nothing was known of the habits of the Spot-throat until Moreau published his observations (*Ibis*, 1932: 672 and 1938:302). He noted particularly its thrush-like habits and beautiful voice. He further described the nest, eggs, and nestlings, all reasonably thrush-like, but unfortunately the nestlings were destroyed before he could observe the juvenal plumage.

In its uniform coloration, spotted throat, and wing and tail formation, *stictigula* differs notably from the members of the genus *Cossypha*, and I therefore propose the erection of a new genus.

Modulatrix, n. gen.

Type.—*Turdinus stictigula* Reichenow 1906.

This genus is similar to *Cossypha* Vigors 1825 in its narrow bill and its long tarsi and toes; but the wing, which is rounded, has the sixth primary longest rather than the fifth and the first primary is less than two-thirds the length of the second (shorter than in species of *Cossypha*). The tail, which is shorter than the wing and of 12 feathers, is slightly rounded rather than squared, the individual rectrices being somewhat pointed. The color pattern of *Modulatrix* is distinctive uniform deep olive brown on the crown and back, with a faint tendency to terminal barring on the feathers of the center of the back. The tail is rich rufescent. Below, the throat is buffy-gray with terminal black spots; the abdomen is rufous. The flanks are dark brown. There is no tendency to a white eyebrow, crown or presuperciliary spot or stripe, so uniform a feature of *Cossypha*.

Measurements of three males are: wing, 79-81; tail, 71-72; culmen, 16; and tarsus, 29-30 mm.

Two forms of this genus have been described:

1. *Modulatrix stictigula stictigula* (Reichenow)

2. *Modulatrix stictigula pressa* (Bangs and Loveridge)

"*Modulatrix*," a singer *Tertull.*

Postilla

YALE PEABODY MUSEUM

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THE THRUSHES

S. DILLON RIPLEY

"The merle, the mavis, and the nichtingale,
With mirry notis mirthfully forth burst,"

from *May* by Gavin Douglas, 1513.

The thrushes are one of the most cosmopolitan of the groups of birds. References to the nightingale as Procne rather than as Philomela occur in the work of Apollodorus, about B. C. 140. By the time of Ovid, B. C. 43-18 A. D., Philomela had become the nightingale and so continued through early legend and poetry. The Persian bulbul of the eastern poets was undoubtedly the nightingale which was supposed to pour forth its strain of melody while pressing its breast against a rose thorn to ease its heart's pain. Thrushes of numerous sorts have been noted as superlative songsters in many countries since earliest times.

By the Nineteenth Century Seebohm (1881) and other students of birds were inclined to list the thrushes as the most highly developed among the birds on account of their singing qualities and the development of the plantar tendons. Newton (1893) citing Cabanis (1847) and W. K. Parker (1872-1873) disagreed, and later arrangers from Stejneger to Stresemann have listed the crows and their allies as the highest group of the *Oscines*.

The work of Seebohm (*op. cit.*), however, and that of Seebohm and Sharpe (1898-1902) have certainly been, historically, the most important monographs on the thrushes. These authors felt, as I do, that the thrushes represent a subfamily, the Turdinae, closely allied to the warblers, Sylviinae, from which they differ by not possessing a complete double molt, and by having in nearly all cases a spotted plumage in the young. Thrushes also, in most cases, have a booted rather than a scutellated tarsus. But even these rather generalized characters tend to have exceptions. Perhaps in such closely related groups as those within the Passeres, exceptions tend to prove the rule.

Hartert (1910) also listed the thrushes as a subgroup within the Muscicapidae, and this arrangement has been followed recently by Mayr and Amadon (1951). The principal objections to such a classification have been expressed by Witherby, Jourdain, Ticehurst, and Tucker (1938). In actual effect the objections to listing the thrushes as a subfamily may be reduced to the simple fact that the group is a very large one numerically, and that to lump them together with such other large groups as the warblers, babblers, and flycatchers into a single family may be an exceedingly unwieldly arrangement. This of course is true, but against this must be balanced the lack of well-defined characters, morphological or otherwise, to separate these groups. If categories, and especially higher categories in the Class Aves are to have comparable validity to those in other classes of animals it would be well to be somewhat more conservative in these matters than many systematists have been in the past. It has been amply demonstrated in recent years that many of the *minutiae*, the characters set up by avian taxonomists to create such categories as subgenera, genera, subfamilies, and the like, based on the relative differences between the length of the tarsus and the wing or tail, the length of bristles versus the bill length and so on, are extremely plastic in nature. Too much reliance on such relatively trivial morphological characters serves rather to obscure than to define relationships.

My inclination then to list the thrushes as a subfamily is based not only on the consideration of morphological and evolutionary characters, but also on the desire to be consistent. The characters separating the groups of the Muscicapidae are so few and inconstant that to keep the groups as separate families serves only to damage the concept of the term, family. Within the Muscicapidae, the differences between the numerically largest subfamilies may be listed as follows:

Subfamily	*Juvenile plumage*	*Double molt*	*Tarsus*	*Rictal bristles*
Muscicapinae	spotted	uncommon	weak, scutellate	strong
Timaliinae	unspotted	uncommon	scutellate	present
Sylviinae	unspotted	usual	scutellate primarily	distinct
Turdinae	spotted	uncommon	booted or scutellate	variable

Relatives

Besides the above closely related subfamilies, the dippers, Cinclinae, seem to me to be nearly related to the thrushes as suggested by Stejneger (1905), and I am inclined to agree with Mayr and Amadon (*op. cit.*) in making them a subfamily of the Muscicapidae.

The mockingbirds, Mimidae, recently have been considered a separate family, but formerly were included as a subfamily of the wrens (Coues and others). Perhaps both wrens and mockingbirds should be placed in the Muscicapidae as suggested recently by Mayr and Amadon (*op. cit.*). The tarsus of the mockingbirds is barely scutellate. The internal anatomy of this group differs only slightly in the narrowness of the anteorbital region of the skull, the rather narrow descending process of the nasal bone and the slightly differently shaped coracoid, sternum, and the narrow pelvis. In *Dumetella* the maxillo-palatines approach the thrushes exactly in shape, rather than being claviform as in the other mimine genera. These differences are no more compelling than those between other subfamilies of the Muscicapidae.

Ridgway (1907) erected a family for *Zeledonia*, the aberrant wren-thrush of Costa Rica on the basis of its possessing 10 tail feathers. The young also are not really spotted, having only a tendency to pale edgings on the feathers of the lower parts. In view of the diversity of the thrushes, and from the appearance, anatomy (Pycraft, 1905), and of what is known of its habits, I consider *Zeledonia* to be a relict member of the Turdinae, and a geographical representative allied to the short-wings, a group of South Asian chat-thrushes of the genus *Brachypteryx*.

The hedge-sparrows (*Prunella*) are kept by most authors as a separate family. Field and museum study inclines me to the belief that these birds are a subgroup within the thrushes as proposed by Baker (1924). The hedge-sparrows have scutellate tarsi, but the structure of the tibiotarsus in *Saxicoloides* seems to me intermediate and leading directly to *Prunella*. The musculature of the cheek in the hedge-sparrows puts this genus into the chat-like thrushes according to Beecher (personal communication), as does the immature plumage which is streaked or mottled. I consider, therefore, that the hedge-sparrows are a group of the chat-like thrushes which has become secondarily bunting-like in its food adaptations.

Acknowledgments

I am most grateful to the authorities of the American Museum of Natural History and the United States National Museum who have loaned me material in their care. Several individuals have been particularly helpful in discussions, notably Dr. J. P. Chapin who has generously shared with me his wealth of knowledge on the African thrushes. Without his advice I should have been unable to consider many of these peculiar genera. The comments of Messrs. Amadon, Beecher, Deignan, Delacour, Friedmann, and Peters have all been sought and freely given. Their advice has been most welcome and instructive.

Distribution

The thrushes would seem to be primarily of Palaearctic origin, I believe. The greatest number and complexity of forms occur in the Old World. Africa, also, has been an important evolutionary center in this subfamily, especially in the chat-like forms. From Eurasia there have been several invasions into the New World, even reaching outlying groups such as Hawaii and isolated Tristan da Cunha. In the other direction invasions have penetrated into the Australian region, and into Polynesia. New Zealand apparently has not been reached. *Turnagra*, formerly considered the New Zealand thrush, now appears to be nearer the shrike-billed flycatchers (Oliver, 1945). No continental area, however, is without some member of the thrush group.

Arrangement

In general the thrushes fall into two large groups or tribes, the chats and the true thrushes. The name for the second group is a convenient one in that the word, thrush, conjures-up to the mind a generalized bird of a definite size; a bird which might be a robin in the United States, a song thrush in England, a mistle thrush, fieldfare, or blackbird in many parts of Europe and northern Asia, or their equivalents in such a variety of places as Tierra del Fuego and the Solomon Islands. These birds are all of a roughly equivalent size and shape and even have roughly similar types of song. The chats on the other hand are in general small, skulking, often very difficult to see or observe if they belong to jungle-living species, and do not generally convey the impression of being thrushes at all except to the initiated, aside from those species which happen also to possess fine songs.

Chat Thrushes

The chats seem to me to represent the earlier forms of the subfamily. They are all smaller; many are more specialized for tropical or subtropical habitats; they are less uniform as a group, and generally present the impression of containing more end-lines of evolution and differentiation among them, more relicts. The exceptional cases of unturdine-like characters such as unspotted young, scutellate tarsus, prominent bristles and so forth occur among the chat-like aggregation. As a tribe, then, they would seem to have had a longer history. Some genera are transitional between thrushes and warblers. Others resemble the flycatchers. In general the chat tribe might be characterized as being smaller, possessing more slender legs, more diverse nesting habits, weaker song, and a tendency to brighter, more variegated plumage in adult and young. Diverse as they are, however, they seem to stand closer together as a group, distinct from the larger, more compactly evolved true thrushes. Mr. William Beecher's anatomical researches on the musculature of the cheek of passerine birds inclines him, also, to this division into two main groups within the Turdinae (personal communication). The largest development numerically of the chat thrushes has taken place in Africa and may well have commenced there for all that we know geologically or climatologically speaking.

The most primitive of the chat thrushes would seem to consist of two types, the short-wings, personified by *Brachypteryx* and *Zeledonia,* which I feel are equivalent tropical relict forms of the Old and New World, and the genus *Erythropygia,* which seems rather like a link between the warblers and the thrushes. Near *Erythropygia* may come the aberrant *Drymodes* of Australia and New Guinea, a relationship suggested to me by Dr. Amadon. I had previously thought these scrub-robins nearer the true thrushes, the group with closer geographical connections. In pattern of coloration there are many similarities even though the longer tail in *Drymodes,* longer than the wing in all cases, is certainly proportionally different from that in *Erythropygia.*

From such warbler-like origins have developed the robins, *Erithacus,* with their bewilderingly diverse complex of relatives in Africa, the magpie-robins, *Copsychus,* the fork-tails, *Enicurus,* the solitaires, *Myadestes,* of the New World, an early successful invader of that area with its own offshoot, *Phaeornis,* and its Old World relict relatives, *Cochoa* (?), and possibly *Stizorhina* (?).

The remaining subdivisions of the chat thrushes are more uniform, running from the redstarts, *Phoenicurus*, again through an array of African relatives, to *Cercomela* and the chats, *Saxicola*, beyond which in the evolutionary scale would seem to lie the wheatears and the rock-thrushes. Low down in the chat thrush group lies the small twig leading off through *Saxicoloides* to *Prunella*.

True Thrushes

The true thrushes consist of a more uniform group of birds in size, almost all of which have fine powers of song. These birds range from open heath in the temperate and subarctic regions to deepest tropical jungle. They have strong tarsi, strong bills lacking frontal hairs in most cases, and they molt from immature plumage in the first autumn directly into the adult plumage.

These thrushes have certain seemingly more primitive offshoots among them, notably *Myiophoneus* of the Indo-Malaysian region, several isolated genera in Celebes and New Guinea, and at least three separate invasions of the New World. The earliest of these would seem to be represented by the forest thrush of the West Indes, *Cichlherminia*, and the Tristan da Cunha thrush, *Nesocichla*, which I feel shows New World rather than Old World affinities.

A second invasion has produced the distinctive birds grouped currently in the genera, *Hylocichla* and *Catharus*, birds of the forest or the forest edge which in their habits and song seem almost intermediate between the nightingale-robin group of the Old World, and the true thrushes. A third rather interesting minor invasion in terms of end results has left two stranded species of the *Zoothera* assemblage in western North America and Mexico. A final invasion has populated the whole of both continents with a multitude of true thrushes of the genus *Turdus* which I would rank as the most highly developed genus of the subfamily. Whatever the varying points of view may be as to its place in the evolutionary sequence, it is certainly the most widespread of all the genera.

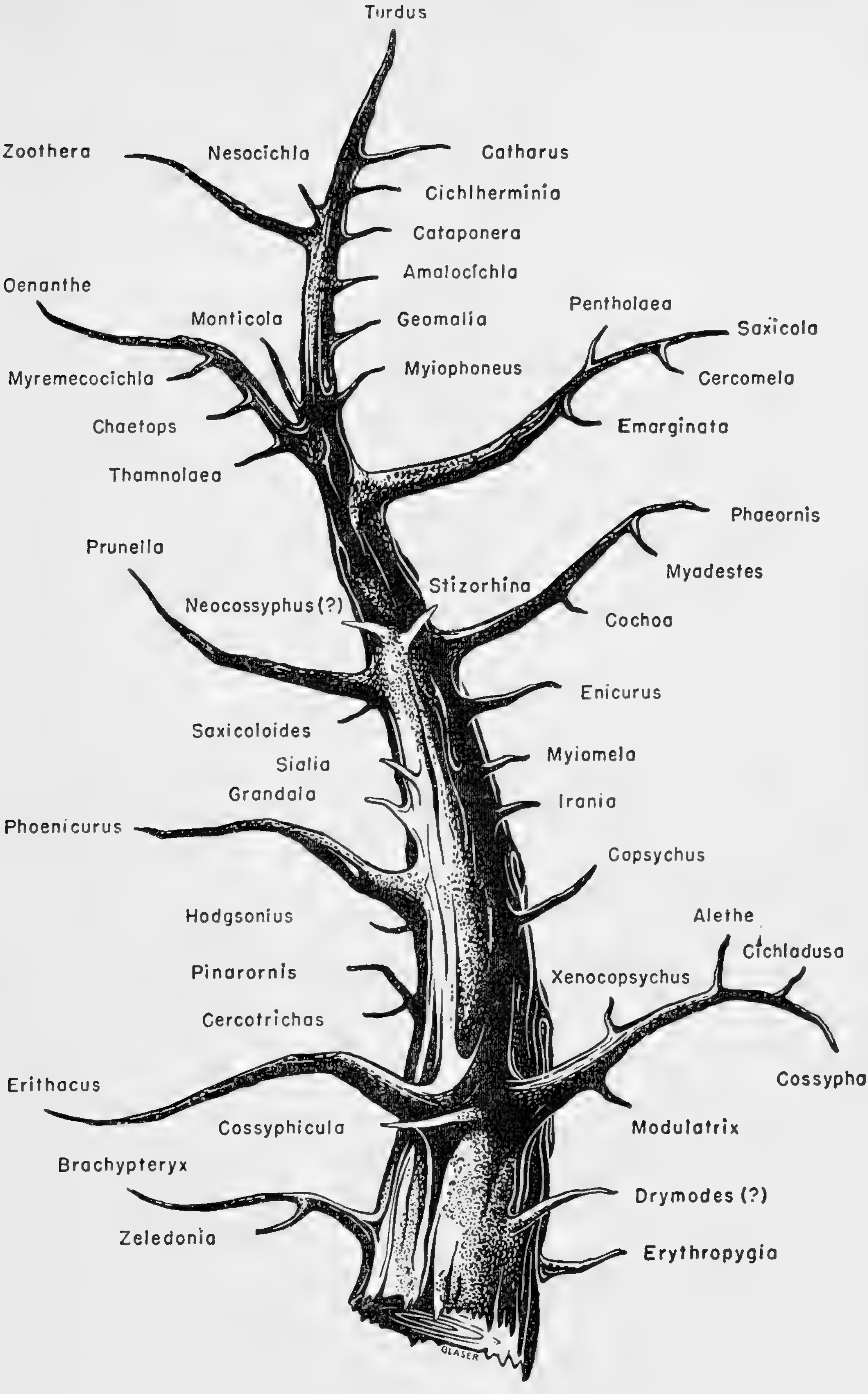
The Genera

Sharpe (1903) listed 75 genera in his "Hand List" in the family Turdidae. Excluding *Turnagra* and *Ephthianura*, and adding eight genera placed by him in the Timaliidae and Sylviidae, namely *Drymodes, Chaëtops, Cataponera, Myiophoneus, Arrenga, Brachypteryx, Heteroxenicus*, and *Agrobates* raises his total to 81. In the list following I propose that the number recognized be 46, a reduction of 45 per cent.

1) chat thrushes

Among the chat thrushes several generic names seem more usefully dropped than retained. The genus *Heteroxenicus* Sharpe, a new name for *Drymochares* Gould, was separated from *Brachypteryx* on the basis of having a tail less than twice the length of the tarsus. The type of *Heteroxenicus cruralis* is now considered a subspecies of the species *B. montana* of most authors, so unimpressive does this tail character appear. The same character was used for the species *stellatus*, type of *Drymochares*. The genus *Heinrichia* was erected by Stresemann for the species *calligyna* discovered on Celebes by Heinrich. It is similarly, if somewhat somberly colored to *Brachypteryx*, but happens to be somewhat larger than the other species. I can glean no indication of its habits or structure being in any way different from a typical *Brachypteryx*.

In the genus *Erythropygia* I include *Tychaëdon*, a renaming by Richmond of Sharpe's *Aedonopsis*, erected for the species *signata* of South Africa. In color pattern and habits this brown robin-chat seems to belong with the scrub-robins and should be placed there. The fact that the culmen in *signata* is longer



A suggested evolutionary tree.

than the hind toe with claw does not in any way separate it from *Erythropygia.*

I have felt impelled to place nearly all the small robin-like birds in one expanded genus, *Erithacus.* This action will be questioned by many, especially in western Europe where the robin is preëminent, a familiar bird to all, indeed a legendary bird. The weight of public opinion will lean toward keeping the Robin Redbreast apart, separate. Outside Europe, in Asia and Africa, however, there are so many parallel and related forms of robin-like birds that I prefer to lump them all into this one genus. Seebohm (*op. cit.*) included *Luscinia, Larvivora,* and *Calliope* in *Erithacus,* genera which were revived later and are used currently, although in the "Handbook" (Witherby, Jourdain, Ticehurst, and Tucker, *op. cit.*), *Luscinia* is enlarged to include *Cyanosylvia.* All these genera are separated from each other on the basis of the development of the rictal bristles, the degree of squareness or roundness of the tail, and the softness of the plumage. In habits all are very similar, their young are similarly spotted, the bill is rather slender, the rictal bristles generally small, and indeed they present a very uniform appearance as a group of robin-like species. Delacour (1951) attempts to separate the blue-throat, *svecica,* from the nightingale, *megarhyncha,* but as the British Handbook points out (*op. cit.*), color cannot serve as a sole basis for generic separation, so that it is better to align all these species in the single genus.

The genus *Tarsiger* is distinguished from *Calliope* by having a throat colored similarly to the underparts, and from *Ianthia* by having the tail only about twice the length of the tarsus. In habits and general appearance these forms are so similar that I would consider their differences only of specific rank. *Ianthia* is distinguished as having the tail feathers rather pointed, again not a sufficient reason it seems to me to separate it from *Erithacus.* "*Tarsiger*" shows a tendency in this direction.

Three African genera appear to me to be better placed in *Erithacus.* These are *Pogonocichla, Sheppardia,* and *Stiphrornis. Pogonocichla,* while separated from the typical Robin Redbreast by bright plumage and a distinct patch of bright feathers at the base of the throat, has no other morphological or ethological characters to distinguish it. *Sheppardia* and *Stiphrornis* are simply forest-living robins. The sole character of the first genus is its very slightly arched bill, and of the second, a white spot in front of the eye. Both these forms are very closely allied to the typical Robin Redbreast and my own feeling is that *rubecula* is in fact a species which originated in Africa from some common ancestor of all these related African forms, and which has extended into Europe in a gradual process during the inter-glacials. There is no evidence for such a supposition, of course, beyond the distribution of the species as it stands today with populations scattered around the Mediterranean and the Middle East, but the migration pattern of *rubecula* of Europe and the British Isles with the provocative occasional occurrence of a tendency toward a second breeding in the autumn by resident robins in England as discussed by Lack (1946), seems to me to point toward a tropical origin.

Very close to *Erithacus* is the little white-bellied robin-chat of Fernando Po Island and the eastern Belgian Congo, the species *roberti,* which has been placed in the genus *Cossyphicula* by Grote. So little is known of the habits and life history of this species that I feel that nothing can be done except to leave it as a monotypic genus. The species, while colored very similarly to the robin, has a rather broader bill, well-marked bristles and weak legs and feet.

Next to the robins are the larger robin-chats of Africa placed in the genus *Cossypha,* a brightly colored group, usually with a white crown patch or superciliary stripe. *Bessonornis,* founded on the species *humeralis,* seems to me untenable as it differs only slightly in color pattern.

Pseudocossyphus of Madagascar has a rather broad culmen with prominent bristles like *Cossypha.* I feel that the species *imerina* and *sharpei* should be included in the latter genus.

Near *Cossypha* is the species *stictigula* of eastern Africa, removed from the babblers by Delacour (1946) and placed by me (1952) in a monotypic genus, *Modulatrix.*

The genus *Cichladusa* in proportions seems near *Cossypha* and I place it there noting that Chapin (personal communication) avers that in song and behavior it is near the robin-chats. Meinertzhagen (1951) states that *Cichladusa* is a synonym of

Erythropygia although he gives no reasons. I cannot agree with his opinion.

Following *Cichladusa* I place *Alethe* which also seems near *Cossypha* and following this *Xenocopsychus*, which Chapin (1948) places in the *Cossypha* group, not far from *humeralis.*

Cercotrichas and *Pinarornis* seem to me closely related monotypic forms, and Delacour (*op. cit.*) has removed the latter from the babblers where it was placed by Sclater (1930) and others. Heim de Balsac and Mayaud (1951) feel that *Cercotrichas* is very close to *Erythropygia galactotes*, but the latter is only one species of the genus and a rather aberrant one at that. I would place these two genera between the *Cossypha* group and the *Copsychus* group. Within *Copsychus* I include *Kittacincla* and *Trichixos.*

The genus *Irania* with a single species *gutturalis* seems qualified to stand by itself midway between the robins and robin-chats (*Cossypha*) of Africa and the redstarts of the Palaearctic region.

To *Phoenicurus*, the genus of the redstarts, I would add the genera *Adelura*, *Chaimarrhornis*, *Diplootocus*, *Rhyacornis*, and *Ruticilla*. *Adelura* and *Ruticilla* have already been united by Hartert (*op. cit.*). *Chaimarrhornis* and *Rhyacornis* are simply redstarts with more aquatic habits, in the former case the sexes being colored alike, in the latter differently. There seems to be no other significant difference to warrant generic separation. *Diplootocus* was erected by Hartert (1902) for the species *moussieri* of North Africa on the basis of size and proportions. Bannerman and Priestley (1952) feel that in habits it is separated from *Phoenicurus* and that the retention of the genus *Diplootocus* is thus advisable. In coloration certainly it cannot be separated, nor can I find that Whitaker (1905) or others who speak of its habits can make its generic separation sound convincing. It seems to me merely a distinct miniature redstart just as *scouleri* is simply a distinct miniature forktail.

Near *Phoenicurus* I would place *Hodgsonius*. In its plumage, its longish tail and its habits it seems intermediate to me between the redstarts and the blue robins, *Myiomela*, contra Baker (*op. cit.*), who placed this species with the short-wings, *Brachypteryx*. *Myiomela*, the blue robin, formerly called *Notodela*, includes also *Callene* which differs from it only in lacking a white patch at the base of the outer tail feathers.

Hodgson's Grandala of the Himalayas was placed by Seebohm (*op. cit.*) with the American bluebirds, *Sialia.* I do not agree that the genus, *Grandala,* cannot stand by itself, but I do feel that this single Himalayan species is most closely related to the North American bluebirds who have, ever since the time of Audubon been called "Redstarts" by European visitors. Certainly *Grandala* and *Sialia* in habits, coloration, and in overall appearance seem close to the redstarts as exemplified by *Phoenicurus.*

The forktails, *Enicurus,* are a compact group of slender-legged, long-tailed birds which have become adapted to living along the edges of jungle streams in southern Asia. The genus, *Microcichla,* erected for the species *scouleri* does not seem to me to be valid, based as it is on the single character of the short tail. Otherwise *scouleri* is identical with the other forktails, merely smaller. Delacour (*op. cit.*) comes to the same opinion. *Hydrocichla* has been proposed for two of the smaller species of *Enicurus.* Except that the tail is shorter and perhaps somewhat less forked, I can find no other distinction and do not feel that this is a valid genus. Beecher (personal communication) finds the cheek anatomy of the forktails similar to the other chat-like thrushes.

Four genera with a broadened bill and a tendency to prominent bristles are found in parts of the New and Old Worlds. *Cochoa,* the broad-billed, long-winged thrush of the Himalayas, Indo-Chinese countries, and the Malaysian area has been variously assigned to the true thrush group near *Myiophoneus,* by some authors, and as a sort of relict, near the short-wings, by others. Sharpe (1879), placed *Cochoa* in the Prionopidae in the "Catalogue of Birds", and listed *Phaeornis* immediately next to it. Sharpe (1881) also suggested that *Cassinia* (now *Stizorhina*) was close to *Myadestes.* It has seemed to me that all these genera might replace each other on the different continents and might be a group of relict forms of which only the solitaires of the New World have any very large distribution and group of species. What is known of the habits of the rarer forms fits in fairly well with those that are better known as the solitaires. *Phaeornis*, the Hawaiian Islands thrush is very close to *Myiadestes* in wing and tail proportions but with larger feet and longer legs. It may be kept as a distinct genus as a measure of its separation from the mainland species in time and degree of evolution.

Two genera, *Entomodestes* and *Cichlopsis*, seem better united to *Myiadestes*, however. In color *Entomodestes* seems to differ from typical solitaires, but individual species of *Myiadestes*, such as *genibarbis*, do also, and I can find no other valid characters. *Cichlopsis* is simply a plain brown solitaire with a paler yellowish-tinted throat and paler underparts.

The genus *Neocossyphus*, while bearing a close resemblance to *Stizorhina* in color and plumage pattern, seems to differ in habits to some extent, being a shy, typically chat-like species of the undergrowth, while *Stizorhina* is more arboreal. *Neocossyphus* has two species which are most closely related to each other and to no other, and which are sympatric in considerable parts of West Africa in Gabon and the Cameroon. The genus seems near *Alethe* and *Cossypha* in many ways. The young are not spotted.

The typical chats consist of a group which shades through various degrees of size into the true thrushes. These are primarily birds of the open country, perching on a rock, a small bush or other eminence, looking from this vantage point for their insect prey and hawking out after it. *Emarginata* is a typical chat from Africa, closely related to *Cercomela*, which is in itself close to *Saxicola*. I have united *Karrucincla* with *Emarginata*, and *Pinarochroa* with *Cercomela*, as I can find no outstanding differences either morphological or ethological between them.

In *Saxicola*, for the most part brightly patterned small chats, I include *Oreicola* and *Pratincola*. All are similar in plumage, sexually dimorphic forms with spotted young, and entirely similar habits. *Oreicola* is separated on the basis of a longer, more graduated tail, but among the species of *Saxicola* currently recognized, this distinction fades out. The genus was founded on *pyrrhonota*, and so *Rhodophila* Jerdon has been more recently used (Baker, 1930). *Pratincola* (founded on *rubetra*) loses its validity as a genus if *Saxicola* is used as a genus for the small chats and not for the wheatears as Hartert (*op. cit.*) proposed.

Pentholaea is close to *Saxicola* but seems differently formed in wing and bill, distinctly enough to remain as a genus apart.

Thamnolaea, a much larger bird, approaches the wheatears as does *Chaëtops* which resembles it in pattern. *Myrmecocichla* is another genus of large cliff-chats which is approaching the wheatears. In *Myrmecocichla* I include *Sciocincla* as to me these larger dark species, *nigra* and *arnotti*, belong in *Myrmecocichla* rather than in *Thamnolaea.*

The genus *Oenanthe* has recently been ably discussed by Vaurie (1949, 1950). I follow his arrangement.

An offshoot from the thrushes may well be placed here, although there will be those who differ. *Saxicoloides* seems to be related to *Prunella* and I place these two genera at this point, followed by *Monticola.* In *Saxicoloides* the bill is slender and rather downwardly curved, the tarsus is very well developed and is scutellated and the wings are long and pointed. The young are obsoletely barred and streaked. In *Prunella* the bill is rather wide at the base and hard, the culmen rounded and slightly curved. The feet are very strong and the tarsus is short, but scutellated. Both genera are hole-nesters, in banks or walls, and both have reduced song. Both genera are rather shy and skulking, and do not associate with other birds to a great extent. In both, family parties or groups occur after the breeding season.

2) TRUE THRUSHES

The genus *Monticola* seems to me closely related to the chats and wheatears and serves, therefore, to introduce the tribe of true thrushes. Meinertzhagen (*op. cit.*) has recently rearranged the species reducing the number to four. I would recognize eight.

Next to *Monticola* in a linear arrangement I place *Myiophoneus*, although the genera have little in common. *Myiophoneus* seems, however, a rather relict genus of thrush confined to southern Asia and the Himalayan area, therefore, a primitive member of the group. Delacour (1942) has reviewed the genus, including *Arrenga* of Ceylon which is suppressed.

Geomalia of Celebes is closely related to the next group which I would include in *Zoothera.* These are the ground thrushes which have been placed in various genera, *Geokichla, Oreocincla, Ixoreus, Ridgwayia,* and others. Delacour and Mayr (1945) have already suggested that *Oreocincla* is a synonym of *Zoothera.* All are characterized by having the bases of the secondaries and many of the primaries white, occasionally tinted with buff. but distinctly demarcated from the surrounding brown. This is particularly noticeable on the underwing. In *pinicola* the axillaries are uniform white, the most extreme variant of this coloration. The wing is rounded in virtually all the species, the tarsi are not scutellated, the young are spotted on the back and breast, the tail is nearly even and may contain 12 or 14 feathers. The group seems to me an old one, widely spread in the Malaysian and African areas, ranging as far as Australia and the Solomon Islands and across to eastern Siberia, the western coast of North America, and the highlands of Mexico. The birds are all forest or jungle species, shy, unobtrusive, nesting fairly near the ground with well developed powers of song.

Two genera found in the Moluccan-New Guinea region seem to me to be very primitive offshoots of the true thrushes, possibly most nearly related to *Turdus.* These are *Amalocichla* of New Guinea which has two species only. One species is rather small and looks almost exactly like a *Brachypteryx.* The other is large and looks like a *Turdus.* And yet in pattern and proportions the two species are very close, indeed, to each other, closer than to anything else. Perhaps these two species represent an accidental hold-over, a demonstration of foundation thrush stock. *Cataponera* of Celebes is very thrush-like in form and apparently in its habits also.

Two other primitive genera which seem related to *Turdus* are *Nesocichla,* the Tristan da Cunha thrush, and *Cichlherminia,* the forest thrush of the West Indies. Although by no means closely related to each other, I find them reminiscent enough in pattern and form to hazard a guess that the Tristan thrush came from some ancestral thrush stock of the New World, rather than from Africa as has been suggested. A similar derivation has been suggested for some of the other Tristan avifauna (Lowe, 1923).

Dorst (1950) has made a recent, most interesting study of the genus *Turdus*, in which he includes the genus *Hylocichla*, found primarily in the New World. His reasons for doing so are the extraordinary superficial resemblance between the European song thrush and the North American wood thrush. To American ornithologists familiar with both species in life, Dorst's reasons are not compelling. The resemblance seems to be more one of parallelism in external appearance only. The wood thrush is a much more delicate bird in build with far more slender legs and slender, long bill, somewhat broadened at the base. However, the striking difference between the American thrushes of this group and the European song thrush is in habits. The song thrush is far more like European thrushes, the redwing, fieldfare, and blackbird in its habits, seeking food in the open, running forward with a succession of hops or a short run, head often on one side and so forth; the behavior which in America is associated with the American robin and other true thrushes. The wood thrush and its relatives on the other hand are rather shy, forest birds, whose behavior can be compared more nearly with a European nightingale. The display of a song thrush tends to be on the ground, that of a wood thrush in flight. The song thrush nests in hedgerows, bushes, low trees, sometimes on the ground or on banks. Its eggs are spotted like those of other European thrushes. The wood thrush tends to nest in trees, usually in thick cover, often in heavy woods, from six to 50 feet above the ground. The eggs are unspotted, and of course, much smaller.

The wood thrush in fact is the largest member of a group of thrushes found in the Americas which also includes a group of Neotropical species listed by most authors in the genus *Catharus*. Except for the fact that most species of *Catharus* are rather dark in color, some having a blackish cap, there is no difference in proportion or size among the species of the two genera, *Catharus* and *Hylocichla*, and no difference in their habits, although the *Catharus* species are not famous for fine song, with the exception of *frantzii* whose song has been compared to that of the hermit thrush, *guttatus*. In fact the hermit thrush links the two genera, as in it the 10th primary is long, as long as in some species of those separated by Ridgway (*op. cit.*) in *Catharus*, whose principal character was the presence of a long 10th primary.[1] Ridgway himself (*op. cit.*) was perhaps the first to point out the extreme closeness of these two genera, the one a neotropical group of species, the other temperate. In view of the series of intermediates running from the smallest species listed under *Catharus* up to the largest and palest of those forms, and on to the smallest species listed under *Hylocichla*, in view, too, of the acknowledged similarity of the habits and appearance of the groups of species, it seems wiser to merge both groups into one genus of which *Catharus* is the oldest name. Should some utterly convincing anatomical or other proof of the distinctness of these two groups of species be produced in the future, I would gladly acknowledge my error in suggesting this course, but at present with the current state of information, it seems wiser to emphasize relationships of species rather than their presumed diversity.

The genus *Philomeloides* Blyth, quoted by N. Wood ("British Song Birds," May 1836, p. 25), was a *nomen nudem* at its first appearance. I do not agree with Wolters (1950) that *Philomeloides* Blyth is tenable for *Hylocichla* which in any case as I have stated above, I feel should be merged with *Catharus*.

In the genus, *Turdus*, I include *Arceuthornis* used by some for the mistle thrush, fieldfare, and redwing on the basis of a smaller bili and similar plumage in the sexes. I also include *Haplocichla* and *Mimocichla*, two West Indian genera closely related to each other which differ from most *Turdus* species in having white tips to the tail feathers or else a white patch on the innermost greater wing coverts. Patches of white or grayish white appear in other widely scattered species of *Turdus*, ranging from the white gorget, and grayish white

[1] In fact if Ridgway's strict diagnosis of the genera *Catharus* and *Hylocichla* is followed, it might be better to list *guttatus* in *Catharus* and leave the rest of the species familiarly placed in *Hylocichla* in that genus!

margins on the tail feathers and primaries, secondaries, and coverts of the ring-ouzel (*T. torquatus*) to the ashy gray patch on the wing coverts of the gray-winged blackbird (*T. boulboul*) of India. I cannot feel that the coloration of these species should separate them from the genus *Turdus. Haplocichla* has already been supressed by Bond (1940).

Finally, I include *Platycichla* in *Turdus*, a monotypic genus, whose species, *flavipes*, with a somewhat stouter bill seems hardly to separate it from the rest of the South American members of *Turdus*.

Following is a list of the genera proposed to be synonymized in this and other recent revisions:

Adelura	= *Phoenicurus*	*Luscinia*	= *Erithacus*
Arceuthornis	= *Turdus*	*Microcichla*	= *Enicurus*
Bessonornis	= *Cossypha*	*Mimocichla*	= *Turdus*
Callene	= *Myiomela*	*Notodela*	= *Myiomela*
Calliope	= *Erithacus*	*Oreicola*	= *Saxicola*
Chaimarrhornis	= *Phoenicurus*	*Oreocincla*	= *Zoothera*
Cichlopsis	= *Myadestes*	*Pinarochroa*	= *Cercomela*
Cyanosylvia	= *Erithacus*	*Platycichla*	= *Turdus*
Diplootocus	= *Phoenicurus*	*Pogonocichla*	= *Erithacus*
Drymochares	= *Brachypteryx*	*Pratincola*	= *Saxicola*
Entomodestes	= *Myadestes*	*Pseudocossyphus*	= *Cossypha*
Geokichla	= *Zoothera*	*Rhodophila*	= *Saxicola*
Haplocichla	= *Turdus*	*Rhyacornis*	= *Phoenicurus*
Heinrichia	= *Brachypteryx*	*Ridgwayia*	= *Zoothera*
Heteroxenicus	= *Brachypteryx*	*Ruticilla*	= *Phoenicurus*
Hydrocichla	= *Enicurus*	*Sciocincla*	= *Myrmecocichla*
Hylocichla	= *Catharus*	*Sheppardia*	= *Erithacus*
Ianthia	= *Erithacus*	*Stiphrornis*	= *Erithacus*
Ixoreus	= *Zoothera*	*Tarsiger*	= *Erithacus*
Karrucincla	= *Emarginata*	*Trichixos*	= *Copsychus*
Kittacincla	= *Copsychus*	*Tychaëdon*	= *Erythropygia*
Larvivora	= *Erithacus*		

The Species

In the following list of the species of thrushes, I have attempted to list the genera in the linear arrangement necessary for a manuscript, but often so misleading from the point of view of relationships. In the particular cases where I could, I have tried to list the relict species or others which seemed to me from my own subjective point of view to be the representations of the earliest or more generalized ancestral forms first, and to list the more highly evolved forms last. To some extent my listing may seem to conform to the "Age and Area" concept, if only because the more widely distributed forms often seem to represent more highly evolved species. But as each species has its own evolutionary rate, as each is responsive in its own way to the environment, to the changes in it, and to the relative degree of isolation with which it is confronted, there is no hard and fast rule such as "Age and Area" presupposes. Many so-called primitive forms may owe their primitive character to a secondary loss in a more specialized or isolated environment. Many species may be similar on an entirely superficial level. Others may be closely related but may have developed strikingly different ecological characteristics, as well as a varying degree of morphological differentiation.

I have tried to list all the subspecies, but in many cases have been unsure of these forms. Those which I have not seen and have formed no concrete opinion on are followed by an asterisk.

I.	*Brachypteryx*	*stellata*	*stellata*	Gould
	”	”	*fusca*	Delacour and Jabouille
	”	*hyperythra*		Jerdon and Blyth
	”	*major*	*major*	(Jerdon)
	”	”	*albiventris*	(Fairbank)
	”	*calligyna*	*calligyna*	(Stresemann)
	”	”	*picta*	(Stresemann)
	”	”	*simplex*	(Stresemann)
	”	*leucophrys*	*nipalensis*	Horsfield and Moore
	”	”	*carolinae*	LaTouche
	”	”	*langbianensis*	Delacour and Greenway
	”	”	*wrayi*	Ogilvie-Grant
	”	”	*leucophrys*	(Temminck)
	”	*montana*	*cruralis*	(Blyth)
	”	”	*sinensis*	Rickett and LaTouche
	”	”	*goodfellowi*	Ogilvie-Grant
	”	”	*poliogyna*	Ogilvie-Grant
	”	”	*brunneiceps*	Ogilvie-Grant
	”	”	*mindanensis*	Mearns*
	”	”	*malindangensis*	Mearns

Brachypteryx montana saturata Salvadori
" " *erythrogyna* Sharpe
" " *montana* Horsfield
" " *floris* Hartert

II. *Zeledonia coronata* Ridgway

III. *Erythropygia coryphaeus coryphaeus* (Lesson)
" " *abbotti* Friedmann*
" *hamertoni* Ogilvie-Grant*
" *leucophrys lecoptera* (Rüppell)
" " *eluta* Bowen
" " *vulpina* Reichenow
" " *brunneiceps* Reichenow
" " *soror* Reichenow
" " *jugens* Bowen*
" " *vansomerni* Sclater
" " *ruficauda* Sharpe
" " *zambesiana* Sharpe
" " *munda* (Cabanis)
" " *pallida* Benson
" " *sclateri* Grote
" " *pectoralis* A. Smith
" " *leucophrys* (Vieillot)
" " *kabalii* White
" *hartlaubi* Reichenow
" *galactotes galactotes* (Temminck)
" " *minor* (Cabanis)
" " *syriaca* (Hemprich and Ehrenberg)
" " *familiaris* (Menetries)
" *paena benguellensis* Hartert
" " *damarensis* Hartert
" " *paena* A. Smith
" *leucosticta collsi* Alexander
" " *leucosticta* (Sharpe)*
" *reichenowi* Hartert
" *barbata erlangeri* Reichenow*
" " *greenwayi* Moreau*
" " *quadrivirgata* (Reichenow)
" " *rovumae* (Grote)
" " *barbata* (Finsch and Hartlaub)
" " *wilsoni* Roberts*
" *signata* (Sundevall)

IV. *Drymodes brunneopygius brunneopygius* Gould
" " *pallidus* (Sharpe)
" *superciliaris colcloughi* Mathews
" " *beccarii* (Salvadori)
" " *superciliaris* Gould
" " *brevirostris* (De Vis)
" " *nigriceps* Rand

V. *Erithacus erythrothorax erythrothorax* (Hartlaub)
" " *gabonensis* (Sharpe)
" " *xanthogaster* (Sharpe)
" " *mabirae* (Jackson)
" *sharpei sharpei* (Shelley)
" " *usambarae* (Macdonald)*
" *gunningi gunningi* (Haagner)
" " *bensoni* (Kinnear)*
" " *sokokoensis* (van Sommern)
" *cyornithopsis cyornithopsis* (Sharpe)
" " *lopezi* (Alexander)
" " *acholiensis* (Macdonald)*
" " *bangsi* (Friedmann)
" " *houghtoni* (Bannerman)
" " *aequatorialis* (Jackson)
" *margaritatus ruwenzorii* (Ogilvie-Grant)
" " *guttifer* (Reichenow and Neumann)
" " *elgonensis* (Ogilvie-Grant)
" " *keniensis* (Mearns)
" " *macarthuri* (van Sommern)
" " *orientalis* (Fischer and Reichenow)
" " *johnstoni* (Shelley)
" " *transvaalensis* (Roberts)*
" " *lebombo* (Roberts)
" " *margaritatus* (Sundevall)
" *swynnertoni* (Shelley)
" *rubecula melophilus* Hartert
" " *rubecula* (Linnaeus)
" " *xanthothorax* Salvadori and Festa
" " *sardus* Kleinschmidt
" " *superbus* Koenig
" " *witherbyi* Hartert
" " *atlas* Lynes

Erithacus rubecula tataricus Grote
" " *caucasicus* Buturlin
" " *hyrcanus* Blanford
" *sibilans* (Swinhoe)
" *luscinia* (Linnaeus)
" *megarhynchos caligiformis* (Clancey and von Jordans)*
" " *megarhynchos* (Brehm)
" " *corsa* (Parrot)*
" " *hafizi* (Severtsov)
" " *lusciniodes* (von Jordans)*
" " *africana* (Fischer and Reichenow)
" *akahige akahige* (Temminck)
" " *tanensis* Kuroda
" " *kobayashii* (Momiyama)
" *calliope camtschatkensis* (Gmelin)
" " *beicki* (Meise)
" " *calliope* (Pallas)
" *svecicus svecicus* (Linnaeus)
" " *namnetum* (Noirmoutier)
" " *occidentalis* (Zarudny)
" " *cyaneculus* (Wolf)
" " *luristanicus* nom. nov.[2]
" " *pallidogularis* (Zarudny)*
" " *abbotti* (Richmond)
" " *tianschanicus* (Tugarinov)*
" " *kaschgariensis* (Tugarinov)*
" " *altaicus* (Sushkin)
" " *saturatior* (Sushkin)
" " *weigoldi* (Kleinschmidt)
" " *przevalskii* (Tugarinov)*
" " *kobdensis* (Tugarinov)*
" *pectoralis pectoralis* (Gould)
" " *confusus* (Hartert)
" " *ballioni* (Severtsov)
" " *tschebaiewi* (Przevalski)
" *ruficeps* (Hartert)
" *wickhami* (Baker)
" *pectardens* (David)

[2] *Erithacus svecicus magnus* (Zarudny and Loudon), 1904, is preoccupied by *Philomela magna* Blyth, 1833 (a *nomen nudum* in synonymy with *Luscinia luscinia* Linnaeus).

Erithacus hachisukae nom. nov.[3]
" *cyane cyane* (Pallas)
" " *bochaiensis* (Shulpin)
" *brunneus* (Hodgson)
" *komadori komadori* (Temminck)
" " *namiyei* (Stejneger)
" " *subrufus* (Kuroda)
" *cyanurus cyanurus* (Pallas)
" " *rufilatus* (Hodgson)
" " *practicus* (Bangs and Phillips)
" " *pallidor* (Baker)
" " *albocoeruleus* (Meise)
" " *ussuriensis* (Stegmann)
" *chrysaeus chrysaeus* (Hodgson)
" " *whistleri* (Ticehurst)
" " *vitellinus* (Stresemann)
" *indicus indicus* (Vieillot)
" " *yunnanensis* (Rothschild)
" " *formosanus* (Hartert)
" *hyperythrus* (Blyth)
" *johnstoniae* (Ogilvie-Grant)

VI. *Cossyphicula roberti roberti* (Alexander)
" " *rufescentior* (Hartert)

VII. *Cossypha insulana insulana* Grote
" " *granti* Serle
" " *kungwensis* Moreau
" *polioptera polioptera* Reichenow
" " *tesmanni* Reichenow
" " *nigriceps* Reichenow
" *bocagei* Finsch and Hartlaub
" *archeri* Sharpe
" *isabellae isabellae* G. R. Gray
" " *batesi* (Bannerman)
" *natalensis natalensis* A. Smith
" " *hylophona* Clancey*
" " *garguensis* Mearns
" *dichroa* (Gmelin)
" *semirufa semirufa* (Rüppell)

[3] As Marquess Hachisuka has noted (in litt.) *Erithacus obscura* Berezowski and Bianchi, 1894, is preoccupied by *Cyanecula obscura* Brehm 1831, a synonym of *Erithacus svecicus cyaneculus* (Wolf), 1810.

Cossypha semirufa donaldsoni Sharpe
" " *intercedens* (Cabanis)
" *heuglini heuglini* Hartlaub
" " *subrufescens* Boacage
" " *intermedia* (Cabanis)
" *cyanocampter cyanocampter* (Bonaparte)
" " *periculosa* Sharpe
" " *bartteloti* Shelley
" *caffra iolema* Reichenow
" " *kivuensis* Schouteden
" " *caffra* (Linnaeus)
" " *namaquensis* Sclater
" *albigularis albigularis* (Reichenow)
" " *maclounii* (Shelley)
" " *porotensis* (Bangs and Loveridge)
" " *njombe* Benson
" " *anomala* (Shelley)
" *humeralis* (A. Smith)
" *niveicapilla niveicapilla* (Lafresnaye)
" " *melanonota* (Cabanis)
" *albicapilla albicapilla* (Vieillot)
" " *giffardi* Hartert
" " *genderuensis* Reichenow
" " *omonensis* Sharpe
" *sharpei sharpei* G. R. Gray
" " *erythronata* Lavauden
" *imerina* Hartlaub

VIII. *Modulatrix stictigula stictigula* (Reichenow)
" " *pressa* (Bangs and Loveridge)

IX. *Cichladusa guttata guttata* (Heuglin)
" " *rufipennis* Sharpe
" *arquata* Peters
" *ruficauda* (Hartlaub)

X. *Alethe castanea castanea* (Cassin)
" " *woosnami* Ogilvie-Grant
" *poliophrys* Sharpe
" *fülliborni fülliborni* Reichenow
" " *usambarae* Reichenow
" *poliocephala poliocephala* (Bonaparte)
" " *castanonota* Sharpe
" " *carruthersi* Ogilvie-Grant

Alethe poliocephala akeleyae Dearborn
" *diademata* (Bonaparte)
" *choloensis choloensis* Sclater
" " *namuli* Vincent*
" *sharpei* (Shelley)*

XI. *Xenocopsychus ansorgei* Hartert

XII. *Cercotrichas podobe podobe* (P. L. S. Müller)
" " *melanoptera* (Hemprich and Ehrenberg) (?)[4]

XIII. *Pinarornis plumosus* Sharpe

XIV. *Copsychus saularis saularis* (Linnaeus)
" " *ceylonensis* Sclater
" " *andamanensis* Hume
" " *prosthopellus* Oberholser
" " *amoenus* (Horsfield)
" " *erimelas* Oberholser
" " *nesiotes* Oberholser
" " *zacnecus* Oberholser
" " *nesiarchus* Oberholser
" " *masculus* Ripley
" " *pagiensis* Richmond
" " *javensis* Chasen and Kloss
" " *problematicus* Sharpe
" " *pluto* Bonaparte
" " *adamsi* Elliott
" " *mindanensis* (Gmelin)
" *seychellarum* Newton
" *albospecularis albospecularis* (Eydoux and Gervais)
" " *pica* Pelzeln
" " *inexpectatus* Richmond
" *malabaricus malabaricus* (Scopoli)
" " *indicus* (Baker)
" " *leggei* (Whistler)
" " *albiventris* (Blyth)

[4] Two specimens of this form in the collection of the Bombay Natural History Society from S. W. Arabia have brownish quills and a rufous patch on the inner webs, but they are very worn specimens.

Copsychus malabaricus interpositus (Robinson and Kloss)
" " *minor* (Swinhoe)
" " *mallopercnus* (Oberholser)
" " *tricolor* (Vieillot)
" " *melanurus* (Salvadori)
" " *opisthopelus* (Oberholser)
" " *javanus* (Kloss)
" " *omissus* (Hartert)
" " *ochroptilus* (Oberholser)
" " *heterogynus* (Oberholser)
" " *eumesus* (Oberholser)
" " *abbotti* (Oberholser)
" " *suavis* Sclater
" " *nigricaudus* (Vorderman)
" " *stricklandii* Motley and Dilwyn
" " *barbouri* (Bangs and Peters)
" *luzoniensis luzoniensis* (Kittlitz)
" " *parvimaculatus* (McGregor)
" " *superciliaris* (Bourns and Worcester)
" *niger niger* (Sharpe)
" " *cebuensis* (Steere)
" *pyrropygus* (Lesson)

XV. *Irania gutturalis* (Guérin)

XVI. *Phoenicurus alaschanicus* (Przewalski))
" *erythronotus* (Eversman)
" *caeruleocephalus* Vigors
" *ochruros gibraltariensis* (Gmelin)
" " *aterrimus* von Jordans*
" " *ochruros* (S. G. Gmelin)
" " *semirufus* (Hemprich and Ehrenberg)
" " *phoenicuroïdes* (Horsfield and Moore)
" " *xerophilus* Stegmann
" " *rufiventris* (Vieillot)
" *phoenicurus phoenicurus* (Linnaeus)
" " *algeriensis* (Kleinschmidt)
" " *samamiscus* (Hablizl)
" " *turkestanicus* Zarudny*
" *hodgsoni* (Horsfield and Moore)

Phoenicurus frontalis frontalis Vigors
" " *sinae* Hartert*
" *schisticeps schisticeps* (Gray)
" " *beicki* Stresemann
" *auroreus auroreus* (Pallas)
" " *leucopterus* Blyth
" *moussieri* (Olphe-Gaillard)
" *erythrogaster erythrogaster* (Güldenstädt)
" " *maximus* Kleinschmidt
" " *grandis* (Gould)
" *leucocephalus leucocephalus* Vigors
" " *pamirensis* (Zarudny and Moltchanow)
" *bicolor* (Ogilvie-Grant)
" *fuliginosus fuliginosus* Vigors
" " *affinis* (Ogilvie-Grant)
" *frontalis frontalis* (Blyth)
" " *orientalis* (Delacour and Jabouille)

XVII. *Hodgsonius phoenicuroides phoenicuroides* (Gray)
" " *ichangensis* Baker

XVIII. *Myiomela leucura leucura* (Hodgson)
" " *cambodiana* (Delacour and Jabouille)
" *diana sumatrana* (Robinson and Kloss)
" " *diana* (Lesson)
" *frontalis* (Blyth)

XIX. *Grandala coelicolor coelicolor* Hodgson
" " *florentes* Bangs and Peters

XX. *Sialia sialis sialis* (Linnaeus)
" " *grata* Bangs
" " *episcopus* Oberholser
" " *fulva* Brewster
" " *azurea* Swainson[5]
" " *meridionalis* Dickey and van Rossem*
" *mexicana mexicana* Swainson
" " *australis* Nelson*
" " *anabelae* Anthony
" " *occidentalis* Townsend

[5] Replaces *guatemalae* Ridgway.

Sialia mexicana bairdi Ridgway
" *currucoides* (Bechstein)

XXI. *Enicurus scouleri scouleri* Vigors
" " *fortis* (Hartert)
" *velatus sumatranus* (Robinson and Kloss)
" " *velatus* Temminck
" *ruficapillus* Temminck
" *immaculatus* (Hodgson)
" *schistaceus* (Hodgson)
" *leschenaulti indicus* Hartert
" " *sinensis* Gould
" " *frontalis* Blyth
" " *borneensis* (Sharpe)
" " *leschenaulti* (Vieillot)
" " *chaseni* de Schauensee
" *maculatus maculatus* Vigors
" " *guttatus* Gould
" " *omissus* Rothschild
" " *robinsoni* Baker

XXII. *Cochoa purpurea* Hodgson
" *viridis* Hodgson
" *azurea beccarii* Salvadori
" " *azurea* (Temminck)

XXIII. *Myadestes townsendi townsendi* (Audubon)
" " *calophonus* Moore
" *obscurus obscurus* Lafresnaye
" " *oberholseri* Dickey and van Rossem
" " *occidentalis* Stejneger
" " *cinereus* Nelson
" " *insularis* Stejneger
" *elisabeth elisabeth* (Lembeye)
" " *retrusus* Bangs and Zappey
" *genibarbis solitarius* Baird
" " *montanus* Cory
" " *dominicanus* Stejneger
" " *genibarbis* Swainson
" " *sanctae-luciae* Stejneger
" " *sibilans* Lawrence
" *ralloides ralloides* (d'Orbigny)
" " *plumbeiceps* Hellmayr
" " *venezuelensis* Sclater

Myadestes ralloides candelae de Schauensee
" " *coloratus* Nelson
" " *melanops* Salvin
" *unicolor unicolor* Sclater
" " *veraepacis* Griscom
" " *pallens* Miller and Griscom
" *leucogenys leucogenys* (Cabanis)
" " *gularis* (Salvin and Godman)
" " *peruvianus* (Hellmayr)
" " *chubbi* (Chapman)
" *leucotis* (Tschudi)
" *coracinus* Berlepsch

XXIV. *Phaeornis obscura obscura* (Gmelin)
" " *lanaiensis* Wilson
" " *rutha* Bryan
" " *oahensis* Wilson and Evans
" " *myadestina* Stejneger
" *palmeri* Rothschild

XXV. *Stizorhina fraseri fraseri* (Strickland)
" " *rubicunda* (Hartlaub)
" " *vulpina* Reichenow
" *finschii* (Sharpe)

XXVI. *Neocossyphus rufus gabunensis* Neumann
" " *arrhenii* Lönnberg
" " *rufus* (Fischer and Reichenow)
" *poensis poensis* (Strickland)
" " *praepectoralis* Jackson
" " *granti* Alexander

XXVII. *Emarginata sinuata* (Sundevall)
" *schlegelii benguellensis* (Sclater)
" " *namaquensis* (Sclater)
" " *schlegelii* (Wahlberg)*
" " *pollux* (Hartlaub)

XXVIII. *Cercomela fusca* (Blyth)
" *dubia* (Blundell and Lovat)*
" *melanura melanura* (Temminck)

Cercomela melanura neumanni nom. nov.[6]
" " *lypura* (Hemprich and Ehrenberg)
" " *aussae* Thesiger and Meynell*
" " *aïrensis* Hartert
" " *ultima* Bates*
" *scotocerca scotocerca* (Heuglin)*
" " *spectatrix* S. Clarke
" " *furensis* Lynes*
" " *turkana* van Someren
" " *enigma* Neumann and Zedlitz
" *familiaris sennaarensis* (Seebohm)*
" " *omoensis* (Neumann)
" " *falkensteini* (Cabanis)
" " *angolensis* Lynes
" " *gambagae* (Hartert)
" " *hellmayri* (Reichenow)
" " *galtoni* (Strickland)
" " *familiaris* (Stephens)
" " *lübberti* (Reichenow)
" *sordida sordida* (Rüppell)*
" " *erlangeri* Reichenow*
" " *schoana* Neumann
" " *ernesti* Sharpe
" " *hypospodia* Shelley
" " *olimotiensis* Elliott*

XXIX. *Saxicola rubetra* (Linnaeus)
" *macrorhyncha* (Stolicza)
" *insignis* (Gray)
" *dacotiae dacotiae* Meade-Waldo
" " *murielae* Bannerman
" *torquata theresae* Meinertzhagen
" " *hibernans* (Hartert)
" " *rubicola* (Linnaeus)
" " *maura* (Pallas)
" " *desfontainesi* Blanchet*
" " *archimedes* Clancey*
" " *variegata* (Gmelin)
" " *indica* (Blyth)[7]

[6] The name *erlangeri* Neumann and Zedlitz, is preoccupied in the genus *Cercomela.*

[7] I include *indica,* as I believe the breeding form of the Himalayas differs from the Palaearctic race, *maura.* This whole species seems in need of critical examination and revision, but I have not seen enough material.

Saxicola torquata przewalskii (Pleske)
" " *yunnanensis* (LaTouche)
" " *stejnegeri* (Parrot)
" " *armenica* Stegmann*
" " *leucura* (Blyth)
" " *gabrielae* Neumann and Paludan
" " *felix* Bates
" " *albofasciata* Rüppell
" " *jebelmarrae* Lynes
" " *axillaris* (Shelley)
" " *promiscua* Hartert
" " *moptana* Bates*
" " *nebularum* Bates
" " *adamauae* Grote
" " *pallidigula* (Reichenow)
" " *salax* (Verreaux)
" " *robusta* (Tristram)
" " *torquata* (Linnaeus)
" " *sibilla* (Linnaeus)
" " *ankaratrae* Salomonsen
" " *voeltzkowi* Grote
" *tectes* (Gmelin)[8]
" *delacouri* David-Beaulieu*
" *caprata bicolor* Sykes[9]
" " *nilgiriensis* Whistler
" " *atrata* (Blyth)
" " *burmanica* Baker
" " *caprata* (Linnaeus)
" " *albonotata* Stresemann
" " *francki* Rensch
" " *cognata* Mayr
" " *pyrrhonota* (Vieillot)
" " *fruticola* Horsfield
" " *aethiops* (Sclater)
" " *wahgiensis* Mayr and Gilliard
" " *belensis* Rand
" *jerdoni* (Blyth)
" *ferrea* Gray
" *gutturalis gutturalis* (Vieillot)
" " *luctuosa* Bonaparte*

[8] Stresemann (*Ibis,* 1952, 94:520), shows that Gmelin's name must be used rather than *borbonensis* Sclater.

[9] I include *rossorum* (Hartert) in *bicolor, vide* Dementiev (*Systema Avium Rossicarum,* Paris, 1935, p. 254).

XXX. *Pentholaea albifrons albifrons* (Rüppell)
" " *pachyrhyncha* Neumann
" " *frontalis* (Swainson)
" " *limbata* Reichenow
" *clericalis* Hartlaub
" *melaena* (Rüppell)

XXXI. *Thamnolaea cinnamomeiventris cinnamomeiventris* (Lafresnaye)
" " *albiscapulata* (Rüppell)
" " *subrufipennis* Reichenow
" " *bambarae* Bayes
" " *cavernicola* Bates*
" *coronata coronata* Reichenow
" " *kordofanensis* Wettstein
" *semirufa* (Rüppell)

XXXII. *Chaëtops frenatus frenatus* (Temminck)
" " *aurantius* Layard

XXXIII. *Myrmecocichla tholloni tholloni* (Oustalet)
" " *chaboti* (Menegaux and Berlioz)
" *bifasciata* (Temminck)
" *aethiops aethiops* Cabanis
" " *buchanani* Rothschild
" " *sudanensis* Lynes
" " *cryptoleuca* Sharpe
" *formicivora formicivora* (Vieillot)
" " *minor* Roberts
" *nigra nigra* (Vieillot)
" " *stoehri* Sclater
" *arnotti leucolaema* Finsch and Reichenow
" " *collaris* Reichenow
" " *arnotti* (Tristram)
" " *harterti* Neunzig

XXXIV. *Oenanthe tractrac tractrac* (Wilkes)
" " *albicans* (Wahlberg)
" *isabellina isabellina* (Temminck)
" " *bottae* (Bonaparte)
" " *frenata* (Heuglin)

Oenanthe isabellina heuglini (Finsch and Hartlaub)
" " *campicolina* (Reichenow)
" *xanthoprymna xanthoprymna* (Hemprich and Ehrenberg)
" " *chrysopygia* (de Filippi)
" " *kingi* (Hume)
" *oenanthe leucorhoa* (Gmelin)
" " *nivea* (Weigold)
" " *oenanthe* (Linnaeus)
" " *virago* Meinertzhagen
" " *seebohmi* (Dixon)
" " *phillipsi* (Shelley)
" *deserti oreophila* (Oberholser)
" " *atrogularis* (Blyth)
" " *deserti* (Temminck)
" " *homochroa* (Tristram)
" *hispanica hispanica* (Linnaeus)
" " *melanoleuca* (Güldenstädt)
" *finschii finschii* (Heuglin)
" " *barnesi* (Oates)
" *picata* (Blyth)
" *lugens boscaweni* Bates
" " *lugentoides* (Seebohm)
" " *persica* (Seebohm)
" " *lugens* (Lichtenstein)
" " *halophila* (Tristram)
" " *vaurei* Meinertzhagen*
" *lugubris lugubris* (Rüppell)
" " *schalowi* (Fischer and Reichenow)
" *monacha* (Temminck)
" *alboniger* (Hume)
" *pleschanka pleschanka* (Lepechin)
" " *cypriaca* (Homeyer)
" *leucopyga leucopyga* (Brehm)
" " *ernesti* Meinertzhagen
" *leucura leucura* (Gmelin)
" " *riggenbachi* (Hartert)
" " *syenitica* (Heuglin)
" *monticola monticola* Vieillot
" " *atmorii* (Tristram)
" " *albipileata* (Bocage)
" *moesta moesta* (Lichtenstein)
" " *theresae* Meinertzhagen

	Oenanthe	*moesta*	*brooksbanki*	Meinertzhagen
	”	*pileata*	*pileata*	(Gmelin)
	”	”	*livingstonii*	(Tristram)
XXXV.	*Saxicoloides*	*fulicata*	*cambaiensis*	(Latham)
	”	”	*stuartbakeri*	Koelz
	”	”	*intermedia*	Whistler and Kinnear
	”	”	*fulicata*	Linnaeus[10]
	”	”	*leucoptera*	(Lesson)[11]
XXXVI.	*Prunella*	*collaris*	*collaris*	(Scopoli)
	”	”	*subalpina*	(Brehm)
	”	”	*montana*	(Hablizl)
	”	”	*rufilata*	(Severtzov)
	”	”	*whymperi*	(Baker)
	”	”	*nipalensis*	(Blyth)
	”	”	*tibetana*	(Bianchi)
	”	”	*ripponi*	Hartert
	”	”	*kwenlunensis*	(Buturlin)*
	”	”	*erythropygia*	(Swinhoe)
	”	*himalayana*		(Blyth)
	”	*rubeculoides*	*rubeculoides*	(Moore)
	”	”	*muraria*	(Meinertzhagen)
	”	*strophiata*	*sirotensis*	Koelz*
	”	”	*jerdoni*	(Brooks)
	”	”	*strophiata*	(Blyth)
	”	”	*multistriata*	(David)* ?
	”	*montanella*		(Pallas)
	”	*fulvescens*	*fulvescens*	(Severtsov)
	”	”	*dresseri*	Hartert
	”	”	*dahurica*	(Taczanowski)*
	”	”	*ocularis*	(Radde)
	”	”	*fagani*	(Ogilvie-Grant)*
	”	*atrogularis*	*atrogularis*	(Brandt)
	”	”	*huttoni*	(Moore)
	”	*koslowi*		(Przewalski)

10 Stresemann (*Ibis*, 1952, 94:521), points out that *fulicata* must be restricted to Pondichery on the peninsula of India. *Ptymatura*, restricted by Whistler (*Jour. Bomb. Nat. Hist. Soc.*, 1935, 38:286) to Pondichery thus becomes again a synonym of *fulicata*.

11 *Rufirenter* Swainson 1831, based on “Le traquet à queue striée” of Levaillant (Oiseaux d'Afrique, pl. 188) is hereby restricted to Pondichery also. This leaves Lesson's name (1840) for the Ceylon bird.

Prunella modularis modularis (Linnaeus)
" " *occidentalis* (Hartert)
" " *hebrideum* Meinertzhagen
" " *hibernica* Meinertzhagen
" " *lusitanica* Stresemann
" " *enigmatica* Dunajewski*
" " *orientalis* (Sharpe)
" " *obscura* (Hablizl)
" *rubida* (Temminck and Schlegel)
" *immaculata* (Hodgson)

TRUE THRUSHES

XXXVII. *Monticola rupestris* (Vieillot)
" *explorator explorator* (Vieillot)
" " *tenebriformis* Clancey*
" *brevipes brevipes* (Waterhouse)
" " *pretoriae* Gunning and Roberts*
" *rufocinereus rufocinereus* (Rüppell)
" " *sclateri* Hartert
" " *tenuis* (Friedmann)
" " *angolensis* Sousa
" *saxatilis* (Linnaeus)
" *gularis cinclorhynchus* (Vigors)
" " *gularis* (Swinhoe)
" *rufiventris* (Jardine and Selby)
" *solitarius solitarius* (Linnaeus)
" " *longirostris* (Blyth)
" " *scorteccii* Moltoni*
" " *behnkei* Niethammer*
" " *magnus* (LaTouche)
" " *philippensis* (P. L. S. Müller)
" " *pandoo* (Sykes)
" " *madoci* Chasen

XXXVIII. *Myiophoneus blighi* (Holdsworth)
" *melanurus* (Salvadori)
" *glaucinus castaneus* Ramsay
" " *glaucinus* (Temminck)
" " *borneensis* Sclater
" *robinsoni* Ogilvie-Grant
" *horsfieldii horsfieldii* Vigors

Myiophoneus horsfieldii insularis Gould
" *caeruleus turcestanicus* Zarudny
" " *teminckii* Vigors
" " *eugenei* Hume
" " *caeruleus* (Scopoli)
" " *crassirostris* Robinson
" " *dicrorhynchus* Salvadori
" " *flavirostris* (Horsfield)

XXXIX. *Geomalia heinrichi heinrichi* Stresemann
" " *matinangensis* Stresemann

XL. *Zoothera schistacea* (Meyer)
" *dumasi dumasi* (Rothschild)
" " *joiceyi* (Rothschild and Hartert)
" *interpres interpres* (Temminck)
" " *leucolaema* (Salvadori)
" " *minima* (Hachisuka)
" *erythronota erythronota* (Sclater)
" " *dohertyi* (Hartert)
" " *mendeni* (Neumann)
" *wardi* (Blyth)
" *cinerea* (Bourns and Worcester)
" *peronii peronii* (Vieillot)
" " *audacis* (Hartert)
" *everetti* (Sharpe)
" *sibirica sibirica* (Pallas)
" " *davisoni* (Hume)
" *citrina citrina* (Latham)
" " *cyanota* (Jardine and Selby)[12]
" " *melli* (Stresemann)
" " *aurimacula* (Hartert)
" " *innotata* (Blyth)
" " *andamanensis* (Walden)
" " *gibson-hilli* (Deignan)
" " *albogularis* (Blyth)
" " *rubecula* (Gould)
" " *orientis* (Bartels)*
" " *aurata* (Sharpe)
" *piaggiae piaggiae* (Bouvier)

[12] Comparison of material in New York inclines me not to recognize the race, *amadoni* (Biswas), 1951.

Zoothera piaggiae hadii (Macdonald)*
" " *kilimensis* (Neumann)
" " *rowei* (Grant and Mackworth-Praed)*
" " *williamsi* (Macdonald)*
" *oberländeri* (Sassi)
" *gurneyi gurneyi* (Hartlaub)
" " *otomitra* (Reichenow)
" " *usambarae* (Neumann)
" " *raineyi* (Mearns)*
" " *chuka* (van Somern)*
" *princei princei* (Sharpe)
" " *cameronensis* (Sharpe)
" " *graueri* (Sassi)*
" " *batesi* (Sharpe)
" *crossleyi crossleyi* (Sharpe)*
" " *pilettei* (Schouteden)*
" *naevia naevia* (Gmelin)
" " *meruloides* (Swainson)
" *pinicola* (Sclater)
" *spiloptera* (Blyth)
" *talaseae* (Rothschild and Hartert)
" *margaretae* (Mayr)
" *andromedae* (Temminck)
" *mollissima whiteheadi* (Baker)
" " *simlaensis* (Baker)
" " *griseiceps* (Delacour)
" " *mollissima* (Blyth)
" *dixoni* (Seebohm)
" *dauma imbricata* Layard
" " *neilgherriensis* (Blyth)
" " *dauma* (Latham)
" " *miharagokko* (Momiyama)*
" " *toratugami* (Momiyama)*
" " *aurea* (Holandre)
" " *major* (Ogawa)
" " *horsfieldi* (Bonaparte)
" " *choiseuli* (Hartert)
" " *eichhorni* (Rothschild and Hartert)
" " *papuensis* (Seebohm)
" " *machiki* (Forbes)
" " *heinei* (Cabanis)
" " *lunulata* (Latham)

Zoothera dauma halmaturina (Campbell)
" " *macrorhyncha* (Gould)
" *monticola monticola* Vigors
" " *atrata* Delacour and Greenway*
" *marginata marginata* Blyth
" " *parva* Delacour
" *terrestris* (Kittlitz)*

XLI. *Amalocichla sclateriana sclateriana* De Vis
" " *occidentalis* Rand
" *incerta incerta* (Salvadori)
" " *olivascentior* Hartert
" " *brevicauda* (De Vis)

XLII. *Cataponera turdoides turdoides* Hartert
" " *tenebrosa* Stresemann
" " *abditiva* Riley
" " *heinrichi* Stresemann

XLIII. *Nesocichla eremita eremita* Gould
" " *gordoni* Stenhouse*

XLIV. *Cichlherminia l'herminieri l'herminieri* (Lafresnaye)*
" " *lawrencii* Cory
" " *dominicensis* (Lawrence)
" " *sanctae-luciae* (Sclater)

XLV. *Catharus gracilirostris gracilirostris* Salvin
" " *accentor* Bangs
" *griseiceps russatus* Griscom
" " *griseiceps* Salvin
" " *phaeopleurus* Sclater and Salvin
" *aurantiirostris clarus* Jouy
" " *melpomene* (Cabanis)
" " *bangsi* Dickey and van Rossem
" " *costaricensis* Hellmayr
" " *aurantiirostris* (Hartlaub)
" " *birchalli* Seebohm
" " *insignis* Zimmer
" *fuscater hellmayri* Berlepsch
" " *sanctae-martae* Ridgway
" " *fuscater* (Lafresnaye)
" " *caniceps* Chapman

Catharus fuscater mentalis Sclater and Salvin
" *occidentalis olivascens* Nelson
" " *fulvescens* Nelson
" " *occidentalis* Sclater
" " *alticola* Salvin and Godman
" " *frantzii* Cabanis
" *dryas dryas* (Gould)
" " *maculatus* (Sclater)
" " *mexicanus* (Bonaparte)
" " *cantator* Griscom
" " *fumosus* Ridgway
" *fuscescens fuscescens* (Stephens)
" " *salicicolus* (Ridgway)
" " *fuliginosus* (Howe)*
" *minimus minimus* (Lafresnaye)
" " *bicknelli* (Ridgway)
" *ustulatus ustulatus* (Nuttall)
" " *swainsoni* (Tschudi)
" " *almae* (Oberholser)
" " *oedicus* (Oberholser)*
" *guttatus guttatus* (Pallas)
" " *nanus* (Audubon)
" " *slevini* (Grinnell)
" " *sequoiensis* (Belding)
" " *polionotus* (Grinnell)
" " *auduboni* (Baird)
" " *faxoni* (Bangs and Penard)
" " *crymophilus* (Burleigh and Peters)
" *mustelinus* (Gmelin)

XLVI. *Turdus bewsheri bewsheri* Newton
" " *comorensis* Milne-Edwards and Oustalet
" *olivaceofuscus olivaceofuscus* Hartlaub
" " *xanthorhynchus* Salvadori
" *nigrilorum nigrilorum* Reichenow
" " *poensis* Alexander
" *olivaceus chiguancoides* Seebohm
" " *saturatus* (Cabanis)
" " *adamauae* Grote*
" " *bocagei* (Cabanis)
" " *centralis* Reichenow
" " *pelios* Bonaparte

Turdus olivaceus stormsi Hartlaub
" " *williami* White
" " *graueri* Neumann
" " *swynnertoni* Bannerman
" " *smithi* Bonaparte*
" " *transvaalensis* (Roberts)*
" " *olivaceus* Linnaeus
" *abyssinicus abyssinicus* Gmelin[13]
" " *baraka* (Sharpe)
" " *oldearni* Sclater and Moreau*
" " *bambusicola* Neumann
" " *polius* Mearns*
" " *elgonensis* (Sharpe)
" " *deckeni* Cabanis
" " *uluguru* Hartert
" " *roehli* Reichenow
" " *helleri* (Mearns)*
" " *nyikae* Reichenow*
" " *milanjensis* Shelley
" *libonyanus verreauxi* Bocage
" " *tephrinus* Oberholser[14]
" " *tropicalis* Peters
" " *niassae* Rensch*
" " *costae* Rensch*
" *tephronotus tephronotus* Cabanis
" " *australoabyssinicus* Benson*
" *menachensis* Ogilvie-Grant
" *ludoviciae* (Phillips)
" *litsipsirups simensis* (Rüppell)
" " *litsipsirupa* (Smith)
" " *kösteri* Neumann*
" " *stierlingi* (Reichenow)
" *fischeri natalicus* Grote
" " *fischeri* Hellmayr*
" " *belcheri* Benson*
" *dissimilis* Blyth
" *hortulorum* Sclater
" *unicolor* Tickell
" *cardis* Temminck

13 I am much indebted to Dr. Chapin for suggestions on the arrangement of this and the following species.

14 Replaces *cinerascens* Reichenow, a name which is preoccupied in the genus *Turdus*.

Turdus albocinctus Royle
" *torquatus torquatus* Linnaeus
" " *alpestris* (Brehm)
" " *amicorum* Hartert
" *boulboul* (Latham)
" *merula ticehursti* Clancey
" " *merula* Linnaeus
" " *cabrerae* Hartert
" " *azorensis* Hartert
" " *agnetae* Volse*
" " *mauritanicus* Hartert
" " *algirus* (Madarasz)
" " *aterrimus* (Madarasz)
" " *insularum* Niethammer*
" " *syriacus* Hemprich and Ehrenberg
" " *maximus* (Seebohm)
" " *intermedius* (Richmond)
" " *mandarinus* Bonaparte
" " *sowerbyi* Deignan
" " *nigropileus* (Lafresnaye)
" " *spencei* Whistler and Kinnear
" " *simillimus* Jerdon
" " *bourdilloni* (Seebohm)
" " *kinnisii* (Blyth)
" *poliocephalus erythropleurus* Sharpe
" " *indrapurae* Robinson and Kloss
" " *löseri* de Schauensee
" " *javanicus* Horsfield
" " *biesenbachi* Stresemann*
" " *fumidus* S. Müller
" " *whiteheadi* (Seebohm)
" " *seebohmi* (Sharpe)
" " *albiceps* Swinhoe
" " *thomassoni* (Seebohm)
" " *mayonensis* (Mearns)*
" " *mindorensis* Ogilvie-Grant
" " *nigrorum* Ogilvie-Grant
" " *kelleri* (Mearns)
" " *malindangensis* (Mearns)*
" " *celebensis* (Büttikofer)
" " *hygroscopus* Stresemann
" " *sterlingi* Mayr
" " *schlegeli* Sclater

Turdus poliocephalus deningeri Stresemann
" " *versteegi* Junge
" " *keysseri* Mayr
" " *erebus* Mayr and Gilliard
" " *papuensis* (De Vis)
" " *canescens* (De Vis)*
" " *heinrothi* Rothschild and Hartert
" " *renellianus* Mayr
" " *bougainvillei* Mayr
" " *kulambangrae* Mayr
" " *vinitinctus* (Gould)
" " *poliocephalus* Latham
" " *xanthopus* Forster
" " *pritzbueri* Layard
" " *albifrons* (Ramsay)
" " *efatensis* Mayr
" " *becki* Mayr
" " *malekulae* Mayr
" " *whitneyi* Mayr
" " *placens* Mayr
" " *vanikorensis* Quoy and Gaimard
" " *ruficeps* (Ramsay)
" " *layardi* (Seebohm)
" " *tempesti* Layard
" " *hades* Mayr
" " *vitiensis* Layard
" " *samoensis* Tristram
" *chrysolaus orii* Yamashina
" " *chrysolaus* Temminck
" *celaenops celaenops* Stejneger
" " *yakushimensis* (Ogawa)*
" *niveiceps* (Hellmayr)*
" *rubrocanus rubrocanus* Hodgson
" " *gouldi* (Verreaux)
" *kessleri* Przewalski
" *feai* (Salvadori)*
" *pallidus* Gmelin
" *obscurus* Gmelin
" *ruficollis atrogularis* Jarocki
" " *ruficollis* Pallas
" *naumanni naumanni* Temminck
" " *eunomus* Temminck
" *pilaris* Linnaeus

Turdus musicus coburni Sharpe
" " *musicus* Linnaeus[15]
" *ericetorum hebridensis* Clarke
" " *catherinae* Clancey*
" " *ericetorum* Turton
" " *philomelos* Brehm
" " *nataliae* Buturlin*
" *viscivorus viscivorus* Linnaeus
" " *reiseri* Schiebel
" " *deichleri* Erlanger
" " *theresae* Meinertzhagen*
" " *bithynicus* Keve-Kleiner*
" " *transcaspius* Zarudny*
" " *bonapartei* Cabanis
" *mupipennis mupipennis* Laubmann
" " *conquisitus* Bangs*
" *swalesi* (Wetmore)
" *aurantius* Gmelin
" *ravidus* (Cory)
" *plumbeus rubripes* Temminck
" " *coryi* (Sharpe)
" " *schistaceus* (Baird)
" " *plumbeus* Linnaeus
" " *ardosiaceus* Vieillot
" " *verrillorum* (Allen)
" *flavipes flavipes* Vieillot
" " *venezuelensis* (Sharpe)
" " *polionotus* (Sharpe)
" " *melanopleurus* (Sharpe)
" " *xanthoscelus* Jardine
" " *leucops* Taczanowski
" *chiguanco chiguanco* Lafresnaye and d'Orbigny
" " *anthracinus* Burmeister
" *nigrescens* Cabanis
" *fuscater cacozelus* (Bangs)
" " *gigas* Fraser
" " *quindio* Chapman

[15] Mayr (*Ibis*, 1952, 94:532-534) suggests using *musicus* for the song thrush and *iliacus* for the redwing, on the basis of a reëxamination of Linnaeus' Editions of the "Systema" and "Fauna Svecica," a suggestion with which I am heartily in accord. Perhaps this question can be finally voted on and an opinion rendered by the International Commission on Zoological Nomenclature.

Turdus fuscater gigantodes Cabanis
" " *ockendeni* Hellmayr
" " *fuscater* Lafresnaye and d'Orbigny
" *serranus infuscatus* (Lafresnaye)
" " *cumanensis* (Hellmayr)
" " *atro-sericeus* (Lafresnaye)
" " *serranus* Tschudi
" *nigriceps nigriceps* Cabanis
" " *subalaris* (Seebohm)
" *reevei* Lawrence
" *olivater olivater* (Lafresnaye)
" " *caucae* (Chapman)
" " *sanctae-martae* (Todd)
" " *ptaritepui* Phelps*
" " *paraquensis* Phelps*
" " *duidae* Chapman
" " *roraimae* Salvin and Godman
" *maranonicus* Taczanowski
" *fulviventris* Sclater
" *falcklandii falcklandii* Quoy and Gaimard
" " *magellanicus* King
" *rufiventris juensis* (Cory)
" " *rufiventris* Vieillot
" *leucomelas albiventer* Spix
" " *leucomelas* Vieillot
" " *cautor* Wetmore
" *amaurochalinus* Cabanis
" *ignobilis differens* (Nelson)
" " *plebejus* Cabanis
" " *ignobilis* Sclater
" " *goodfellowi* Hartert and Hellmayr
" " *debilis* Hellmayr
" " *murinus* Salvin
" " *arthuri* (Chubb)
" *lawrencii* Coues
" *fumigatus bondi* Deignan
" " *personus* (Barbour)
" " *aquilonalis* (Cherrie)
" " *fumigatus* Lichtenstein
" " *hauxwelli* Lawrence
" " *colombianus* Hartert and Hellmayr
" " *parambanus* Hartert
" " *obsoletus* Lawrence

Turdus haplochrous Todd
" *nudigenis umbrinus* Griscom
" " *grayi* Bonaparte
" " *tamaulipensis* (Nelson)
" " *casius* (Bonaparte)
" " *incomptus* (Bangs)
" " *nudigenis* Lafresnaye
" " *extimus* Todd
" " *maculirostris* Berlepsch and Taczanowski
" *jamaicensis* Gmelin
" *albicollis assimilis* Cabanis
" " *renominatus* Miller and Griscom
" " *rubicundus* (Dearborn)
" " *leucauchen* Sclater
" " *parcolor* Austin*
" " *atrotinctus* Miller and Griscom
" " *oblitus* Miller and Griscom
" " *cnephosus* (Bangs)
" " *coibensis* Eisenmann*
" " *daguae* Berlepsch
" " *paraguayensis* (Chubb)
" " *albicollis* Vieillot
" " *crotopezus* Lichtenstein
" " *contemptus* Hellmayr
" " *spodiolaemus* Berlepsch and Stolzmann
" " *berlepschi* Todd
" " *phaeopygus* Cabanis
" " *phaeopygoides* Seebohm
" " *minusculus* (Bangs)
" *rufo-palliatus rufo-palliatus* (Lafresnaye)
" " *graysoni* (Ridgway)
" *rufitorques* Hartlaub
" *migratorius migratorius* Linnaeus
" " *nigrideus* Aldrich and Nutt
" " *achrusterus* (Batchelder)
" " *caurinus* (Grinnell)
" " *propinquus* (Ridgway)
" " *phillipsi* Bangs
" " *confinis* Baird

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Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 14 December 15, 1952 New Haven, Conn.

A NEW RACE OF BLACK-THROATED BABBLER FROM ASSAM

S. Dillon Ripley

The Mishmi Hills in northeastern Assam, India, were so violently devastated by the great earthquake of August 1950 that whole hillsides for miles along the narrow steep valleys have been denuded of soil and vegetation. Centuries will be needed in some areas to restore even an approximate habitat for the fauna. That this fauna is in many respects unique was abundantly shown by the Smithsonian-Yale Expedition of 1946-1947, the results of which were discussed in "The Birds of the Mishmi Hills" by Mr. Salim Ali and myself (*Jour. Bombay Nat. Hist. Soc.*, 48(1):1-37, 1948). It is a sad fact that the fate of many of these little known bird and animal species will probably remain unknown for an indefinite period of time to come.

Meanwhile, reëxamination of specimens of the Black-throated Babbler from the Mishmi Hills, at the suggestion of Mr. H. G. Deignan, prompts the recognition of another population of this species as follows:

Stachyris nigriceps coei, subsp. nov.

Type: ♂ ad. (Y.P.M., No. 9585), collected January 4, 1947, by S. Dillon Ripley at Dreyi, Mishmi Hills, northeastern Assam, India.

Diagnosis: from typical *nigriceps* of Nepal and the Himalayas ranging east into northern Assam this form differs by generally darker tone of plumage, and by having a blackish unstreaked throat and very slightly darker ear coverts.

From *spadix* of Cachar and the Khasia Hills this population differs by being notably darker with a more blackish throat and dark, really seal-brown, ear coverts. Compared with *coltarti*, the subspecies found in Margherita, the Naga Hills, and north Burma, *coei* differs by having dark brown rather than rufous-brown ear coverts, and by being a purer, less rufescent brown below.

Range: Mishmi Hills, northeastern Assam, India.

Remarks: in describing the subspecies, *spadix* (*Bull. British Ornith. Club*, 68:89-90, 1948), I left the Mishmi Hills population unnamed as an intermediate. Recent collections in the Naga Hills in 1950 of *coltarti* demonstrated anew the fallacy of this course and the necessity for recognizing this population.

It gives me great pleasure, therefore, to name this new subspecies for Yale's notable benefactor and collector of *ornithologica*, William Robertson Coe.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 15 May 12, 1953 New Haven, Conn.

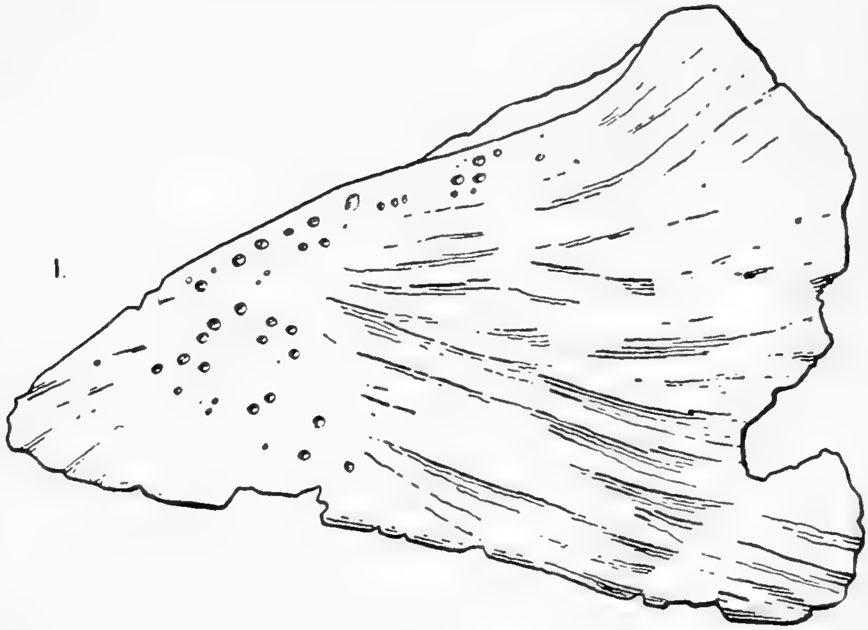
TYPOTHORAX SCUTES FROM GERMANY

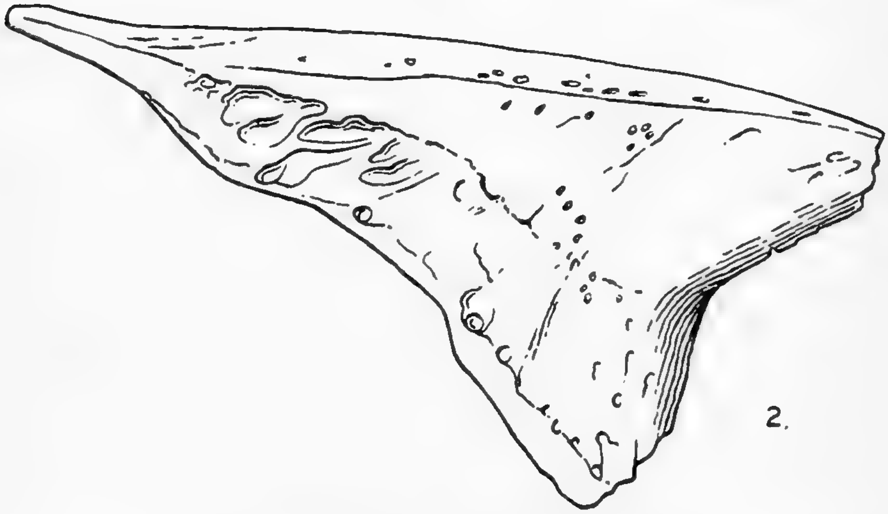
JOSEPH T. GREGORY

Among a small lot of Triassic fossils from Württemberg presented to Professor O. C. Marsh by Dr. Eberhard Fraas is a lateral dorsal armor plate of a pseudosuchian, Yale Peabody Museum no. 3694, which bears a small pyramidal spine. Similar plates were figured by H. von Meyer (1861, p. 341-342, pl. 43, figs. 4-7) and attributed to "*Belodon.*" These plates so closely resemble the corresponding portions of the armor of *Typothorax meadei* Sawin from the Dockum formation of Texas that familial or even generic affinity is suspected. Inasmuch as no horned pseudosuchian has hitherto been recognized from Europe, they deserve particular notice.

Description: The spine was directed outward and backward, but rose little or not at all above the level of the reptile's back, which suggests a thoracic position. The dorsal surface of the plate is slightly convex, triangular in outline as preserved. The medial portion is broken off so that its full width and precise shape cannot be determined. Traces of the smooth, narrow, anterior border which was overlapped by the plate ahead of it are present; the remainder of the dorsal surface is covered by a weak sculpture of ridges and grooves radiating from a pitted area above the junction of the lateral and dorsal portions of the plate, which might be termed the base of the spine (fig. 1).

1.





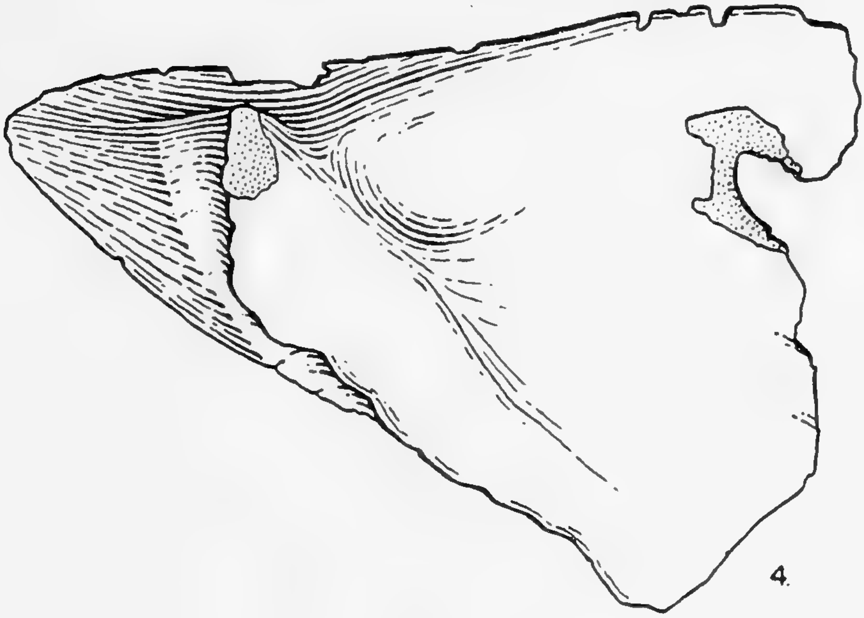
2.

DESCRIPTION OF ILLUSTRATIONS

Left lateral thoracic dermal scute of pseudosuchian allied to *Typothorax*, Y.P.M. no. 3694. From Keuper formation near Stuttgart, Württemberg, Germany. All figures X 1.

Figure 1. Dorsal surface
Figure 2. Anterolateral surface

The anterior and posterior edges of the spine are acutely angulate (fig. 3). An angular ridge also runs inward on the lower side of the spine for less than a centimeter from the apex and then disappears into the rounded surface which joins the anterior and posterior faces of the spine and merges with the lateral face of the plate.



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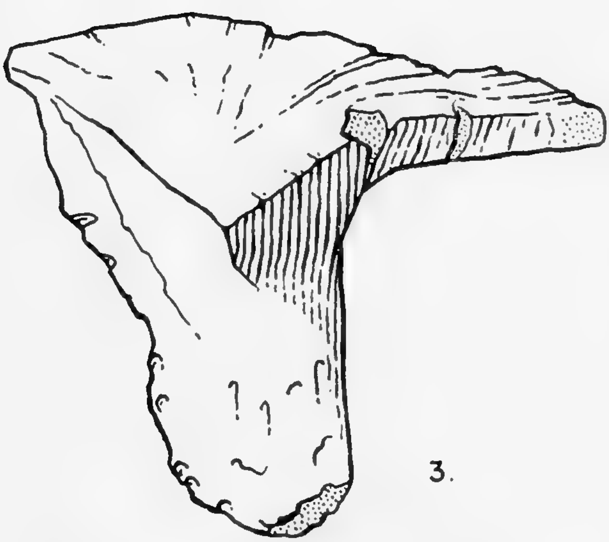

3.

Figure 3. Posterolateral view
Figure 4. Internal surface

The lateral portion of the plate is very short antero-posteriorly but projects down conspicuously from the nearly flat dorsal portion, almost at right angles to the latter, below the base of the spine. Its medial surface (fig. 4) consists of an anterior inwardly directed narrow band which abruptly turns upward to merge with the posterior face of the spine. A shallow depression lies medial to the base of the spine at the posterior internal junction of the lateral and dorsal parts of the plate. The dorsal section is flat internally.

Along the anterior face of the bone (fig. 2) a slight ridge branches from the angle between anterior and dorsal surfaces and roughly divides the face into equal parts, a lower with radiate sculpture and an upper "spine" area with weaker ornament of pits. The posterior face of the spine has a weak concavity leading to the internal surface at the angle between lateral and dorsal sections of the plate.

Measurements:

Length, normal to posterior margin	60 mm.
Length, anterolateral corner to tip spine	82 mm.
Height, dorsal surface to tip lateral process ..	46 mm.

Comparisons: The plates from Germany appear to differ from those of *Typothorax meadei* Sawin in the somewhat shorter spine which does not curve backward so markedly at its tip as do those of the lateral dorsal plates of that species. Also it lacks any indication of the faint dorsal ridge from the tip of the spine, which occurs on the Texas specimen. It differs from the lateral plates of *Desmatosuchus* in its smaller size, the broader base to the spine which is indistinguishable from above from the whole dorsal surface of the plate, and in the fine radial sculpture rather than coarse irregular pitting on the dorsal surface. These features are essentially those which distinguish *Typothorax* from *Desmatosuchus.*

It would appear to differ from *Stegomus* as *Typothorax* does, in the much greater development of the laterodorsal spine and in the reduced size of the lateral portion of the plate. From *Stagonolepis* it apparently differs in the development of a strong spine and in the more acute angle between dorsal and lateral faces. This is somewhat uncertain, for although the limited assemblage of plates figured by Huxley did not include any like the lateral dorsals of *Typothorax*, it is not impossible that such existed. The mid-dorsal plates of the two genera are quite similar. *Typothorax* differs from *Stagonolepis* in its ventral armor, which consisted of separate small quadrangular plates (Sawin, 1947, p. 232) instead of the articulating scutes of the latter genus (Huxley, 1877, p. 10-11).

Dermal "skin plate" armor was first associated with phytosaurs by H. von Meyer in 1861. At that time he figured a large number of the trapezoidal, longitudinally ridged plates which have since come to be known as mystriosuchid, and also a few elongate-rectangular plates bearing knob-like eminences and showing a coarser sculpture. On the same plate with these long plates (von Meyer, 1861, pl. 43) he illustrated a lateral dorsal plate extremely similar to the one described above. All of these specimens were referred to "*Belodon*" (ibid, p. 337-342), but it is clear that there was no association with the phytosaur skeletons; they merely were found in the Stubensandstein which also produced the phytosaurs. E. Fraas (1896, p. 16) definitely described the elongate median dorsal plates and attributed them to *Phytosaurus kapffi.* Von Huene (1911, p. 103) affirmed the association of this type of plate with *Phytosaurus kapffi*, and contrasted them with the mystriosuchid plates.

In North America this quadrangular type of plate has been found principally associated with pseudosuchians; *Desmatosuchus* and *Typothorax* have such plates as the median elements of their dorsal armor; they are found with a pseudosuchian type pelvis and vertebrae in University of Michigan Museum of Paleontology no. 13950, described as a "phytosaur" by Case (1932) at a time when that term was also applied to *Desmatosuchus*-like forms. Occasionally such plates have been found near phytosaur skulls (Camp, 1930, p. 89, and a plate, Y.P.M. no. 3695, found near a *Machaeroprosopus gregorii* skull at San Jon, New Mexico), but never demonstrably in association with them. Camp has expressed his skepticism over the association of this type of plate with *Phytosaurus kapffi*, and the presence of these unmistakably pseudosuchian lateral armor plates in the Württemberg Triassic strongly suggests that the specimens figured by von Meyer actually belonged to *Typothorax* or a closely related genus which has otherwise escaped detection in the German deposits.

Without more material it is impossible to decide whether the plates from the German Keuper represent *Stagonolepis*, *Typothorax*, or another as yet unknown genus of pseudosuchian. Consequently to propose a name for this almost unknown form at this time would be most improper. However, the existence of such a creature seems well established; its presence serves to strengthen the faunal similarity between the late Triassic faunas of Europe and North America.

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TYPOTHORAX AND DESMATOSUCHUS

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Much uncertainty has been expressed by students of North American Triassic reptiles over the relationships and possible synonymy of the pseudosuchian genera *Typothorax* Cope (1875R), *Episcoposaurus* Cope (1887A), and *Desmatosuchus* Case (1920B). Still another genus belonging to this group, *Acompsosaurus* Mehl (1915), has been described, but its relationships to the better known forms have never been adequately determined. In the course of preparing faunal lists of the Dockum formation it was necessary to face the problem of nomenclature of these reptiles; the inadequacy of some of the early descriptions led me to examine Cope's types (one of which had never been illustrated), and to compare these with the more complete specimens described by Case (1922B) and Sawin (1947).

From this study it is evident that the type of *Episcoposaurus haplocerus* Cope is a specimen of the large, horned genus well known as *Desmatosuchus* Case and quite unlike *E. horridus* Cope, the type of *Episcoposaurus. Desmatosuchus,* the type species of which becomes *D. haplocerus* (Cope), is a valid genus quite distinct from *Typothorax* Cope, which is best known from the Texas species *T. meadei* Sawin. Cope's original type of *Episcoposaurus horridus* is hopelessly mixed with bones of other individuals, some of which were referred by him, and later by von Huene (1915A), to *Typothorax,* and which include characteristic dorsal armor of that genus. Although it is not demonstrable from the type material, the similar proportions and size of the limb bones originally described as *Episcoposaurus horridus* by Cope to those of *Typothorax meadei* Sawin, and the intimate association of these bones with larger armor plates of *Typothorax*, strongly suggests that *E. horridus* Cope actually is a synonym of *T. coccinarum* Cope. The pelvis and associated fragments of *Acompsosaurus wingatensis* Mehl are clearly pseudosuchian but are not diagnostic portions for generic identification within this Family. There is some suggestion that they may belong to *Typothorax*.

Discussions of this problem with Professors C. L. Camp and E. C. Case have stimulated this attempt to solve a persistent taxonomic puzzle. It is a great pleasure to record the assistance rendered by many colleagues in the course of this study. Repeated opportunities to examine Cope's types and other collections from the region of Gallina, New Mexico, at the American Museum of Natural History have been given me by Dr. Edwin H. Colbert, with whom I have profitably discussed many aspects of this problem. Dr. Horace G. Richards of the Academy of Natural Sciences in Philadelphia graciously permitted me to study the type of *Episcoposaurus haplocerus* and to borrow portions of that specimen for illustration. Through the kindness of Dr. E. C. Case of the University of Michigan, I have been able to study the type of *Desmatosuchus spurensis* closely and to benefit from his long experience collecting in the Triassic of western Texas. Professor A. S. Romer has permitted me to examine an undescribed skeleton of *Typothorax* in the Museum of Comparative Zoology at Harvard. The illustrations were prepared with great care by Miss Shirley Glaser.

Bibliographic citations correspond to those used in O. P. Hay's "Catalogue and Bibliography of Fossil Vertebrates of North America." Museum locations of specimens are abbreviated as follows:

A.M.N.H.	American Museum of Natural History, New York City, New York
A.N.S.P.	Academy of Natural Sciences, Philadelphia, Pennsylvania

M.C.Z.	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts
U.M.	University of Michigan, Museum of Paleontology, Ann Arbor, Michigan
Y.P.M.	Peabody Museum of Natural History, Yale University, New Haven, Connecticut

Taxonomic History

During the summer of 1874, E. D. Cope accompanied one of the parties of Lt. G. M. Wheeler's Geographical Survey west of the 100th Meridian in northwestern New Mexico (Cope 1875U).[1] In the region of Gallina, New Mexico, he collected a few scraps of reptilian bones which he described (Cope 1875R) as *Typothorax coccinarum* Cope. Largely on the basis of these he correctly determined the age of the strata as Triassic. Cope's original description of *Typothorax* mentions in order: a fragment of a jaw which he recognized as phytosaurian; dermal scutes; part of vertebral centrum; and the head of a femur. A phytosaur tooth also was associated. A second specimen including part of the top of a skull, pitted dermal bone like the type, and a single keeled scute was doubtfully referred to the species (Cope 1875R, p. 266).

David Baldwin collected new material from the Gallina Creek locality in 1881 which formed the basis for a more detailed discussion of *Typothorax* and the description of *Episcoposaurus horridus* by Cope several years later (1887A). *Typothorax* was diagnosed on the basis of dermal plates, ribs, and femur; the jaw fragment was excluded from the type, which Cope restricted to the dermal scutes with regular round pitting, figures 4, 5, and 9 of plate 22, Cope 1877K. This emendation of the type appears perfectly valid, for the restricted type is more homogeneous than the original, yet is strictly part of it. Skin plates of large size attached to each other by matrix (Cope believed

[1]An illuminating account of this trip is given by G. G. Simpson in, "Hayden, Cope, and the Eocene of New Mexico." Acad. Nat. Sci. Phila., Proc., 103, p. 1-21, 1951.

them fused to ribs) and a complete femur of small size from the 1881 collection were referred to *Typothorax*; but smaller, keeled dermal plates, a large and massive femur, bones of the forelimb, and some vertebrae were made the type of *Episcoposaurus horridus.* These specimens (A.M.N.H., nos. 2710-2713) are intimately mixed, partly still in matrix, the two types of dermal plates occurring together but not in original position. There is no evidence as to which limb bones are associated with each type of armor; if size is regarded as a criterion, the large femur of *Episcoposaurus* should belong with the *Typothorax* armor, and the smaller femur would be associated with the keeled plates. It is more than likely, however, that the two types of skin plates came from different parts of the same animal, and that the larger hind limb bones are associated with them. The small femora which Cope and von Huene regarded as *Typothorax* may well belong to one of the small phytosaurs which occur in the deposit, or else are those of somewhat smaller individuals of *Typothorax.* The size difference is easily accounted for on the basis of growth, the greater curvature of the shaft and twisting of the ends are harder to evaluate, for in these Triassic clays bones are frequently deformed in various ways. I do not regard the differences as proof of original diversity in form. Limb bones of M.C.Z., no. 1488, from the Ghost Ranch above Abiquiu in northwestern New Mexico are intermediate in size and similar to the "*Typothorax*" material in form. Alternatively, the large femur may be incorrectly associated, though this seems unlikely in view of Sawin's discoveries.

Von Huene redescribed and figured the material in the American Museum in 1915 (Baldwin's collection of 1881). He pointed out the difficulty of determining the association of bones and also of determining which specimens were in fact the types. By error he regarded the specimens which formed the basis of Cope's 1887 redescription of *Typothorax* as the type of that species, and included with it fragments of tibia, metatarsals, and scapula which Cope (1887A, p. 210) had regarded as of uncertain reference. Although realizing the uncertainty of association of the various dermal plates and other bones, von Huene attributed to *Typothorax* a number of small scutes bearing conical central eminences (1915A, figs. 7-10) in addition to the flat, shallowly pitted plates. Some of these he regarded as caudal, others as lateral to the costals. (Comparison with the articulated armor of M.C.Z., no. 1488 and *Typothorax meadei* Sawin shows that they are from proximal and medial parts of the tail.) These plates are sculptured with ridges and grooves radiating outward from the central boss exactly like those which von Huene and Cope attributed to *Episcoposaurus* (cf. von Huene 1915A, fig. 24).

Von Huene rejected the association of fore and hind limbs of *Episcoposaurus* on the grounds that the bones were too disproportionate in size; he restricted the type of *E. horridus* to the large femur and referred the small forelimb bones to a mystriosuchid phytosaur, possibly "*Belodon*" *scolopax* Cope.

However, the femur of *T. meadei* is much longer and stouter than that referred to *T. coccinarum.* If Sawin's figures 7 A and B are compared with von Huene's figures 1 (*Typothorax coccinarum*) and 12 (*Episcoposaurus horridus*) it will be seen that the femur of the Texas pseudosuchian is far less curved than that attributed to *Typothorax* and much more like that of *Episcoposaurus.* Moreover the dimensions of the bones agree better with the latter genus.

Measurements in millimeters of limb bones

	Typothorax coccinarum (AMNH 2710)	*Typothorax* sp.? (M.C.Z. 1488)	*Episcoposaurus horridus* (AMNH 2713)	*Typothorax meadei* (Texas 31185-84)
Length femur	22	25.8	31.5 (est.) lacks condyle	33
Length humerus	..	17.5	22	21
Length radius	..	..	..	14
Length ulna	..	13.0	16.1	18

The humerus and ulna of *T. meadei* are quite similar to those belonging to the type collection of *Episcoposaurus horridus* which von Huene (1915A, p. 493, 499, figs. 25-27) rejected as too small to belong with the femur of that animal. Their proportions suggest that Cope may have been correct in his reference of the small forelimb and large femur to the same animal (*Episcoposaurus horridus*).

But the probable association of the *Episcoposaurus* femur (lectotype of *E. horridus*) with unmistakable armor of *Typothorax*, and the further likelihood that the supposed distinctive armor of *Episcoposaurus* is merely that of the tail rather than thorax or abdomen, and finally the intimate association of the type specimen of *Episcoposaurus horridus* with bones referred by Cope as well as subsequent students to *Typothorax coccinarum*, all suggest that only one species is present. If this be so (it is probably incapable of absolute proof), *Episcoposaurus* is a synonym of *Typothorax* having been established upon remains of the same species.

Smaller femora referred by von Huene to *Typothorax coccinarum* probably belong to younger individuals of that species, but in no case have any crucial bearing on the taxonomic problem as they are not primary types.

W. F. Cummins of the Second Geological Survey of Texas began explorations of northwest Texas in 1889. In 1890 he found vertebrate fossils in the Dockum formation and in 1891 collected near Dockum the specimen which Cope described as *Episcoposaurus haplocerus*. Cope himself accompanied Cummins on a collecting trip along the east side of the Staked Plains in 1892, securing additional material including fragments of pseudosuchian armor which he referred to *Typothorax* (Cope 1893A, p. 17). The thick, coarsely sculptured armor plate and large lateral horns of *E. haplocerus* are obviously so similar to *Desmatosuchus spurensis* Case as to leave no doubt of specific identity. The type localities are only a few miles apart and at about the same level in the Dockum formation.

In 1917 Professor E. C. Case of the University of Michigan discovered a pseudosuchian skeleton in Crosby County, Texas, which he described in 1920 as *Desmatosuchus spurensis*. Later

Case (1929B, p. 43) suggested that *Desmatosuchus* might prove to be a synonym of *Episcoposaurus*; Sawin (1947, p. 233) was also of this opinion. This view undoubtedly arose from comparison with Cope's description of *E. haplocerus*, which is indeed the same as *Desmatosuchus*. But this animal, which will have to be known as *Desmatosuchus haplocerus* (Cope), differs widely from *Episcoposaurus horridus*, the type species of the genus *Episcoposaurus*. As has been pointed out above, the latter is probably a synonym of *Typothorax coccinarum*.

A full description of the type of *E. haplocerus* is given below, with comparisons to Case's excellent account of *Desmatosuchus*. *Desmatosuchus* differs from *Typothorax* most obviously in the coarser and unequal pitting of the dermal armor plates and in the greatly enlarged horn over the shoulder region.

In 1915 Dr. M. G. Mehl of the University of Wisconsin described the pelvis, sacrum, and other fragments of a pseudosuchian from a "red shale series near the base of the Mesozoic section" at Fort Wingate, New Mexico, and called the fossil *Acompsosaurus wingatensis*. The specimen is not readily comparable with the better known members of the group; some points in the description suggest *Typothorax*, others *Desmatosuchus*. There is no satisfactory indication that it represents a distinct genus. (I have not been able to examine this specimen.)

The extensive collections from Howard County, Texas, by the Texas Bureau of Economic Geology, W. P. A. Paleontological Survey, under the supervision of Grayson Meade in 1940 included two skeletons of a pseudosuchian described as *Typothorax meadei* by Sawin (1947). The species differs in minor details from *T. coccinarum* Cope and provides by far the most complete picture thus far obtained of the anatomy of these reptiles.

Other specimens of *Typothorax* have been obtained in eastern Arizona and northwestern New Mexico by the University of California, the Museum of Comparative Zoology, and Yale Peabody Museum, but these have contributed little toward the understanding of the family. Thus far *Desmatosuchus* has been found only in the Crosby County area of Texas.

Systematic Revision

Class **REPTILIA**

Order THECODONTIA

Family Stagonolepidae

Genus **Typothorax**[2] Cope 1875R

Typothorax Cope. Acad. Nat. Sci. Phila., Proc. **27**, p. 265, 1875; type species by original designation *Typothorax coccinarum* Cope.

Episcoposaurus Cope. Am. Philos. Soc., Proc. **24**, p. 213-217, 1887; type species by original designation *Episcoposaurus horridus* Cope.

Quadrupedal archosaurian reptiles 2½ to 3 meters long, with short, pointed heads, depressed bodies enclosed in dermal armor of overlapping bony plates, and with forelimbs much smaller than hind limbs.

Skull pointed, flat-topped, overlapped by nuchal armor; the upper temporal opening laterally situated, lateral opening low, not completely known. A large antorbital fenestra. Mandible edentulous anteriorly and possibly covered by horny beak.

Dorsal armor of two rows of overlapping plates, medial pair of plates flat, wider than long except in anterior cervical series, flat or with low conical or pyramidal eminence near center of posterior edge; lateral plates angulate with dorsal and lateral flanges meeting at sharp angle below base of projecting lateral spines; no enlarged, hornlike shoulder spines; surface of scutes covered with shallow, round, uniform sized pits about ½ cm. in diameter, except on smooth anterior articular flange and on bosses and spines which are covered with fine punctation; armor plates relatively thin (5 to 8 mm. thick).

Ventral armor of small polygonal plates in regular rows narrower near the midline than laterally, with anterior flange for articulation with overlapping plates similar to dorsal series; pitting of ventral plates similar to dorsal armor. Tail enclosed in rings consisting of four keeled plates each rising to an angu-

[2] The name *Typothorax* is derived from the Greek τυπος, a model or image, and θώραξ, breastplate, in allusion to the shallow pitting of the dermal scutes which resemble a hammered surface.

lar posterolateral point; sculpture consisting of punctate surface on boss and weak pits or grooves radiating from boss over remainder of outer surface except articular flanges. Distal caudal plates elongate rods with posterior projecting spikes.

Pelvis resembling that of Phytosauria but with ilium higher and more elongate anterior and shorter posterior iliac spines. Pectoral girdle poorly known, the glenoid an open, posteriorly directed notch as in crocodiles, coracoids rounded medially and not elongate as in Crocodilia; dermal shoulder elements unknown.

Humerus with ends expanded, at 45° angle, shaft slender; rear limb much longer and more massive than forelimb; femur nearly straight (slightly sigmoid) with strong 4th trochanter; tarsus with crocodiloid astragalus. Feet pentadactyl, toes of manus short and weakly clawed, those of pes with stout claws: metatarsal V hook shaped.

Typothorax is readily distinguished from *Desmatosuchus* by the absence of enlarged curved horns on the dorsal armor over the shoulder, by the regular round pitting of its armor, by relatively thin dermal plates, and by its slightly smaller size.

Typothorax coccinarum[3] Cope 1875R

Typothorax coccinarum Cope. Acad. Nat. Sci. Phila., Proc., **27**: p. 265, 1875.
Cope, E. D. 1877K, p. 29-30, pl. 22, figs. 1-9.
Cope, E. D. 1887A, p. 210-213, pl. I.
von Huene, F. 1915A, p. 485-490, figs. 1-10.

Episcoposaurus[4] *horridus* Cope. Am. Philos. Soc., Proc., **24**., p. 213-217.

[3] The trivial name *coccinarum* was given by Cope from the Latin *coccineus,* scarlet colored, referring to the red-beds from which the specimen was derived.

[4] Cope gives no hint of the derivation of *Episcoposaurus*; two suggestions are possible. Latin *episcopus,* bishop + *saurus,* in allusion to the resemblance of some of the conical caudal scutes to a bishop's mitre. Alternatively, as Cope regarded the animal an ally of the phytosaurs, the literal Greek derivation επὶ, over + σκοπεὶν to look at + σαυρα, σαυρος, a lizard; a reptile which looks over or upward, in allusion to the high and upwardly directed orbits of phytosaurs is possible. The specific name, *horridus,* was derived from the Latin *horrere,* to bristle or tremble with dread, to be terrible.

Type: U.S.N.M., no. 2585, dermal scutes (Cope 1877K, pl. 22, figs. 4, 5, and 9.) Collected by E. D. Cope, October 5, 1874.

Type locality: "Triassic red beds of the western side of the Sierra Madre on Gallinas Creek" (Cope 1877K, p. 28). This site has been relocated by Camp (1930B, p. 143) as at Cerro Blanco, north of Gallina, New Mexico. It lies near the center of the N½ sec. 9, T. 23 N., R. 1 E. New Mexico Principal Meridian. Chinle formation, Upper Triassic.

Type of *Episcoposaurus horridus*: A.M.N.H., no. 2713 (formerly 2307). Two caudal vertebrae (proximal and distal); humerus; two ulnae; femur lacking condyles; proximal part of tibia; distal part of fibula; calcaneum; a number of dermal bones. Splenial possibly associated. Von Huene (1915A, p. 492-493) designated bones of hind leg as lectotype. From same locality as type of *Typothorax coccinarum.* Collected by David Baldwin, April 12, 1881.

The only diagnostic features of the type of *Typothorax coccinarum* are the thin, flat, dermal plates ornamented with numerous rather small, shallow round pits. A single keeled scute in the original collection was regarded by Cope (1875R, p. 266) as of uncertain reference. The later collection by Baldwin (A.M.N.H., nos. 2710-2713) contained both flat plates which Cope referred to *Typothorax* (1887A, p. 211) and keeled plates which he ascribed to *Episcoposaurus* (ibid. p. 216-217).

Both Cope (1887A) and von Huene (1915A) emphasized the difference in size and shape of the femora as distinctions between *Typothorax* and *Episcoposaurus.* At first sight the massive straight femur of the latter appears quite different from the small sigmoid femora attributed by Cope to *Typothorax.* But aside from the question of reference of these specimens, discussed on a previous page, the similar shape of the head of the two bones, and the intermediate character of the femora of *Typothorax meadei* Sawin and M.C.Z., no. 1488 makes reference to the same species at least reasonable. The surprisingly small forelimb of "*Episcoposaurus*" is now known from *T. meadei* to be characteristic of *Typothorax,* and the difference in shape and pattern of the dermal plates appears to be controlled by their location on the body; the flat plates which Cope regarded as typical of *Typothorax* belonging to the median dorsal series of the back, the keeled plates of *Episcoposaurus* (fig. 17) belonging to the caudal series.

Typothorax meadei[5] Sawin

Typothorax meadei Sawin. Jour. Paleontology, **21**, p. 201-238, 1947.

Syntypes: Univ. Texas, Bur. Econ. Geol., Coll. no. 31185-84A, "fragmentary skull, a poorly preserved vertebral column, appendages, and dermal armor susceptible of reconstruction from the anterior cervical region to the proximal caudal. Associated with this specimen were numerous small dermal buttons and plates referable to the ventral and appendicular armor," and no. 31185-84B, fairly complete skull, portions of nuchal plates, fragments of dorsal plates, incomplete vertebral column, major limb bones, fragmentary remains of the girdles.

Three other specimens referred. Collected by Grayson Meade and W. P. A. Paleontological Survey, 1940.

Type locality: Univ. Texas, Bur. Econ. Geol., loc. 31185, Quarry 3A, 3 miles north of Otis Chalk, Howard Co., Texas, Dockum formation.

These specimens belong to a rather wide and flattened animal with a short pointed pseudosuchian skull, prominent, backwardly directed spines along the edge of the dorsal armor, large rear limbs and relatively weak forelimbs, and rather crocodiloid feet. Sawin (1947, p. 233) distinguished the species from *T. coccinarum* Cope on the basis of (1) pyramidal instead of conical eminences on the median dorsal plates and (2) smaller size. A further distinction between the Texas specimen and *Typothorax coccinarum* is the uniform presence of posteromesial eminences on the rear borders of the median series of plates in *T. meadei*. On *T. coccinarum* these plates are flat.

As pointed out above, the limbs have the proportions and form of those of *Episcoposaurus horridus*. Sawin's illustrations of the dorsal armor suggest a radial pattern on the median plates, and the presence of keeled bosses on these plates is distinctly more like the type of *Episcoposaurus* than that of *Typothorax*. The admixture in this animal of the supposed characters of the two genera further supports the evidence of their identity.

[5] The species was named for the collector, Dr. Grayson E. Meade.

Our knowledge of the range of variation in these reptiles is far too meagre to permit a reasonable assessment of the biological validity of these species. It would be equally unwise to unite them in spite of these tangible differences or to flatly assert that the differences were unquestionably due to genetic isolation. The excellence of the *Typothorax meadei* specimens in comparison to other material of the genus is ample justification for retention of the specific name in the absence of proof of identity with another form.

Typothorax cf. *coccinarum* Cope

Typothorax is represented in collections of Yale Peabody Museum from the middle part of the Dockum formation west of San Jon, New Mexico. Two fragments of median dorsal plates with characteristic shallow pitting were found during the excavation of a *Machaeroprosopus gregorii* skull (along with several other specimens which could not possibly have belonged to that animal), and the fragmentary weathered remains of much of a carapace (Y.P.M., no. 3696) were collected nearby. None of these plates show any trace of a boss or tubercle on the median series. Short posteriorly directed spines at the angles of the lateral plates are suggested by a few fragments.

With grave doubts, a large thin median scute of a mid-dorsal series (Y.P.M., no. 3695) found near the same *Machaeroprosopus* skull is referred to *Typothorax* (fig. 16). Its shape and thinness suggest this genus, but the ornamentation consists of radial ridges and grooves arranged around the very low round conical boss, which lies slightly behind the middle of the plate and rises less than a millimeter above its general surface. Inasmuch as one of the typical *Typothorax* plates mentioned above was found only a few inches from this plate, and as both show the same prominent anterointernal projection one may wonder whether the difference in sculpture is anything more than an artifact of preservation and preparation. The upper surface of the peculiar scute appears damaged. It (Y.P.M., no. 3695) is generally similar to those from the Keuper of

Württemberg attributed by von Meyer (1861, pl. 43, p. 337-342) and Fraas (1896, p. 16) to *Phytosaurus kapffi.*

Rectangular median plates with similar sculpture characterize the specimen (U.M., no. 13950) from the Dockum formation on Cerita de la Cruz Creek northwest of Amarillo, Texas, which Case (1932A) referred questionably to *Phytosaurus.* Pelvis and vertebrae of that specimen are of pseudosuchian rather than phytosaurian type, as Case realized (ibid. p. 71-74); the dermal armor is more like *Typothorax* than *Desmatosuchus* and may be tentatively referred to the former.

The posterior portion of a *Typothorax* skeleton was collected from the Chinle formation at the Ghost Ranch on Canjilon Creek northwest of Abiquiu, New Mexico, by a party from Harvard University. Professor A. S. Romer most kindly permitted me to examine this specimen (M.C.Z., no. 1488; also other bones, no. 1487). It is important because the typical flat *Typothorax* plates of the body are associated with keeled scutes on the tail. Also its size is intermediate between the various specimens described by Cope as *Typothorax coccinarum* and *Episcoposaurus horridus.* The femur is 25.8 cm. long, essentially straight and stout like that of *E. horridus* but with a well developed 4th trochanter. The tibia is very broad and massive, 12.5 cm. long. Another tibia from the same locality, no. 1487, is 13.5 cm. The humerus is 17.5 cm. long to the ulnar condyle; an ulna is 13.0 cm. If my interpretation of the specimen is correct the ventral armor consists of transverse bands of plates which overlap in the same fashion as the dorsal armor, with an articular flange on the anterior external edge of each plate. Two narrow rows of plates along the midline are flanked by an uncertain number of wider scutes; all have shallow round pits like the dorsal armor, arranged in a faintly radial pattern about a central point. The latter is not raised as a boss above the surface.

Camp (1930B, p. 3) reported *Typothorax* locally abundant in the upper Chinle formation of Arizona and Utah, and rare in the lower part of that formation. Camp, Colbert, McKee, and Welles (1947, p. 4) list "*Stagonlepis,*" *Typothorax*, and *Episcoposaurus* in the Lower Chinle fauna of Arizona and Utah, and *Typothorax* in the Upper Chinle of northwestern

New Mexico. I have collected characteristic armor of the genus from the lower Chinle near St. Johns, Arizona, but am not able to determine whether early and late species can be differentiated.

Desmatosuchus[6] Case

Desmatosuchus Case. Jour. Geology, **28**, p. 524-529, 1920. Type species by monotypy *Desmatosuchus spurensis* Case = *Episcoposaurus haplocerus* Cope.

Large quadrupedal pseudosuchians, 3 meters or more in length, with short-snouted skull, depressed body covered by heavy bony armor, the lateral plates over the shoulders prolonged into curved, hornlike spines. Limbs and feet unknown but presumably crocodiloid.

Dorsal armor distinguished from that of *Typothorax* by its greater thickness, much coarser and less regular pitting of the exposed surface, and by the great elongation of the laterodorsal spine over the shoulder.

Desmatosuchus haplocerus (Cope)

Episcoposaurus haplocerus Cope. Am. Philos. Soc., Proc., **30**, p. 129-131, 1892J.

Wilson, J. A. 1950, p. 113-114, figs. 1-3.

Desmatosuchus spurensis Case. Jour. Geology, **28**, p. 524-529, figs. 1-4, 1920.

Case, E. C. 1921A, p. 133-147, pl. 3 (endocast)

Case, E. C. 1922B, 26-48, figs. 7-20, pls. 5-10.

Case, E. C. 1929B, p. 50-51, fig. 21.

[6] The name is derived from the Greek δέσμα, δέσματος, a band or fetter, and σουχος, a crocodile, in allusion to the encircling bands of armor plates. The specific name *spurensis* was given for the town of Spur, Dickens Co., Texas; *haplocerus* comes from the Greek ἁπλος, simple, and κερας, a horn, referring to the hornlike spines of the armor plates. Professor E. C. Case tells me that he formed the name by analogy with *Desmatochelys* Williston.

Type of *D. spurensis*: U.M., no. 7476, skull; an associated skeleton belonging to the same individual includes the greater part of the vertebral column, ribs, fragments of the pelvis, and dermal armor of the back. Collected by E. C. Case in 1917 and 1919.

Type locality: Near the east bank of Blanco or Catfish River, about one-half mile east of the crossing of the old mail road from Spur to Crosbyton, Crosby County, Texas.

Type of *Episcoposaurus haplocerus* Cope: A.N.S.P., no. 14688; a sacral and two caudal vertebrae, right scapula, ribs, and about 30 demal plates. Collected by W. F. Cummins, July 20, 1891.

Type locality: Near windmill in top pasture 3 miles north of Dockum, Dickens Co., Texas.

Distinctive characters include the short-snouted pseudosuchian skull with broad parietals and the temporal fenestrae lateral in position. It is obviously similar to, though not identical with, the skull of "*Typothorax*" *meadei*, which unfortunately is also difficult of interpretation in the postorbital region. The vertebrae differ from those of phytosaurs in the lower neural spines of the cervical, lumbar, and sacral regions, in the more projecting and lower parapophyses of the thoracic series, and in the somewhat lesser expansion of the dorsal ends of the neural spines in the thoracic area; the expanded tips of the spines are carried back farther than in *Machaeroprosopus*, however.

Ribs are broad, stout, with a median supporting ridge running along their internal surface.

The pelvis is imperfectly known. A referred specimen, U.M., no. 7470, has a stronger anterior process of the ilium than phytosaurs. Pseudosuchian features are shown by the glenoid region of the scapula.

Most distinctive of *Desmatosuchus* is the development of the dorsal armor with enlarged hornlike spines above the shoulder region. The armor consists of median and lateral paired plates. The median series of plates are rectangular, wider than long, and bear a smooth anterior facet over which the anterior plate moved, elsewhere they are ornamented by coarse, shallow pitting and by a median posterior raised boss. The lateral dorsal plates are angulate, extending from the median series out to the side of the back and thence downward along the flank. At the angle, a stout spine projects outward. These spines are long in the cervical region, reach a maximum in the curved shoulder horn, and then are abruptly shorter.

It seems very likely that the ilium, U.M., no. 7322 (Case, 1922B, pl. 13A) from Sand Creek in Crosby County, Texas, and the pelvis and vertebrae, U.M., no. 7470, from the head of Holmes Creek, Crosby County, belong to *Desmatosuchus.* Case (1929B, p. 48-50) has pointed out reasons for such reference; the different form of ilium in *Typothorax meadei* (Sawin, 1947, p. 218, fig. 5A) makes confusion with this form unlikely.

Case (1929B, p. 43) and Sawin (1947, p. 233) have suggested that *Desmatosuchus* may prove to be a synonym of *Episcoposaurus.* These statements seem to have arisen from comparisons with *E. haplocerus* Cope.

This species, attributed by Cope to his genus *Episcoposaurus,* was based upon a dorsal and two caudal vertebrae, a right scapula, ribs, and 30 dermal plates, found by Cummins in 1891, near Dockum, Texas. Only the armor is at all comparable with the other type material. It has never been figured, although Wilson (1950) gave drawings of topotype material (Texas Bur. Econ. Geol., no. 18569) which was supposedly part of the original specimen.

Through the kindness of Dr. Horace G. Richards of the Academy of Natural Sciences in Philadelphia, I have been permitted to examine and illustrate the type material. To one familiar with these pseudosuchians the remains are obviously so close to *Desmatosuchus spurensis* Case as to leave no doubt of specific identity. The type localities are only a few miles apart, and at about the same level in the Dockum formation.

The "single dorsal vertebra" mentioned by Cope (figs. 6, 7, 8) is a sacral, to judge by the massiveness of the rib which abuts against the side of the centrum as well as the short transverse process. Its centrum is slightly wider than tall, with moderately flaring, shallowly concave faces and an evenly rounded ventral surface without trace of keel. The neural canal was narrow and rather deeply grooved into the upper surface of the centrum in the middle position. On one side part of the heavy neural arch is preserved adjacent to the head of the sacral rib. This structure occupies the posterior half of the vertebra, and the rib facet stands out from the side of that body with smoothly curved outline. In front of it the side of the centrum is excavated, behind the flaring anterior rim. This rim is marked by vertically elongate facets on either side which can only be interpreted as supports for the head of the expanded rib of the adjacent vertebra. Cope mentions the presence of rib facets at each end, a most unusual feature. As first sacral ribs are generally larger than the second, it seems most reasonable to assume that this is the second sacral vertebra and that these elongate facets supported the enlarged first sacral rib.

The broad centrum, absence of twin ventral keels which characterize the second sacral of *Machaeroprosopus*, (Camp, 1930B, p. 65), and the curving upper surface of the transverse process and second sacral rib, suggest *Acompsosaurus* and the specimens U. M., 13950 and 7470 described by Case (1932A, p. 67-68, figs. 5-6). Unfortunately little of the sacrum was preserved in the type of *Desmatosuchus spurensis,* but this vertebra seems to differ from those of phytosaurs in a manner similar to other parts of the column of that animal.

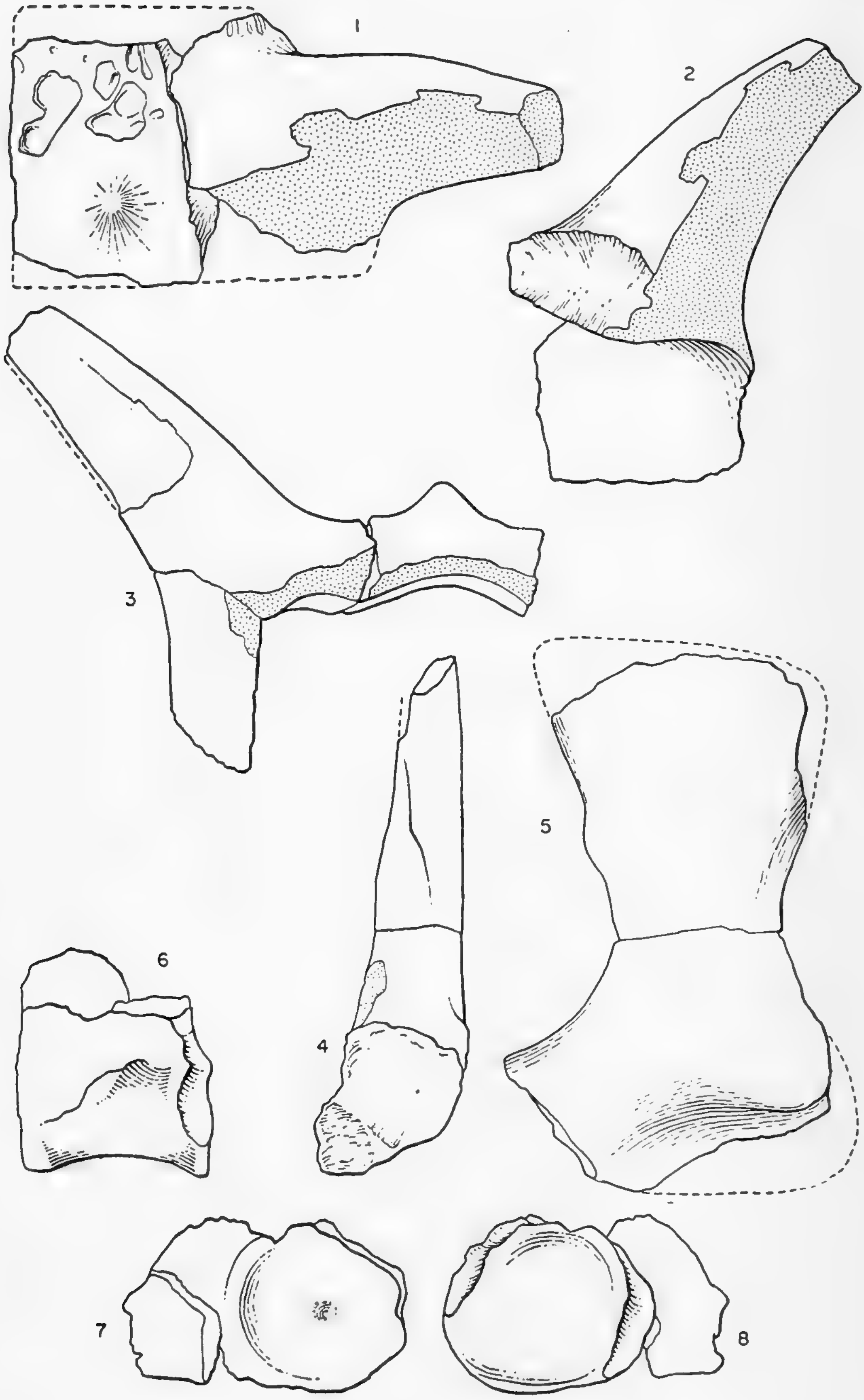
Two other vertebrae were considered by Cope to be caudals; one of these, which he described (1892J, p. 130), may well be a proximal caudal. Its transverse processes arise from the middle of the body of the centrum below the level of the neural canal. The ventral surface is flattened, and meets the lateral surfaces with an abrupt though rounded angle. These angular ridges terminate in facets for chevrons, as do those of phytosaurs. Anterior and posterior faces are flat or nearly so, and as Cope indicates, somewhat taller than wide.

The third vertebra in the collection, which was not described by Cope, consists of only a broken centrum, quite narrow and compressed, more like those of phytosaurs. Its association with the remainder of the specimen is questioned.

Great thickness characterizes the fragment of scapula (figs. 4, 5) which is all of the shoulder girdle preserved. Cope noted the normal inward curvature of the ventral portion, below the glenoid and acromion. However, the bone is not necessarily thinner here, as he said, for a substantial portion of the medial surface is broken away. Likewise the corocoid suture was undoubtedly more extensive than the small area preserved next to the glenoid. A prominent tubercle for the long head of the triceps muscle lies 8 cm. above the glenoid on the posterior edge of the blade. Above this the blade widens and thins, rather symmetrically. Thinness of the dorsal edge, especially anteriorly, suggests that most of the blade is preserved.

Comparison of this specimen with the fragment of the glenoid region of *Desmatosuchus* (Case 1922B, fig. 19) is difficult as there is little in common between them. The prominent acromion and thick oval base of the blade appear similar. It is also evident that the glenoid must have had something of the helical form indicated in Case's figure. These features seem sufficient to establish the association of this kind of scapula with the more characteristic dermal plates.

Numerous features of the scapula distinguish it from that of phytosaurs, especially slight concavity of the anterior profile, the short massive blade, and the pronounced acromion process. It differs from the scapula of *Stagonolepis* (Huxley 1877, pl. x, fig. 1) in greater thickness, much greater separation of glenoid and triceps tubercle, and stronger acromion. The scapula of *Typothorax meadei* as figured by Sawin (1947, fig. 3) ap-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pears to be more expanded above, but also has a prominent acromion and triceps tubercle. These forms are by far closest to one another in characters of this bone.

The rib fragments with flattened external surface and inner convexity are quite similar to those of *Desmatosuchus* (Case, 1922B, fig. 14), and separable from the narrower and more rounded ribs of phytosaurs.

By far the most distinctive portions of the type of *Episcoposaurus haplocerus* Cope are the plates of dermal armor. Three transverse series of plates are figured herewith, and also two other isolated plates of different form. All plates are ornamented in their flatter portions by coarse, irregularly round pits up to one centimeter in diameter. The tuberosities and spines are coarsely punctate. No trace of radial arrangement of the sculpture can be detected. The plates are characterized by greater thickness than phytosaur plates of similar size, or than the plates of *Typothorax*. All are incomplete; the anterior and most of the posterior edges are broken away on the more anterior series so that the smooth articular flanges are not preserved; these are clearly shown by the more posterior plates.

As Cope pointed out, the plates of each transverse row were suturally united. Each row consisted of 2 pairs of plates, the median flat, the lateral, angulate and spinebearing. Both Case's reconstruction of *Desmatosuchus* and Sawin's of *Typothorax* show the median series increasing in width posteriorly to the lumbar region and then gradually decreasing. In *Desmatosuchus* the cervical plates are thicker than those farther back, have more nearly a right angle between the dorsal and flank portion of the lateral plates, and greater ventral development of the lateral plates. The type of *E. haplocerus* agrees in showing a decrease in the angle between the dorsal and flank portions of the lateral plates as the median plates increase in width, and a reduction in thickness of the median series as they increase in width. Aligning the plates on these characters gives a progressive series almost suggestive of contiguity. By far the largest lateral spine is on the most anterior of these series; accordingly the preserved portion may be compared with the 5th to 9th series of *Desmatosuchus* as restored by Case (1922B).

The right median and lateral plates are present in the most anterior preserved series which is that bearing the enlarged shoulder horn (figs.

Desmatosuchus haplocerus (Cope). Type specimen of *Episcoposaurus haplocerus* Cope, A.N.S.P., no. 14688. All figures x ⅓.

Figure 1. Dorsal view posterior cervical series of dermal armor, bearing shoulder horn.

2. Median view of lateral, horn-bearing, plate of posterior cervical series, shown in figure 1.
3. Anterior view of same series as figure 1.
4. Posterior view of scapulocoracoid.
5. Lateral view of scapulocoracoid.
6. Left lateral view of sacral vertebra.
7. Anterior view of sacral vertebra.
8. Posterior view of sacral vertebra.

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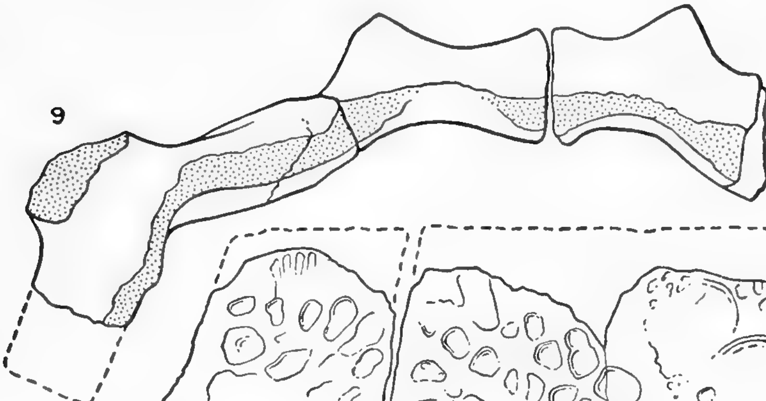

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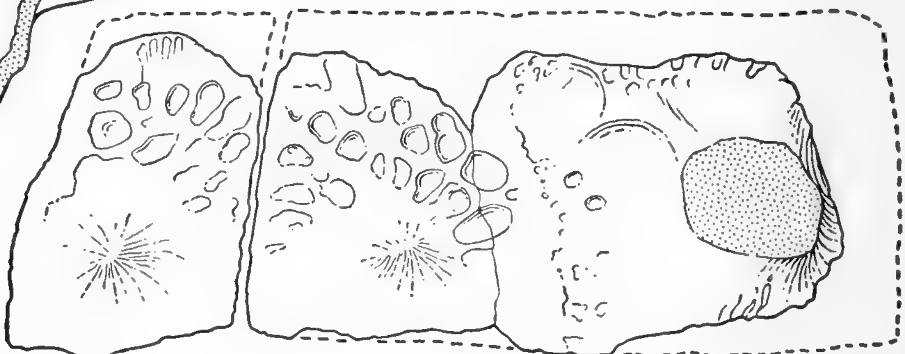

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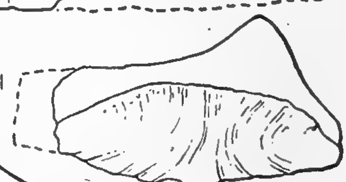

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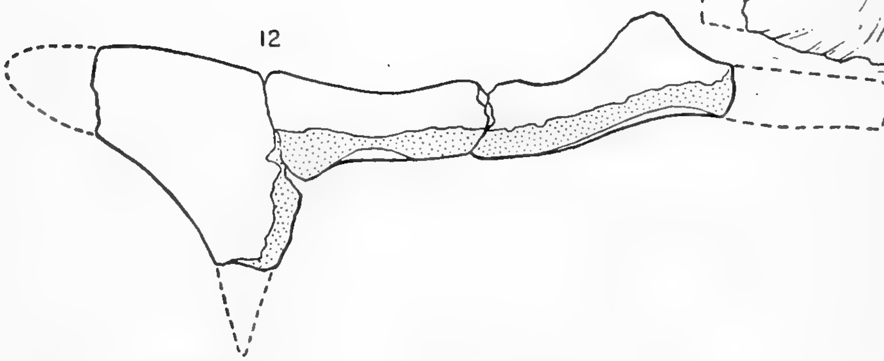

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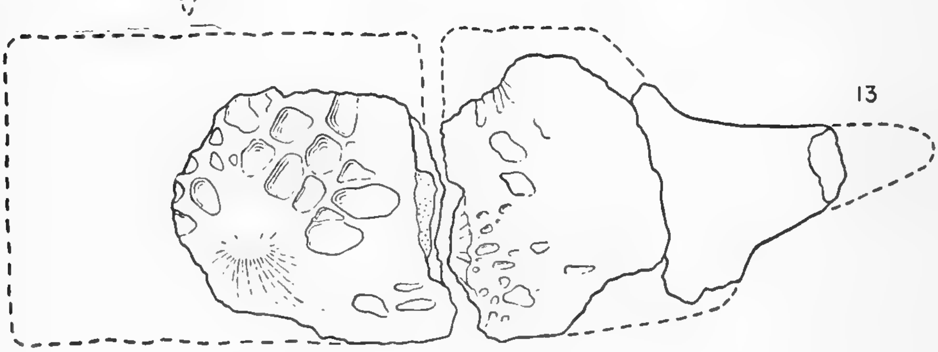

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1-3). The median plate is longer than wide, bears a round tubercle 1½ cm. in height posterior to its center, and is strongly concave from side to side ventrally, but convex anteroposteriorly below, particularly at the sutural edges which are lenticular in outline. The right lateral plate has very little dorsal extent, and this is entirely covered by the base of the horn (fig. 3). Its flank projection is extensive, and at right angles to the dorsal part. The horn itself rises in continuity with the lateral surface of the plate, its axis sloping outward at an angle of 25° from the vertical, and its medial edge reaching the suture with the median plate. Its base is longer than wide, and slightly flattened medially. Toward the tip of the preserved portion the beginning of a backward curve is apparent.

In comparison with the large horn of the type of *Desmatosuchus spurensis* Case, this plate differs in the upward direction of the spine, and in its more rapid tapering, suggesting lesser length. Possibly these are in part due to individual variation. I am inclined to regard the angle of the horn as better established on Cope's type than in Case's specimen.

The second preserved series, which may well fall next behind the first and thus be the sixth in Case's animal, is represented by the left median plate and the conjoined right median and lateral plates (figs. 9, 10). A faint line of pores on the inner surface and of irregular small pits above mark the course of the fused suture between them. The medial plates are similar to that of the previous series save for slightly greater width. Their lenticular longitudinal section is shown in figure 11. The lateral plate, in contrast to that of the preceding series, has an obtuse angle between dorsal and flank portion, considerably greater dorsal extension, and a much smaller horn base. The lateral extent of the plate and length of horn cannot be safely inferred from the broken remains. The diameter of the horn is not greater than that in the 3rd series to be described below. This series differs from that lying behind the large horn of *Desmatosuchus* in retaining essentially the same thickness of plates.

An incomplete median plate and articulating horn-bearing scute (figs. 12, 13) differ from the two preceding series in the appreciably thinner bone. Dimensions of this series suggest that it could have immediately followed the one just described. The bone is appreciably thinner than in plates of the cervical series, and does not thicken greatly at the sutures. The boss and sculpture of the median plate are quite similar to those of the last (?) cervical series, but the distance from boss to lateral border of the plate is greater. Also, the boss may be closer to the posterior edge, although

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Desmatosuchus haplocerus (Cope). Type specimen of *Episcoposaurus haplocerus* Cope, A.N.S.P., no. 14688. All figures x ⅓.

Figure 9. Anterior view of anterior thoracic series of dermal armor, consisting of paired median and right lateral plates.

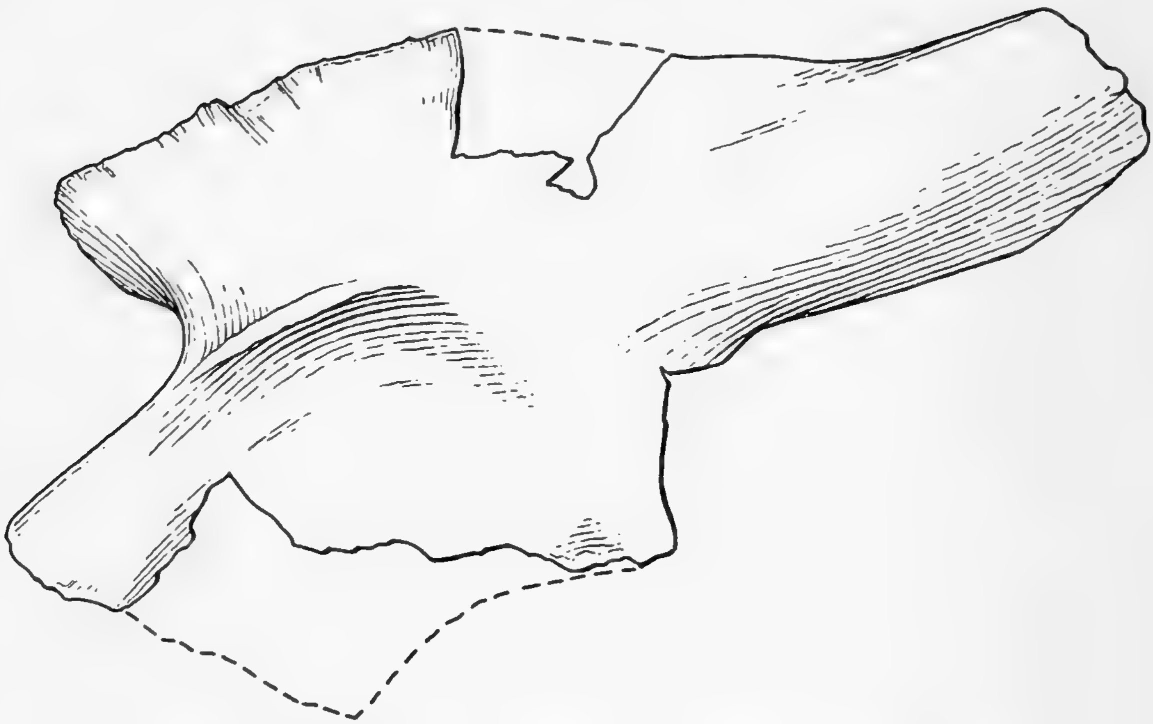
10. Dorsal view of same segment as figure 9.

11. Median view of right median plate of series shown in figures 9 and 10.

12. Anterior view of a more posterior segment of the thoracic armor.

13. Dorsal view of segment shown in figure 12.

14. Dorsal view of median plate from a more posterior dorsal series than figures 12 and 13.

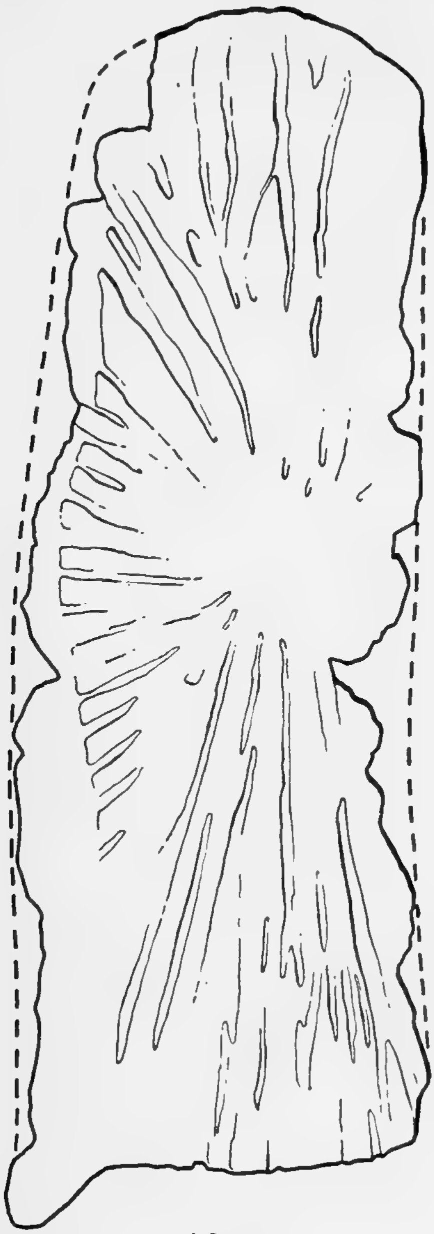


15. *Machaeroprosopus* sp. Phytosaur pelvis found near type locality of *Episcoposaurus haplocerus* by Cope in 1892. A.N.S.P. x ½.

this is not certain as all edges are badly broken. The lateral plate bears a short conical spine directed both upward and outward. Its anteroventral and posterodorsal surfaces bear flattened facets in the portion preserved. The lateral flange of the plate forms almost a right angle with the dorsal portion, and appears to have been fairly extensive from the thickness of the broken edge. The suture between plates of this series is somewhat irregular, in contrast to the straight sutures between the cervical plates.

Other incomplete median plates of the dorsal region are preserved, one of which is illustrated in figure 14. These plates show a pronounced depressed flange devoid of sculpture along the anterior margin; the round conical boss lies close to the posterior edge, and the sculpture is very coarse. The thickness, away from the boss, is about 2 cm.

Included with the type of *Episcoposaurus haplocerus* is a phytosaur ilium (fig. 15) of the type figured by Case (1922B, fig. 27 C; 1927D, U.M., no. 7244). A field label accompanying it says "pelvis supposed to be *Episcoposaurus haplocerus.* Found 50 yards from type specimen. Windmill, Top Pasture. Coll.: E. D. Cope." As Cope accompanied Cummins in 1892 this must have been obtained a year later than the type. Cope did not mention it in his description of *E. haplocerus*; the



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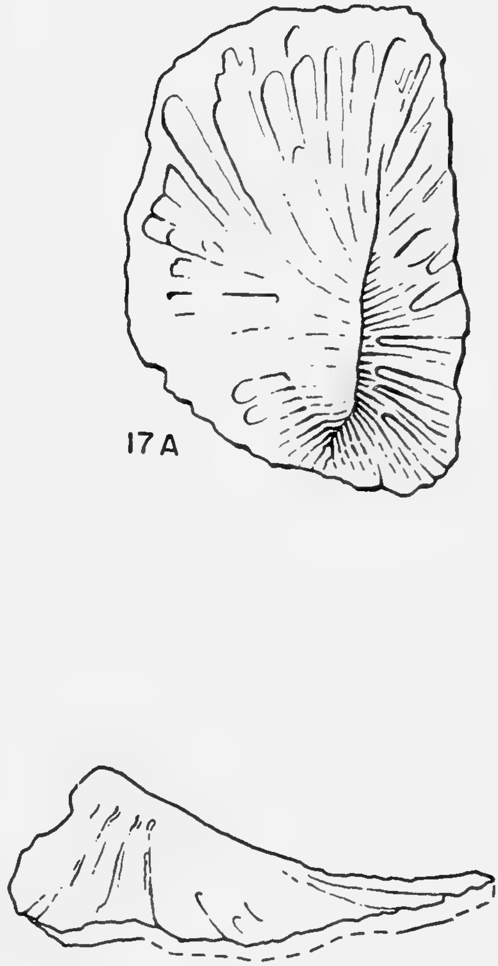

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17 B

16. Cf. *Typothorax* sp. Median dorsal armor plate from Dockum formation west of San Jon, New Mexico. Y.P.M., no. 3695, x ½.

17. Caudal scute from type material of *Episcoposaurus horridus* Cope, A.M.N.H. no. 2713. Specimen figured by von Huene, 1915, fig. 24. A. Dorsal, and B. medial views. x ½.

distance of 50 yards is too great to permit association with the remainder of the specimen, and its form is unlike that which has been found more intimately associated with pseudosuchian remains. The ilium probably belongs to *Machaeroprosopus* (Camp, 1930B, p. 78-79, fig. 16) which occurs abundantly in the Dockum of this area. The length of the spine of ilium is 219 mm.

Desmatosuchus haplocerus differs from *Typothorax meadei* in:

1. Thicker armor plates, especially anteriorly.
2. Coarse pitting of plates with no trace of radial arrangement.
3. Tuberosities and horns rounded instead of angular.
4. Larger size.
5. Median dorsal plates have central tuberosity behind middle of plate but not reaching posterior margin.
6. Fifth lateral plate, situated over shoulder, produced into long backward curving horn.

It differs from "*Episcoposaurus horridus*" in:

1. Larger size.
2. Thicker armor plates.
3. No radial pattern to sculpture.
4. Bosses on median dorsal scutes not keel-like.
5. Probably in presence of shoulder horns.

There can be no possibility of generic identity between these forms.

Acompsosaurus[7] Mehl, 1915

Acompsosaurus Mehl. Science, n.s., **41**, p. 735, 1915. Type species by monotypy *Acompsosaurus wingatensis* Mehl. Science, n.s., **41**, p. 735, 1915.

An imperfectly known genus which resembles *Desmatosuchus* in form of pelvis but has *Typothorax*-like dermal plates. Possibly a synonym of *Typothorax*.

[7] The name *Acompsosaurus* is derived from the Greek *αν*, lacking or without, *κομψος*, elegant, and *σαυρος*, a lizard, hence a reptile lacking elegance. It was given, according to Mehl, because of the massive construction of the pelvic girdle. The species was named for Fort Wingate, New Mexico.

Acompsosaurus wingatensis Mehl

Acompsosaurus wingatensis Mehl. Mehl, Science, n.s., **41**, p. 735, 1915.

Mehl, M. G., Toepelman, W. C., and Schwartz, G. M., 1916, p. 33-39, figs. 12-14, pl. III.

Type: Univ. Wis., no. 3811, pelvic girdle and fragments of vertebral centra, ribs, dermal plates, phalanges. Collected by M. G. Mehl and G. M. Schwartz, 1914.

Type locality: Region of Fort Wingate, New Mexico, in red shale series near base of Mesozoic section (no. 2 of section).

The pelvis is characterized by a forwardly projecting spine of the ilium, deep vertical apronlike pubis, and moderately elongate ischium. The acetabulum is imperforate. Case (1929B, p. 51-52) has pointed out its resemblance to certain pelvic remains found in the Dockum formation of Texas; there is good reason to refer these to pseudosuchian, perhaps *Desmatosuchus.* The associated dermal plates, some of which are closely related to the ribs like those of *Typothorax*, resemble that animal in lacking any trace of the keels or spines such as are found on phytosaur plates, and also in their circular pitting. The pits are also described as deep, which suggests *Desmatosuchus.*

Acompsosaurus may well be a synonym of *Typothorax*, although the poorly preserved types make such determination difficult. Its relationships, at least, appear closer to *Typothorax* than to *Desmatosuchus*, if characters of the dermal plates are regarded as significant. The form of the pelvis differs from that of *Typothorax meadei*, but there may be errors in Sawin's reconstruction of this region from incomplete materials. Possibly *Acompsosaurus* is really a third distinct type of pseudosuchian, but this seems most doubtful.

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Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 17 December 18, 1953 New Haven, Conn.

NOTES ON INDIAN BIRDS. V*

S. DILLON RIPLEY

When my wife and I were in the Naga Hills in 1950, we collected two specimens of the Grayheaded Imperial Pigeon which I subsequently considered to represent the form *griseicapilla*, recorded by Baker (1928, FAUNA OF BRITISH INDIA, 5:204) from southeastern Assam, and extreme eastern Bengal. The Imperial Pigeon was the only species of this genus seen by us in the Naga Hills, where pigeons of this impressive size and beauty now seem rare, no doubt due to the assiduous attentions of the Nagas themselves.

Subsequent comparison of these specimens with birds both in the Peabody Museum collection and in the American Museum of Natural History in New York, from northeast Burma, Tenasserim, Thailand, and Indochina shows that the birds from the Naga Hills are distinct as follows:

Ducula badia carolinae subsp. nov.

Type: ♀ ad. (Y.P.M., no. 12042), collected December 9, 1950, by S. Dillon Ripley at Phek, eastern Naga Hills, Assam, India.

*Previous papers in this series have appeared in 1948, JOUR. BOMBAY NAT. HIST. SOC., 47:622; 1948, ZOOLOGICA, 33:199; 1950, POSTILLA, No. 1; and 1951, POSTILLA, No. 6.

Diagnosis: From *insignis*, the subspecies of the eastern Himalayas and adjacent foothills and the Khasia Hills, this subspecies differs by having the forehead and crown overlaid with gray, the vinous or lilac-gray color of the mantle reaching only to the hind nape and neck. The wing coverts and edges of the secondaries, and especially the lower back and rump are distinctly gray, a brighter, more light color than the mouse-gray, or dull brownish-gray of *insignis*. From *griseicapilla*, this form differs in the noticeably paler, more grayish tone of the scapulars, edges of the secondaries, lower back and rump. This lighter more pure gray tone seems to invade the tail also, the terminal band being paler, more pure gray, although this may be due to comparative age of the specimens examined. Certainly no other specimens in the long series examined by me throughout the species have as light pure grayish colors in the areas above listed.

Measurements: ♂ ♀; wing 242, 240; tail 181, 173; culmen 21.5, 25.5 mm. Soft parts: iris, gray; bill, coral or carmine-cherry basally, distally brownish-horn; feet, coral or carmine-cherry.

Range: Eastern Naga Hills, and probably Cachar and Manipur south through the hills to east Pakistan as cited by Baker (*op. cit.*) for the westernmost range of *griseicapilla*, although no specimens have been available for comparison.

Remarks: It gives me very great pleasure to name a new subspecies of this magnificent pigeon in honor of Mrs. William Robertson Coe.

Among an interesting collection of birds sent to me recently by Mr. N. G. Pillai of the Travancore-Cochin government are four specimens of a pipit which I should like to describe as follows:

Anthus similis travancoriensis, subsp. nov.

Type: ♀ ad. (Y.P.M., no. 23327), collected by N. G. Pillai on the road to Muthukuzhi, about 4500 feet altitude in the Ashambu Hills, April 15, 1952, Travancore-Cochin State, southern India.

Diagnosis: From *similis similis* of Bombay, Mysore, and Madras, this form differs in being uniformly darker above and below and with a much larger area of dark brown on the inner web of the penultimate tail feathers. The feathers of the upper surface are clove-brown edged, in fresh plumage, with dark tawny-olive. Below, this population is cinnamon rather than buff. The edgings to the outer tail feathers are darker, tawny-olive rather than wood-brown. In size there seems to be no difference.

Measurements: Type—wing 89.5, tail 75.5, culmen 17.5 mm. A male molting into fresh post-juvenal plumage is too small to measure.

Remarks: These specimens are so much darker than any other pipit belonging to the species found in India that I cannot understand how the single Travancore bird mentioned in the Ornithological Survey of that State (1936, Jour. Bombay Nat. Hist. Soc., 38:764) was not commented upon at least. Were it not for the similarity in plumage pattern with *similis* and the locality, it would be easy to confuse these birds with one of the dark African forms. In this connection it is worth pointing out that in the specimens of *travancoriensis* examined, there is an important difference from typical *similis*. Baker (*op. cit.*, p. 278) in his key to the Indian pipits, separates *trivialis, hodgsoni,* and *sordidus* (= *similis*) from *nilghiriensis* on the basis of a very small pale tip to the inner web of the penultimate tail feather. The specimens of *travancoriensis* have large pale tips, nearly or more than a third of the total length of the tail. Of course they differ from *nilghiriensis* in the uniform tone to the plumage.

The Rufous Babbler, *Turdoides subrufus,* of Travancore—Cochin is a far more richly colored bird than the neighboring populations from the western Ghats of Bombay, Goa, parts of Madras and Mysore. Through the kindness of Mr. Greenway I have been able to borrow the type of Lafresnaye's "*Timalia*" *poecilorhyncha* (Neilgherries) from the Museum of Comparative Zoology (Harvard). This specimen agrees adequately with present-day specimens of typical *subrufus* and so should be considered a synonym. However, Sharpe (1883, Cat. Bds. Brit. Mus., 7:390) described *Argya hyperythra* from Madras on exactly the characters represented by my present series of Travancore—Cochin birds. I should like to revive this name, therefore, fixing the type locality at Palghat, and list the following populations:

a). *Turdoides subrufus subrufus* (Jerdon), type locality, Wynaad.

Synonym, *Timalia poecilorhyncha* Lafresnaye, type locality "Neilgherries" hereby restricted to the northern slopes of the Nilgiris, as this species does not ascend to the summits of those hills.

Range: Bombay in the western Ghats from Mahableshwar south, Goa, Coorg, western Mysore, and western Madras south to the northern slopes of the Nilgiri Hills, and east to the Shevaroys.

b). *Turdoides subrufus hyperythrus* (Sharpe), type locality, restricted to Palghat.

Range: Southwestern Madras and Travancore-Cochin.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 18 March 6, 1954 New Haven, Conn.

THREE NEW BIRDS FROM THE YUCATÁN PENINSULA.

RAYMOND A. PAYNTER, Jr.*

In the course of an ornithogeographic survey of the Yucatán Peninsula the following new subspecies were found. It is believed that the description of these three races completes the long list of Peninsular endemics, with the possible exception of several forms for which there is still inadequate material.

Dendrocolaptes certhia legtersi subsp. nov.

Type: ♂ ad. (Y.P.M., No. 8471), collected March 4, 1949, by Raymond A. Paynter, Jr., at Carrillo Puerto, Quintana Roo, Mexico.

Diagnosis: closest to *D. c. sancti-thomae*, the contiguous race, but considerably more pallid ventrally and slightly more pallid dorsally; the distinctive rufescent tone of the underparts is almost lacking, the gray of the chin is lighter, and the pileum is less richly rufescent.

Range: known only from Carrillo Puerto and Tabi, in central Quintana Roo; probably ranges northward on the Peninsula to the limit of the rain forest.

*Museum of Comparative Zoology, Cambridge, Massachusetts

Remarks: this is another example of a species characteristic of the rain forest which responds to the drier conditions of the Peninsula by becoming more pallid.

Specimens from southern Campeche and southern Quintana Roo exhibit an approach toward this new form.

It is a pleasure to name this race for Mr. D. B. Legters, a resident of Yucatán, who has been of inestimable assistance in the field and who collected many of the specimens used in these studies.

Specimens examined: *D. c. legtersi*—four males and one female from Carrillo Puerto and Tabi, Quintana Roo. *D. c. sanctithomae*—38 specimens, of both sexes, from Nicaragua, Honduras, British Honduras, Guatemala, and Mexico, including Veracruz, Oaxaca, Chiapas, Campeche, and southern Quintana Roo.

Platyrinchus mystaceus timothei subsp. nov.

Type: ♂ ad. (Y.P.M., No. 13735), collected February 25, 1951, by Raymond A. Paynter, Jr., 24 km. NW. Xtocomo, Quintana Roo, Mexico.

Diagnosis: nearest to *P. m. cancrominus* but dorsally lighter, more olive rather than brown; ventrally paler yellow, the breast band less well-defined, and the streaking reduced.

Range: rain forest in Quintana Roo and Campeche, Mexico, in Petén, Guatemala, and in British Honduras.

Remarks: specimens from Petén and from southern and central British Honduras are slightly less pale than those from Quintana Roo and Campeche.

This race is dedicated to the memory of Timothy H. Laughlin, who spent the last months of his short life as my companion and assistant in Yucatán, and to whom I shall always be greatly indebted.

Specimens examined: *P. m. timothei*—six males and two females from Agua Blanca, Km. 21 on the Chetumal-Bacalar Road, 46 km. W. Chetumal, 24 km. NW. Xtocomo, Carrillo Puerto, Tabi, and Chacalal, Quintana Roo; one female and one unsexed from La Tuxpeña, Campeche; five males and two females from Uaxactún, Petén; three males and one female from Manatee Lagoon, Toledo District, and Cayo District, British Honduras. *P. m. cancrominus*—21 specimens of both sexes from Nicaragua, Honduras, Guatemala, and Mexico, including Veracruz and Tabasco.

Dumetella glabrirostris cozumelana subsp. nov.

Type: ♂ ad. (Y.P.M., No. 8786), collected January 6, 1949, by Raymond A. Paynter, Jr., on Isla Cozumel, Quintana Roo, Mexico.

Diagnosis: differs from the nominate form in having a longer and slightly heavier bill.

Range: Isla Cozumel, Quintana Roo.

Measurements: *D. g. cozumelana*—the culmen, from the base, of seven males ranges from 22.5 to 25.0 mm., with a mean of 23.64 ± 0.29 mm.; one female 22.5 mm.; *D. g. glabrirostris*—seven males from the mainland of Quintana Roo and from Half-moon Cay, British Honduras range from 21.5 to 22.0 mm., with a mean of 21.79 ± 0.09 mm., and five females from Quintana Roo, Campeche, and Yucatán range from 21.0 to 22.5 mm., with a mean of 21.60 ± 0.26 mm. The difference between the means of the males of the two forms is statistically significant ($P < 0.01$).

Remarks: I am unable to recognize any character which warrants maintaining the monotypic genus *Melanoptila* for this species. In structure, size, and behavior this is merely an all-black species of *Dumetella*.

Although not a strongly marked race, as are so many of those endemic to Isla Cozumel, its characters appear to be consistent.

Slightly heavier weight may be an additional character of *D. g. cozumelana*, although the data are insufficient to prove the suggestion. Four males from Isla Cozumel weighed 39.4, 40.3, 40.3, and 41.8 grams; a female 41.3 grams. Two males of *D. g. glabrirostris* from Quintana Roo weighed 36.8 and 38.1 grams; two females from Quintana Roo and one from Campeche 35.3, 36.1, and 31.6 grams respectively.

Specimens examined: *D. g. cozumelana*—seven males, one female, and one unsexed from Isla Cozumel, Quintana Roo. *D. g. glabrirostris*—four males, three females, nine unsexed from Chetumal, 24 km. NW. Xtocomo, Carrillo Puerto, Ch'ich', Isla Holbox, and Isla Mujeres, Quintana Roo; one male and two unsexed from "Yucatán," Chichén Itzá, and Xocempich, Yucatán; one female from 2 km. N. Aguada Seca, Campeche; two males and two females from Belize and Half-moon Cay, British Honduras.

For lending me necessary comparative material under their care I am obligated to E. R. Blake of the Chicago Natural History Museum, to H. Friedmann of the United States National Museum, to J. D. Macdonald of the British Museum (Natural History), to R. W. Storer of the Museum of Zoology, University of Michigan, and to J. T. Zimmer of the American Museum of Natural History.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 19 July 9, 1954 New Haven, Conn.

BIRDS FROM GOUGH ISLAND

S. Dillon Ripley

Recently the Yale Peabody Museum has been fortunate enough to secure a small collection of birds from Gough Island in the South Atlantic Ocean, south of Tristan da Cunha. These specimens were secured through the intercession of Mr. R. Upton, now of the Bechuanaland Protectorate, formerly of Tristan da Cunha. It is of peculiar interest that these birds should come to Yale, as one of the first collections of birds from Gough, secured by Mr. George Comer, was formerly in the possession of Mr. G. E. Verrill, son of Professor A. E. Verrill of Yale; reported upon in the *Proceedings of the Connecticut Academy of Arts and Sciences* (1895, 9:430-477), and certainly, at least, passed through the doors of the Peabody Museum. Except for the type of the Gough Island gallinule, now in the American Museum of Natural History in New York, the whereabouts of the Comer collection at the present time remains a mystery. The Museum's grateful thanks are due to Mr. Wilmarth S. Lewis and to Mr. W. Sheffield Cowles for help in securing these interesting specimens. I am also grateful to Dr. Robert Cushman Murphy of the American Museum for showing me specimens in his care.

Daption capensis (Linnaeus): Cape Pigeon.

A male was taken on Gough October 12, 1952. The species has not previously been recorded from the neighborhood of this island.

Fulmarus glacialoides (A. Smith): Antarctic Fulmar.

This species also is newly recorded from Gough. A male was collected September 13, 1952, and measures: wing 330, tail 120.5, culmen 43.5 mm.

Pachyptila forsteri (Latham): Broad-billed Prion or Whale Bird.

A female, September 5, 1952. Wing 204, tarsus 34, middle toe and claw 38 mm.

Bulweria macroptera macroptera (A. Smith): Great-winged Petrel.

A male, December 15, 1952. Wing 302 mm. This specimen is somewhat more grayish about the throat and forehead than a July female from Tristan da Cunha. Although this bird was presumably not taken during the breeding season (July on Tristan), it appears to be the first definite record for Gough Island.

Bulweria incerta (Schlegel): Atlantic Petrel.

A male and a female taken December 15, 1952, have wing measurements of: ♂ 318, ♀ 326 mm. These specimens are apparently the first recorded from Gough Island. Unfortunately the condition of the gonads was not stated. Compared to July specimens they appear to be in very slightly more worn, brownish plumage.

Bulweria brevirostris (Lesson): Kerguelen Petrel.

A male and female, December 15, 1952. These birds measure: wing ♂ 257, ♀ 265; tail ♂ 110, ♀ 107; exposed culmen

♂ 26.5, ♀ 28.5; tarsus ♂ 38.5, ♀ 37 mm. The collection of these specimens on Gough, although unaccompanied by data on their breeding condition lends credence to the original supposition that the Kerguelen Petrel might breed in the neighborhood of Tristan da Cunha (Salvin, 1896, *Cat. Bds. Brit. Mus.*, 25:410), and later reinforced by the collection of a female in January 1946 on Inaccessible Island (Roberts, 1948, *Ann. Transvaal Mus.*, 21:60). Gough Island is far enough south (lat. 40°19′S.), to lie within the Subantarctic Zone, and the date of collection (December) corresponds to that for the season of nestlings in down, on Kerguelen Island, the only presently known breeding place for this rare species. These birds match approximately in size those recently reported from Kerguelen by Milon and Juanin (1953, *l'Oiseau*, 23:17).

Bulweria mollis mollis (Gould): Soft-plumaged Petrel.

Three specimens taken on December 15, 1952, measure: wing ♂ 249, ♀ (2) 260; tail ♂ 111.5, ♀ 112, 120; culmen ♂ 28, ♀ 28, 29; tarsus ♂ 34, ♀ 36, 37 mm.

Fregetta grallaria melanoleuca Salvadori: Tristan Storm Petrel.

A pair taken December 15, 1952, have wing measurements of ♂ 171, ♀ 155 mm.

Pelecanoides urinatrix dacunhae Nicoll: Tristan Diving Petrel.

A female, December 15, 1952, measures: wing 117.5, tail 37, culmen 16 mm. This specimen confirms the occurrence of this subspecies on Gough Island.

Puffinus assimilis elegans Giglioli and Salvadori: Tristan Shearwater.

A female, December 15, 1952, measures: wing 190, tail 65, culmen 26, tarsus 42 mm.

Gallinula nesiotis comeri (Allen): Gough Island Cock.

The Gough Island Cock, so-called, was originally described by J. A. Allen (1892, *Am. Mus. Nat. Hist.*, Bull. 4:57) as differing from *nesiotis* of Tristan (now extinct?) in having greatly reduced areas of white on the edges of the wings and the flank feathers. In size and structure the two forms appear to be so close that it seems useful to list them as subspecies rather than species.

A pair and a downy young female were collected on December 15, 1952. The adult birds measure: wing ♂ 145.5, ♀ 141.5; tail ♂ 63, ♀ 67; culmen (with shield) ♂ 42.5, ♀ 40; tarsus ♂ 48.5, ♀ 47.5; mid-toe with claw ♂ 64, ♀ 67. The soft parts of these birds appear to be as recorded by Clarke (1905, *Ibis*, 5(8):258-259), the frontal shield and basal two-thirds of the bill being bright coral red, the distal third yellow. The legs in these specimens are red splotched with greenish yellow, the feet rather greenish yellow, the pads, nails, and posterior margins of the tarsi being blackish.

The downy young bird, previously undescribed, is exactly similar to a downy young gallinule or moorhen. It is covered with black down and has black legs and feet. The bill is horny yellow, the upper mandible having a median black band and a black tip. The lower mandible is horny yellow, the basal half of the gonys and the tip being black.

Allen (*op. cit.*:58) created the genus *Porphyriornis* for the Tristan and Gough Island gallinules on the basis of combining the short thick bill and oval nostrils of "*Ionornis*"=*Porphyrula*, with the coloration of *Gallinula*. Actually the nostrils are oval, set in a nasal depression in *Porphyrula*, just as they are in *Gallinula*. The bill is stouter in the Gough and Tristan species than it is in a typical gallinule, but this is a feature of island species in any case, and its shape, and that of the frontal shield are virtually identical. These island birds, as well as the gallinules, both belong to the group which have narrow lateral membranes on the toes as pointed out long ago by Sharpe (1894, *Cat. Bds. Brit. Mus.* 23:6), and in fact the only striking morphological differences are the reduction in size of the wings in connection with flightlessness, and the heavier, more rugged appearing feet and tarsi, usually a corollary development.

It appears to be a question, then, whether the genus *Porphyriornis* should be maintained. Peters (1934, "Check-list of the Birds of the World," 2:206, footnote) united *Ionornis* with *Porphyrula* feeling that the minor external differences of the species concerned were not of generic significance. *Porphyrula* differs from *Gallinula* in lacking lateral membranes on the toes, in having a bright plumage in the adult, differently colored young, and a posteriorly pointed frontal shield. These characters add up to a cumulative factor which may be considered to imply generic value. The sole character of "*Porphyriornis*," aside from relative proportions, is flightlessness. Flightlessness, whether verified in fact or not, has not been thought of as having generic importance in the case of *Rallus wakensis*, for example, (Rothschild, 1903, *Bull. Brit. Ornith. Club*, 13:78). In the case of ducks, flightlessness is not considered to have generic value in itself. The Auckland Island and Campbell Island flightless teal have been made subspecies of the New Zealand Brown Duck, *Anas aucklandica*, by Delacour and Mayr (1945, *Wilson Bull.* 57:20, 39).

Purple gallinules have been shown to occur rather commonly on the Tristan group of islands as occasional vagrants. An immature male and female in the Yale Peabody Museum collection were taken on Tristan in May and June 1952. (See also, Hagen, 1952, "Birds of Tristan da Cunha, Results of the Norwegian Sci. Exped. to Tristan da Cunha 1937-1938," No. 20: 199-201). If Purple gallinules can wander from the New World so easily to Tristan, it seems quite possible that the Tristan and Gough Island gallinules represent an endemic population derived from vagrant *Gallinula* of New World origin.

Rowettia goughensis (Clarke): Gough Island Bunting.

Two pairs of this interesting species were secured December 15, 1952. They measure: wing ♂ 98.5, 100.5, ♀ 96 (worn), 104; tail ♂ 76.5, 81, ♀ 81.5, (w.); culmen ♂ 18, 19, ♀ 18, 19; tarsus ♂ 29, 30, ♀ 27, 31 mm. On the label it is noted that the birds were seen from sea level to 1800 feet.

Certainly in outward appearance *Rowettia* seems of New World origin, markedly similar in color pattern to *Melanodera* as pointed out by Lowe (1923 *Ibis*, 5(11):511-513).

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 20 July 9, 1954 New Haven, Conn.

NOTES ON INDIAN BIRDS. VI.

ADDITIONAL COMMENTS ON THE WREN-BABBLER, *SPELAEORNIS*

S. Dillon Ripley

At the suggestion of Dr. Walter Koelz, I have assembled a number of specimens of *Spelaeornis*, the small Wren-babbler whose status I reviewed in 1950 (*Auk*, 67:390-391), and again in 1952 (*Jour. Bombay Nat. Hist. Soc.*, 50:492-494, and col. pl.). Dr. Koelz has kindly loaned me a series of 10 specimens, which with my own series and 16 specimens of *chocolatinus* and *longicaudatus* from the British Museum and five specimens of *longicaudatus* in the American Museum of Natural History has given me a total of 38 examples of these two species for study. I am most grateful to Dr. Koelz as well as to the authorities of the Institutions concerned for permission to examine this material.

Dr. Koelz' original question concerned my statement (1950 and 1952) that I had examined a specimen of *Spelaeornis longicaudatus* from Kedimai, Manipur, and that thus this species overlapped *S. chocolatinus* in range. As a result, being sympatric, they must be listed as separate species. Dr. Koelz felt (personal communication) that the differences between the species were so slight that they must be considered as all one.

On further examination I find I must stick to my original statement that these are two valid species, and it may be worthwhile here to list the differences between them.

A. *S. longicaudatus.* This species described from the Khasia Hills, occurs as far east as Manipur (one specimen known and reexamined). It is rather olive brown above, each feather particularly on the head and upper back, margined narrowly with black; the rump, tail, and outer edges of the wings and wing coverts tinged or edged with rich chestnut or rufous. In most, but not all, specimens (perhaps partly due to poor make-up of the skins) there is a small, buffy, ashy or white streak just over the eye. The lores, cheeks, and ear coverts are ashy. Below there is a small white chin spot and a number of the feathers of the lower breast and abdomen are terminally white, or tipped with white, particularly along the distal end of the shaft and inner margin of the feather. The effect is to produce an irregular patch of white on the abdomen. The rest of the underparts tend to be deep buff to ferruginous buff, rather rufous buff along the flanks. The feathers of the sides of the throat and upper breast have pale buffy shaft streaks, roughly elongated and diamond-shaped in outline. Higher on the sides of the neck, the feathers have subterminal buffy crescent-shaped spots, producing a slightly scaled appearance.

B. *S. chocolatinus.* This species occurs from Cachar and the Naga Hills south to Manipur, the Chin Hills, Bhamo and the Shan States in Burma, north to Yunuan, and in Tonkin. The nominate form described from Kedimai, Manipur, differs from *longicaudatus* by being deeper, darker olive brown above, but with similar narrow black terminal margins on the head and back. The upper parts including the rump and upper tail coverts and tail tend to be rufous in females, which show considerable dimorphism in this regard. All sexed specimens which show this rufous suffusion are females. The lores, cheeks, and ear coverts, and a circumocular ring are ashy. The underparts show some variation, females tending to have the white areas reduced to a chin spot or small patch, and an abdominal patch similar to that in *longicaudatus*. The majority of specimens, however, 13 out of 17 or 76 per cent, including all the males and one female (in which the buffy throat patch is very extensive and light in color), have large areas of white or palest buff on the throat extending continuously down to the abdomen and belly, so that the underparts may appear largely white with ashy sides of the neck, and buff or olivaceous flanks and under tail coverts (see the colored plate, 1952, *op. cit.* in which the female is the upper figure, the male the lower).

The feathers of the sides of the neck and flanks in typical *chocolatinus* have narrow white shaft streaks opening out near the tip to a narrow whitish fork enclosing a black terminal spot. The white or buffy feathers of the lower throat and breast have this same pattern, which on the white feathers is indicated simply by a terminal black spot.

These differences are summarized below:

Species	Upperparts	Superciliary	Underparts	Pattern of underparts
A.	brownish	small, usually present	uniform, with white submental spot and patch on abdomen	reduced, pale shaft streaks on sides
B.	dark olive or rufous brown	absent	apparently sexually dimorphic, ranging from largely white (♂), to largely buff (♀)	prominent streaks and black spots on breast and sides

Measurements:

	wing	mean	tail	mean	wing-tail index, per cent	culmen
A. 20 (♂♂ ♀♀)	49-55	52.8 ± 0.41	45-55*	50.1 ± 1.36	90-100	11-14 mm.
B. 16 (♂♂ ♀♀)	46-52	50.1 ± 0.43	41.5-47.5	43.8 ± 0.43	81-93	12-14 mm.

* One juvenal female from Mawphlang, Khasia Hills, in the Koelz collection has a tail measurement of only 43.5 mm.

Comparison of the means of the tail length of these two samples gives a figure for σ_d of 1.53 which is statistically significant although somewhat high. It appears, therefore, that there is a distinct likelihood that any specimen of species B., i.e., *chocolatinus*, will tend to have a shorter tail measurement than specimens of the typical form of species A., i.e., *longicaudatus*.

Finally the examination of all available specimens of *chocolatinus* from Manipur and the Naga Hills has convinced me that sexual dimorphism is a prominent feature of this species, that the type and other known specimens of *chocolatinus* from Manipur, although unsexed, are most probably females. In addition Dr. Koelz's series from the Naga Hills contains three strongly rufous colored females, far richer than any in my original series when I described *nagaensis* (*Postilla*, 1951, No. 6:4), with much reduced white areas on the lower parts. As these specimens are inseparable from *chocolatinus*, I feel that all should be combined under that name as follows:

Spelaeornis chocolatinus chocolatinus

(Godwin-Austen and Walden)

Pnoepyga chocolatina Godwin-Austen and Walden, 1875, Ibis, 5(3):252. (Kedimai, Manipur.)

Elachura haplonota Baker, 1892, Ibis 4(6):62. (Hangrum, N. Cachar.)

Spelaeornis chocolatinus nagaensis Ripley, 1951, Postilla, No. 6:4. (Mt. Japvo, Naga Hills.)

Range—Assam in the hill ranges of north Cachar from Hangrum east to the Naga Hills in the Japvo area and east to Pfutsero at least, south to Kedimai in Manipur, presumably above 5500-6000 feet, in evergreen forest.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 21 February 28, 1955 New Haven, Conn.

A NEW FRUIT PIGEON FROM THE PHILIPPINES

S. DILLON RIPLEY AND D. S. RABOR

Recently while collecting in the Mount Canlaon area of Negros Island, on a joint Yale—Silliman University Expedition, Dr. Rabor secured a single female specimen of an unusual Fruit Dove. Comparison with specimens at Yale, at the American Museum of Natural History, and at the U. S. National Museum (through the courtesy of officials of those Institutions) reveals that this single specimen is unlike any other Fruit Dove presently known. It may be described as follows:

Ptilinopus arcanus n. sp.

Type: ♀ ad. (Y.P.M., No. 23535), collected May 1, 1953, by D. S. Rabor at Pula (Pulopantao), Mount Canlaon, Negros Island, Philippines.

Diagnosis: This Fruit Dove bears no resemblance to the other small Fruit Doves of the Philippines such as *Ptilinopus melanospila* or *superbus* (accidental in the Sulu Archipelago). In size and general pattern of coloration it resembles the species *viridis* of the southern Moluccas and New Guinea most closely. It differs from this species, however, in the solid-colored yellow under tail coverts, the more vivid green (not bronzy green) tone of the plumage, the whitish throat, and the more extensive yellow margins to the secondaries. There is no trace of gray on the greater wing coverts although scattered feathers on wings and back are washed with a French green or plumbeus green tone. But more important perhaps, unlike the species *viridis* or indeed most other species of *Ptilinopus*, there is a large circle of naked skin around the eye, roughly 3 mm. wide in the dried specimen, pointing anteriorly towards the rictus. This area is far more prominent than in the species *hyogastra*, for example.

Another species to which this specimen might be compared is *P. monachus* of the north Moluccas from which it differs in the richer yellow under tail coverts, the yellow edging to the abdomen and vent feathers, and the prominent yellow edging to the secondaries.

A general description of *P. arcanus* is as follows: forehead French gray shading over the eye into apple green, a rich vivid tone characteristic of the upper and under plumage; first primary heavily emarginated; primaries blackish, secondaries and tertials shining emerald green with yellow edges becoming very marked on the inner tertials and greater wing coverts to make a distinct yellow wing bar in repose. Central tail feathers green, outer four pairs with blackish gray on the inner webs, and an ill-defined subterminal white spot. Occasional feathers at random on nape, back and wings show traces of a French green or plumbeus green tone. Throat whitish, shading into green of underparts, the breast and abdomen having a grayish effect due to the pronounced gray bases to the feathers showing through. Lower abdomen whitish, the feathers subterminally tipped green, shading to yellow on the vent; the under tail coverts entirely yellow. Bill (in the dried skin) black, feet evidently dull purplish red, orbital skin yellowish (in the dried skin).

Measurements: Wing 100, tail 54, culmen 13 mm.

Range: Known only from the slopes of Mount Canlaon, north-central Negros Island, Philippines.

Remarks: This specimen was one of a pair shot out of a large fruiting tree on the edge of a camp clearing, at an altitude of 3600 feet. The presumed mate was unfortunately lost in the undergrowth. It will be a matter of considerable interest to study the plumage pattern when the male of this species is discovered.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 22 April 29, 1955 New Haven, Conn.

ADDITIONS TO THE ORNITHOGEOGRAPHY OF THE YUCATÁN PENINSULA

RAYMOND A. PAYNTER, JR.*

Since completing the manuscript for "The Ornithogeography of the Yucatán Peninsula" (Peabody Mus. Bull., 9, 347 pp., 1955), I have received from Mr. D. B. Legters a small collection of birds from the Peninsula, principally from the Territory of Quintana Roo. The distribution of the avifauna in the region is still imperfectly known and the breeding and migration dates have been sketched in only the broadest terms. It was, therefore, not surprising that Mr. Legters' collection should contain much of interest and that it should serve to modify parts of a study so recently completed. Rather than accumulate these new data in vague anticipation of a revision of the work in the distant future, it seems the better course to make them accessible now. I am much indebted to Mr. Legters for continuing to collect and for allowing me to place on record these observations.

Ictinia plumbea. A fledgling was collected at Tabi, Quintana Roo on June 23, 1954. The previous record of the species

* Museum of Comparative Zoology, Cambridge, Massachusetts.

breeding on the Peninsula was a nest with incubated eggs in late April (Paynter, *Ibid.*:56).

Claravis pretiosa. On June 25, 1954 a male with enlarged testes was taken at Tabi, Quintana Roo, extending the known breeding season by three months. Mid-March is the earliest record (Paynter, *Ibid.*:120), but nesting throughout the year is to be expected.

Chordeiles acutipennis micromeris. A Lesser Nighthawk was collected at Chetumal, Quintana Roo on March 21, 1954. The species had not been found on the mainland of Quintana Roo previously. This is also the earliest spring date from the Peninsula. The bird was presumably a transient.

Caprimulgus salvini badius. A female, which was incubating two nearly full-term eggs, was taken at Tabi, Quintana Roo on March 6, 1954. Nesting must have begun about the third week in February. A nest with eggs has been recorded on June 5 (Paynter, *Ibid.*:143), indicating that the breeding season is unexpectedly prolonged.

Caprimulgus vociferus vociferus. The first Peninsular record for the Whip-poor-will is a male which was obtained at Dzidzantún, Yucatán on November 21, 1953.

Pachyramphus major itzensis. A male at Tabi, Quintana Roo exhibited enlarged gonads on June 9, 1954. Indications of breeding have been noted before only in a female collected in mid-July (Paynter, *Ibid.*:182).

Myiodynastes luteiventris luteiventris. The latest this species has been found on the Peninsula is July 20, 1954, when a specimen was taken at Tabi, Quintana Roo. Careful observations may extend the date by six weeks.

Onychorhynchus coronatus mexicanus. Males with enlarged gonads were found at Tabi, Quintana Roo on June 24 and 26, 1954. Reproductive activity had been reported only in early June (Paynter, *Ibid.*:199).

Iridoprocne bicolor. Six specimens were collected for Legters in the vicinity of Chetumal, Quintana Roo in January 1953. The fact that I collected in the Chetumal area for ten months but never found this species, seems to indicate that its occurrence must be irregular.

Dumetella glabrirostris glabrirostris. A male was taken with enlarged gonads at Tabi, Quintana Roo on June 26, 1954. This is apparently the first time reproductive activity has been noted in the species.

Vireo flavifrons. On September 2, 1953 an example of this species was shot on the beach at Santa Clara, Yucatán. Many migrants were seen approaching the land from the Gulf on that day and it is presumed that this bird had arrived by the same route. There is, however, no definite record of the species as a trans-Gulf migrant, but it is an uncommon visitant on the Peninsula and probably does not cross the Gulf in large numbers.

Mniotilta varia. A specimen taken at Tabi, Quintana Roo on August 3, 1954 and one taken at Xcan, Quintana Roo on April 29, 1949 are the earliest and latest records of this species in the region.

Habia rubica nelsoni. The only recorded instance of this species breeding on the Peninsula is a male which had enlarged testes on July 20, 1954 at Tabi, Quintana Roo.

Habia gutturalis peninsularis. A male in immature plumage, but with enlarged gonads, was collected at Tabi, Quintana Roo on June 25, 1954. May 18 is the only other known date on which breeding birds were taken (Paynter, *Ibid.*:280).

Eucometis penicillata pallida. Sexually active males were found at Tabi, Quintana Roo on June 24 and 28, 1954. The species has not been reported breeding later.

Volatinia jacarina splendens. A breeding bird was collected at Tabi, Quintana Roo on June 26, 1954, which is three weeks later than the previous date (Paynter, *Ibid.*: 293).

Spinus psaltria jouyi. A male from Tabi, Quintana Roo had enlarged gonads on June 17, 1954. There seems to be no prior breeding record for the race.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 23 October 25, 1955 New Haven, Conn.

A new White-throated Spinetail from western Brazil[1]

S. DILLON RIPLEY

The Yale Peabody Museum has acquired recently by exchange with the Cleveland Museum of Natural History, a considerable segment of the bird collections made by Mr. S. M. Klages. This series, amounting to 4,389 specimens, represents the major part of an original collection of 5,000 specimens purchased by the Cleveland Museum from the Carnegie Museum of Pittsburg shortly after it had been made in the early nineteen-twenties. The collection consists of specimens from French Guiana and from the States of Para and Amazonas in Brazil. Many of the taxonomic papers of Mr. W. E. C. Todd of the Carnegie Museum have of course been based on specimens from the Klages collections, the major parts of which are still housed in the Carnegie Museum. No general report has been written on the collection as a whole, although some of the areas included in this collection have received detailed treatment by authors on other material, most recently the comprehensive paper by Count Gyldenstolpe on the avifauna of the Rio Purús in western Amazonia (1951, Ark. för Zool., Ser. 2, 2, no. 1).

Among the interesting specimens in the collection from western Brazil, are two examples of the White-throated

[1] Dedicated in honor of Professor Alexander Petrunkevitch's eightieth birthday.

Spinetail, previously unreported from this area, which may be known as:

Synallaxis albescens pullata subsp. nov.

Type: ♂ ad. (Y.P.M. No. 29701) collected February 9, 1923, by S. M. Klages at São Paulo de Olivença, Rio Solimões, western Brazil.

Diagnosis: This is the darkest population of the species. The back in this form lacks the grayish tinge to the brownish-toned mantle of the typical form, as well as of *inaequalis*, or the distinctly grayish-tinted *griseonota*. In color the back of these examples is dark sepia, nearly clove brown, only slightly more olive-brown on the rump, and equally dark brown on the upper tail surfaces. The wing coverts are darker, more rufous than any of the other forms, although the pileum seems similar in tone to that of *inaequalis*. Below, these specimens are dark gray, rather pure in tone, not as tinted with brown as in the other races, the black spot on the throat rather pronounced, although this may be seasonal. The center of the abdomen is pure albescent.

Range: Western Brazil on the Rio Solimões at São Paulo de Olivença.

Remarks: Pinto (1938, Cat. das Aves do Brasil, 1:408-09), lists no specimens of this species from the Rio Solimões, nor do other authors who have revised the populations of this species, such as Zimmer (1935, Am. Mus. Novit., No. 819:2-3), or Todd (1948, Ann. Carnegie Mus., 31, art. 4:34-37). Gyldenstolpe (1951, *op. cit.*: 159-160), does not report the species for the Rio Purús where this form might be expected in the future to occur. It is to be expected that this population might appear in patches of suitable biotope in the immediately adjacent areas of extreme southern Colombia or eastern Peru, in which latter country, the species is so far unrepresented.

In addition to the forms mentioned, specimens of *S. a. insignis*, *S. a. nesiotis*, and *S. a. australis*, have also been examined, from all of which this new form differs in greater degree as described.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 24 December 5, 1955 New Haven, Conn.

A THRESHER SHARK FROM LONG ISLAND SOUND

JAMES E. MORROW*

The Bingham Oceanographic Laboratory recently received a fine specimen of the common thresher shark, *Alopias vulpinus* (Bonnaterre) through the courtesy of Mr. S. Doane of Speed's Bait Shop in Niantic, Connecticut. Mr. Doane called us to identify a "strange shark" brought in by a sport fisherman. The fish had been foul hooked in the tail while the angler was trolling a blue mullet plug for bluefish, and had required about twenty minutes to bring to the boat. The locality of capture was stated to have been "between Plum Island and the Bloody Ground." This would be roughly five to six miles due south of Niantic.

The specimen, a juvenile female weighing 43 pounds, is now in the Bingham Oceanographic Collection of Peabody Museum. Measured parallel to the mid-line, the length of the body from the tip of the snout to the anterior edge of the pre-caudal notch was 957 mm. The total length, with the tail laid out in a more or less natural position (Fig. 1), was 1982 mm, or 6 feet 6 inches. The greatest depth of the body was 204 mm. Bigelow and Schroeder (Fishes of the Western North Altantic,

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Pt. 1, pg. 171, 1948) give information suggesting that young threshers are between three and five feet long at birth. Although nothing is known of the rate of growth of this fish, nevertheless it would appear that the present specimen was quite young, possibly only a few months old.

The particular interest of this specimen lies in the locality of its capture. It seems probable that thresher sharks must occasionally occur in Long Island Sound, if only for the reason that they are quite abundant in nearby waters and would be expected to enter the sound from time to time purely on the basis of random wanderings. However, Bigelow and Schroeder (op. cit., pg. 174) state that there is only one previous record of the thresher shark from Connecticut. This is the report by Linsley (Amer. Jour. Sci., *47*: 76, 1844), who recorded a specimen from Stonington, albeit with a question mark. Our specimen, then, would seem to be the only one which can definitely be ascribed to Long Island Sound.

Why the thresher shark, so abundant in outside waters of New England, should be so rare in Long Island Sound, is not at all clear. Perhaps the most logical suggestion is that the lower salinity of the sound is not suitable for these animals. Riley (Bull. Bingham Oceanogr. Coll., *13* (3): 5-39, 1952) has shown the salinity gradient between Block Island Sound and the eastern end of Long Island Sound to be of the order of 1.5 ‰ in a distance of only a few miles. It may be that this salinity gradient is sharp enough to act as a barrier to their entrance. However, lacking definitive knowledge of the salinity tolerance of the thresher shark, this must remain merely a suggestion.

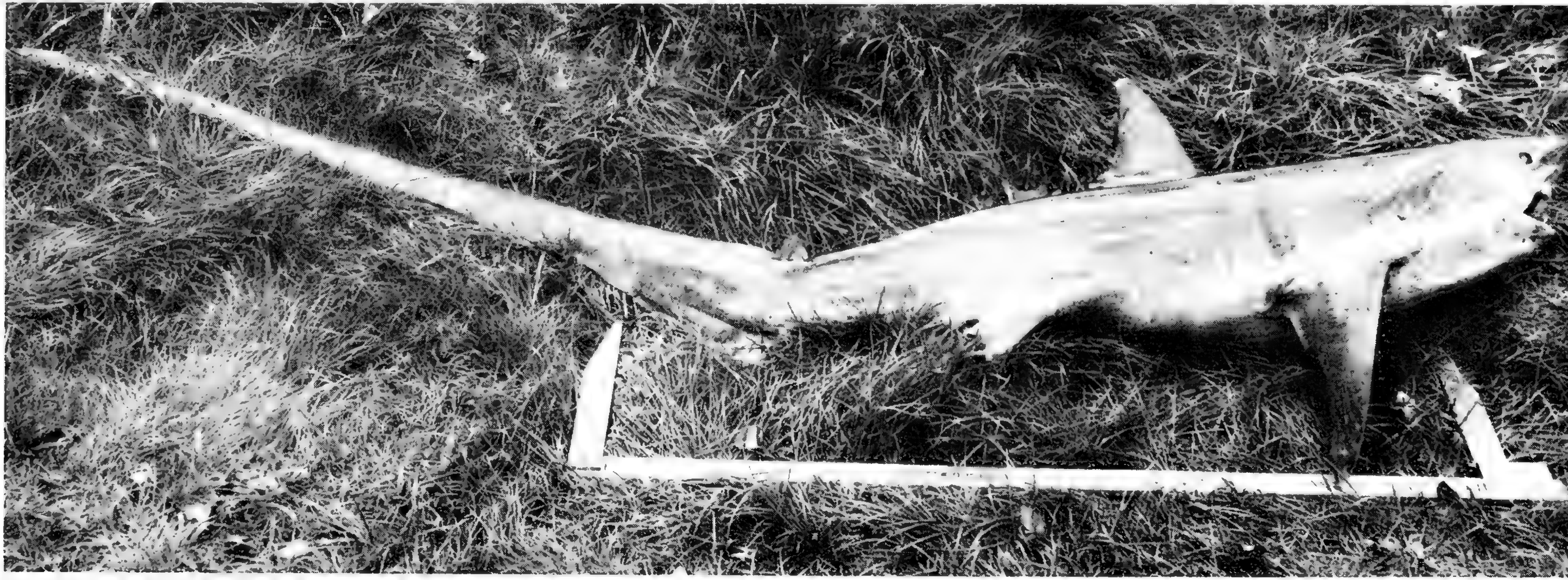

Figure 1. Juvenile female thresher shark (*Alopias vulpinus*) from Long Island Sound. The jaws of the caliper encompass one meter. Photograph by Patricia Harris.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 25 March 14, 1956 New Haven, Conn.

AVIFAUNA OF THE JORULLO REGION, MICHOACÁN, MEXICO

RAYMOND A. PAYNTER, JR.*

INTRODUCTION.

In 1759 the small volcano of Jorullo suddenly arose from the floor of a valley in south-central Michoacán, Mexico and, like its modern counterpart, Parícutin, 80 kilometers to the west, soon covered the surrounding farmlands with a thick blanket of ash. Gadow (1930) estimates that within seven years about 45 square kilometers of land had been seriously devastated and lay under up to 100 meters of lava and cinders; less severe damage occurred over a much wider area. Senescence then began and the volcano ceased to show outward activity after 1774.

Mountains ring the valley about Jorullo, forming a vast amphitheatre with the volcano (alt. ca. 1300 m.), a cinder cone, in the center (Fig. 1). To the west there is a wide breach in the mountains which is occupied by an expansive plain of volcanic sands, through which a stream passes. The village of La Playa (alt. ca. 750 m.) is located on the banks of a brook leading to the stream and a short distance to the south,

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between the water and the edge of the lava flow (*malpaís*), is the settlement of La Puerta (Map 1).

Except for the volcano and the *malpaís*, the surrounding region is almost wholly under cultivation or used for pasture. It is, therefore, a countryside typical of this section of Mexico, having fields dotted with palms or other useful trees and with woods along the streams and in scattered clumps. In the farmed area there is nothing to indicate that total devastation had taken place only 200 years ago.

The *malpaís* consists of jumbled heaps of rough lava with lichens, grass, *Opuntia*, and xerophilous shrubs and small trees dispersed throughout in varying densities (Fig. 2). The recent origin of the lava is evident. The sides of Jorullo are covered with grass, bushes, and low trees, including oak and pine. A comprehensive description of the vegetation of the entire area is presented by Gadow (1930).

The fauna of Jorullo has been little studied, although the site has been visited with comparative frequency, owing to the interest it holds for geologists. The first person to collect zoological material at the volcano seems to have been Baker, who obtained three birds on May 3, 1890 (Stone, 1890). In 1903 Nelson and Goldman were at Jorullo, from March 27 to 29 (Goldman, 1951), collecting plants, mammals, and birds, but no report on their work was prepared. Dr. Herbert Friedmann kindly examined the catalog at the United States National Museum and informs me that five birds were taken. Gadow was the next to work in the region. In 1908 he spent about a month studying the herpetofauna, in particular, which led to the publication of a valuable account of the faunal recolonization of Jorullo (Gadow, 1930). No further biological investigations are known to have been carried on until June 1950, when a field party from the Museum of Zoology at the University of Michigan spent two days collecting around La Playa and on the volcano. Dr. Robert W. Storer has sent me a list of the 12 birds that he and E. K. Miller obtained, as well as a summary of those species that were observed. From October 10 to 18, 1950, the late Timothy H. Laughlin and I collected birds and herpetological specimens in the valley, spending most of the period on the plain, near La Playa and La

Puerta. The birds are deposited in the Yale Peabody Museum of Natural History and the reptiles and amphibians in the University of Michigan Museum of Zoology. From July 1 to 3, 1951, William E. Duellman collected herpetological material near Jorullo for the University of Michigan. Utilizing specimens obtained by the Michigan parties, my collection, and portions of the incomplete manuscript of the present paper, he published a report on the herpetology of Jorullo (Duellman, 1954).

The area about Jorullo is too much disturbed by human occupation to attempt to study its recolonization by birds. However, in spite of its comparatively recent devastation, a great part of the district is similar to farming country elsewhere in that section of Mexico and its avifauna is probably comparable to that found in any like habitat on the edge of the Río Balsas drainage system. The following list is an enumeration of the species occurring in the valley about Jorullo and on the slopes of the volcano. The collection made in 1950 forms the basis of this account but, to make it as complete as possible, I have drawn upon the unpublished data generously given me by Drs. Friedmann and Storer. Nevertheless, the list still does not contain every species resident in the region and certainly gives but the roughest indication of the visitant and transient avifauna. For example, I saw individuals of *Columbigallina*, *Leptotila*, *Myiarchus*, and *Seiurus* but was unable to identify the species with confidence; certainly other forms were present but were not encountered during our short visit. Those birds which seem to be reported from Michoacán for the first time are indicated by an asterisk (*).

ANNOTATED LIST.

Coragyps atratus (Bechstein). Black Vulture. The more abundant vulture. In the mid-morning as many as 28 could be seen circling over the valley.

Cathartes aura subsp. Turkey Vulture. Only one bird was seen during the entire period, although in other parts of the state it has been reported as being common (Blake and Hanson, 1942; Lea and Edwards, 1950; Davis, 1953).

Buteo nitidus subsp. Gray Hawk. A single individual of this species was identified with certainty. Storer saw an adult during his visit.

Polyborus plancus subsp. Crested Caracara. On October 17 two caracaras ranged over the fields on the western side of the stream at La Puerta.

Falco sparverius subsp. Sparrow Hawk. Very common.

Ortalis vetula subsp. Plain Chachalaca. The only suitable habitat for chachalacas is on the surrounding hills. The species is uncommon owing to intensive hunting but was heard calling each morning.

Philortyx fasciatus (Gould). Barred Quail. 2 ♂, Oct. 12; 1 ♂ 1 ♀, Oct. 16. Quail were extremely abundant in the fields, although the villagers kill them with sling shots at every opportunity. All the birds collected had enlarged gonads. The males weighed 125.0, 135.1, and 136.2 grams; the female 126.4 grams.

Actitis macularia (Linnaeus). Spotted Sandpiper. Several were seen regularly along the river.

Columba fasciata subsp. Band-tailed Pigeon. Small flocks passed over the valley several times.

Zenaidura macroura subsp. Mourning Dove. A few were seen each day.

Zenaida asiatica subsp. White-winged Dove. This was the most abundant of the larger doves.

Scardafella inca (Lesson). Inca Dove. Common.

Ara militaris subsp. Military Macaw. Gadow (1930:42) reported seeing a pair of these birds daily.

Aratinga canicularis eburnirostrum (Lesson). Orange-fronted Parakeet. 1 ♂, Oct. 13. The specimen has the broad orange forehead and more yellow ventral coloration of *A. c. ebrunirostrum,* but the size (wing 139.5 mm.; tail 114.0 mm.) is indicative of a tendency toward *A. c. clarae.* The species was seen frequently, particularly in trees standing within fields. The bird weighed 73.5 grams.

Amazona finschi finschi (Sclater). Lilac-crowned Parrot. A female was collected by Nelson and Goldman. Flocks of parrots, presumably of this species, were observed each morning and evening but they never alighted.

Piaya cayana mexicana (Swainson). Squirrel Cuckoo. 1 ♂, Oct. 12. Fairly numerous, several being seen each day. The specimen weighed 99.7 grams.

Crotophaga sulcirostris subsp. Groove-billed Ani. Abundant wherever there were cattle.

Geococcyx velox melanchima Moore. Lesser Road-runner. A male road-runner was collected by Nelson and Goldman. I saw none in the Jorullo region, although they were noted often on the road between Ario de Rosales and La Huacana.

Glaucidium brasilianum subsp. Ferruginous Pygmy-Owl. A specimen was collected at La Playa by Storer, who informs me that it exhibits characteristics of both *G. b. cactorum* and *G. b. ridgwayi*. A series is needed for subspecific determination.

Caprimulgus ridgwayi ridgwayi (Nelson). Buff-collared Nightjar. Storer obtained a specimen on June 19. A few were seen during our visit.

Amazilia beryllina viola (Miller). Berylline Hummingbird. 1 ?, Oct. 12; 1 ♂, Oct. 14; 1 ♂, 1 ?, Oct. 16. An abundant form. The males weighed 5.0 and 5.4 grams; the unsexed birds 4.9 and 5.1 grams.

Selasphorus rufus (Gmelin). Rufous Hummingbird. 1 ♀, Oct. 18. The specimen, which weighed 2.6 grams, was obtained at the base of the volcano. While this form was definitely not so numerous as *Amazilia beryllina,* their relative abundance was not determined. At least two other species of hummingbird were present, but not identified.

Momotus mexicanus mexicanus Swainson. Russet-crowned Motmot. 1 ♂ ?, Oct. 12; 1 ♀, Oct. 18. Fairly numerous. The female weighed 75.5 grams and the bird which was uncertainly identified as a male weighed 91.0 grams.

**Dryocopus lineatus scapularis* (Vigors). Lineated Woodpecker. Miller secured a young female two miles south of La Playa. This appears to be the only record of the species from Michoacán.

Centurus chrysogenys flavinuchus Ridgway. Golden-cheeked Woodpecker. 1 ♂, Oct. 11; 1 ♂, 1 ♀, Oct. 14. Abundant in thinly wooded areas. The males and female weighed, respectively, 75.7, 87.3, and 66.3 grams.

Phloeoceastes guatemalensis nelsoni (Ridgway). Pale-billed Woodpecker. Nelson and Goldman collected a female, which is the only time the bird has been recorded in the district.

Xiphorhynchus flavigaster mentalis (Lawrence). Ivory-billed Woodcreeper. A single bird was seen on the trunk of a palm on October 13. The species has not been seen previously in the vicinity of Jorullo, although Nelson and Goldman took a specimen at nearby Cayaco.

Platypsaris aglaiae albiventris (Lawrence). Rose-throated Becard. 1 ♂, Oct. 13. The specimen, which is immature and in heavy molt, weighed 28.5 grams. It was taken in a densely wooded area along a stream. No other was seen.

Pyrocephalus rubinus mexicanus Sclater. Vermilion Flycatcher. 1 ♂, 1 ?, Oct. 13; 1 ♂, Oct. 14; 1 ♂, Oct. 16. One of the most conspicuous elements of the avifauna, especially in the pastures. The gonads of one male were very enlarged, those of another moderately enlarged, and those of the last small. The last bird retains about one quarter of its immature plumage and weighed 12.8 grams. The remaining males weighed 14.0 and 14.3 grams. The unsexed specimen, which is in immature plumage, weighed 12.6 grams.

Tyrannus vociferans vociferans Swainson. Cassin Kingbird. A female was taken by Nelson and Goldman. To date it is the only record from the vicinity of Jorullo.

Tyrannus melancholicus occidentalis Hartert and Goodson. Tropical Kingbird. 1 ♀, Oct. 12; 1 ♂, Oct. 14. Common. The weights of the male and female were 41.5 and 30.0 grams, respectively.

Myiozetetes similis subsp. Vermilion-crowned Flycatcher. Several pair were along the river.

Pitangus sulphuratus derbianus (Kaup). Derby Flycatcher. 1 ♂, Oct. 18. The bird weighed 84.0 grams. An abundant form.

Contopus pertinax pertinax Cabanis and Heine. Greater Pewee. 1 ♀, Oct. 11; 1 ♂ ?, Oct. 14; 1 ♂, Oct. 17. The species was rather numerous in the fields where a few trees remained. The male and female weighed 24.2 and 25.8 grams, respectively; the bird of doubtful sex 24.3 grams.

Empidonax minimus Baird. Least Flycatcher. 1 ♀, Oct. 12; 1 ♀, Oct. 16. Several seen daily. One bird weighed 9.9 grams.

Progne chalybea subsp. Gray-breasted Martin. Storer informs me that there were two martins present at the hacienda in La Playa.

Stelgidopteryx ruficollis fulvipennis (Sclater). Rough-winged Swallow. 1 ♂, Oct. 13; 2 ♂, Oct. 17. From Brodkorb's discussion (1942) of the races of *Stelgidopteryx ruficollis*, it is apparent that these specimens are referable to *S. r. fulvipennis*. Their chins and throats are conspicuously tinged with buff and the shafts of the under tail coverts are faintly darkened subterminally. Their respective measurements are, wing (flat): 120.0, 119.0, 116.0 mm.; tail 56.0, 51.0, 53.0 mm.; weight, 16.0, 15.0, 15.4 grams. Lea and Edwards (1950) have recorded the species breeding in the region of Pátzcuaro and tentatively identified a specimen as *S. r. fulvipennis*.

Flocks of up to fifty birds appeared over the stream at La Puerta late each afternoon.

Corvus corax subsp. Common Raven. Ravens were seen flying over only once, although on the road between Ario de Rosales and La Huacana they were numerous.

Calocitta formosa formosa (Swainson). Magpie Jay. 1 ♂, Oct. 14; 1 ♀, Oct. 16. Moderately abundant. The male and female weighed 213.3 and 205.5 grams, respectively.

Campylorhynchus rufinucha humilis Sclater. Rufous-naped Wren. Dr. Storer collected a male at La Playa, which he informs me is nearest to *humilis* but show evidence of introgression with *gularis*. I saw none of these wrens during my visit.

Thryothorus pleurostictus nisorius Sclater. Banded Wren. 1 ♂, Oct. 13. Observed several times. The specimen, which is in heavy molt, weighed 23.8 grams.

Troglodytes aëdon parkmanii Audubon. Northern House Wren. 1 ♂, 1 ♀, Oct. 17. These specimens, taken in widely separated localities, were the only house wrens seen. The male weighed 10.0 and the female 9.7 grams.

Mimus polyglottos leucopterus (Vigors). Common Mockingbird. 1 ♂, Oct. 15; 2 ♀, Oct. 18. Mockingbirds were encountered among the lava flows only at the base of Jorullo, where they were numerous. It is surprising that none was seen in the vicinity of the village. The weight of the male was 46.5 grams; that of the females 44.6 and 44.7 grams.

Turdus rufo-palliatus rufo-palliatus Lafresnaye. Rufous-backed Robin. 1 ♂, Oct. 13; 1 ♀, Oct. 14. Abundant. The male and female weighed, respectively, 76.0 and 74.5 grams.

**Catharus ustulatus swainsoni* (Tschudi). Olive-backed Thrush. 1 ♂, Oct. 15. The specimen was brought in by a boy and seems to be the first record of the species from Michoacán. It weighed 30.0 grams.

Polioptila caerulea caerulea (Linnaeus). Blue-gray Gnatcatcher. 1 ♀, Oct. 12; 1 ♀, Oct. 13. These birds have the following measurements: wing (flat), 52.5 and 52.5 mm.; tail, 50.5 and 51.5 mm.; culmen (base), 15.5 and 14.5 mm.; weight, 5.4 and 5.5 grams. The large size of the specimens indicates that they must be either the nominate form or *P. c. amoenissima.* They are pale ventrally and match perfectly some fall specimens of the former race from the southeastern United States. It would appear that the birds should be called *P. c. caerulea* and that they are probably winter visitants. However, the matter is complicated by the discovery by Davis (1953) of a breeding female and two juvenal males, in the vicinity of Tzitzio, whose measurements exceed those of *P. c. deppei,* the race which might be expected to be resident, and thus approach in size the more northern races. It is obvious that the gnatcatchers of this region sorely need study, but adequate breeding material is first required. Nevertheless, because the two birds in the present collection seem indistinguishable from certain individuals from the eastern United States, it is reasonable to assume they are *P. c. caerulea,* although Lea and Edwards (1950) chose not to name a male exhibiting similar characteristics, which they obtained in March at Pátzcuaro.

The species was abundant.

**Lanius ludovicianus excubitorides* Swainson. Loggerhead Shrike. 1 ♀ ?, Oct. 18. This race appears not to have been recorded previously from Michoacán. The specimen, which weighed 46.4 grams, was taken in the *malpaís.* No other was noted.

**Vireo hypochryseus hypochryseus* Sclater. Golden Vireo. 1 ♀, Oct. 13. The specimen was the only one seen. It weighed 12.9 grams.

Mniotilta varia (Linnaeus). Black and White Warbler. A single bird was present almost daily at our camp.

**Vermivora ruficapilla ridgwayi* van Rossem. Nashville Warbler. 1 ♂, Oct. 12. Lea and Edwards (1950) found the nominate form to be a common transient in the spring, but *V. r. ridgwayi* had not been reported heretofore. The species was seen on several occasions near La Puerta. The bird weighed 8.1 grams.

**Vermivora luciae* (Cooper). Lucy Warbler. 1 ?, Oct. 17. Only this bird was encountered. Its weight was 6.0 grams.

Parula americana pulchra (Brewster). Parula Warbler. Miller collected a specimen on the slopes of Jorullo.

Dendroica auduboni nigrifrons Brewster. Audubon Warbler. 1 ♂, Oct. 14. A first winter bird which weighed 12.8 grams.

Dendroica nigrescens (Townsend). Black-throated Gray Warbler. 1 ♀, Oct. 17. The only one seen. It weighed 7.2 grams.

Geothlypis trichas subsp. Common Yellowthroat. Several birds were constantly present by the stream at La Puerta, but the proximity of houses prevented any collecting in that area.

Wilsonia pusilla pileolata (Pallas). Pileolated Warbler. 1 ♂, Oct. 16. Abundant in brushy areas. The bird weighed 7.2 grams.

Cassiculus melanicterus (Bonaparte). Yellow-winged Cacique. 1 ♂, 1 ♀, Oct. 12. Very common, particularly in the palms near the village. The male weighed 82.6 and the female 70.9 grams.

Cassidix mexicanus obscurus (Nelson). Boat-tailed Grackle. 3 ♀, Oct. 16. Although Blake and Hanson (1942) found the nominate form in the vicinity of Apatzingan, only about fifty kilometers to the west of Jorullo, these birds are very dark and definitely referable to *C. m. obscurus*. The species was moderately abundant. The specimens weighed 111.8, 122.1, and 126.3 grams.

Icterus bullockii bullockii (Swainson). Bullock Oriole. 1 ♂, Oct. 11. Numerous. The bird weighed 34.2 grams.

Icterus spurius spurius (Linnaeus). Orchard Oriole. A single male was seen on two days.

Icterus wagleri wagleri Sclater. Black-vented Oriole. There is a female of the species in the collection made by Storer at La Playa.

Icterus cucullatus cucullatus Swainson. Hooded Oriole. 1 ♂, Oct. 13; 1 ♂, 1 ♀, Oct. 14. Frequently observed in the palms. The males, both of which are adults, weighed 24.6 and 25.1 grams; the female, which is immature, 23.6 grams.

Icterus pustulatus subsp. Streak-backed Oriole. Several were identified at La Playa by Storer on June 19.

**Piranga rubra* subsp. Summer Tanager. A pair was seen on October 13.

**Passerina cyanea* (Linnaeus). Indigo Bunting. A single female was observed on October 16.

**Passerina ciris* subsp. Painted Bunting. 1 ♂, Oct. 13. The bird is in the process of assuming adult plumage and its measurements fall within the range of overlap for the two races. It, therefore, cannot be assigned to either race, although, as shown by Storer (1951), the nominate form is not known to winter in western Mexico. The bird weighed 14.0 grams.

Volatinia jacarina subsp. Blue-black Grassquit. Noted by Storer in June but not by us in October. The sparsity of fringillids, particularly those which are usually in the weeds along roads, was striking.

Chondestes grammacus strigatus Swainson. Lark Sparrow. 2 ♂, 1 ♀?, Oct. 15; 1 ♀, Oct. 18. Large flocks occurred in the *malpaís*. One of the males had very enlarged testes while in the other they were slightly enlarged. The bird identified with certainty as a female exhibited no indications of gonadal activity and none of the living birds showed sexual behavior. The indications of breeding, plus the fact that Baker (Stone, 1890) obtained the species at Jorullo on May 3, suggest that the species may be resident.

The males weighed 24.9 and 25.3 grams; the female 26.8 grams; the bird of doubtful sex 27.6 grams.

Aimophila ruficauda subsp. Stripe-headed Sparrow. Storer found this species common about La Playa. I saw none in October.

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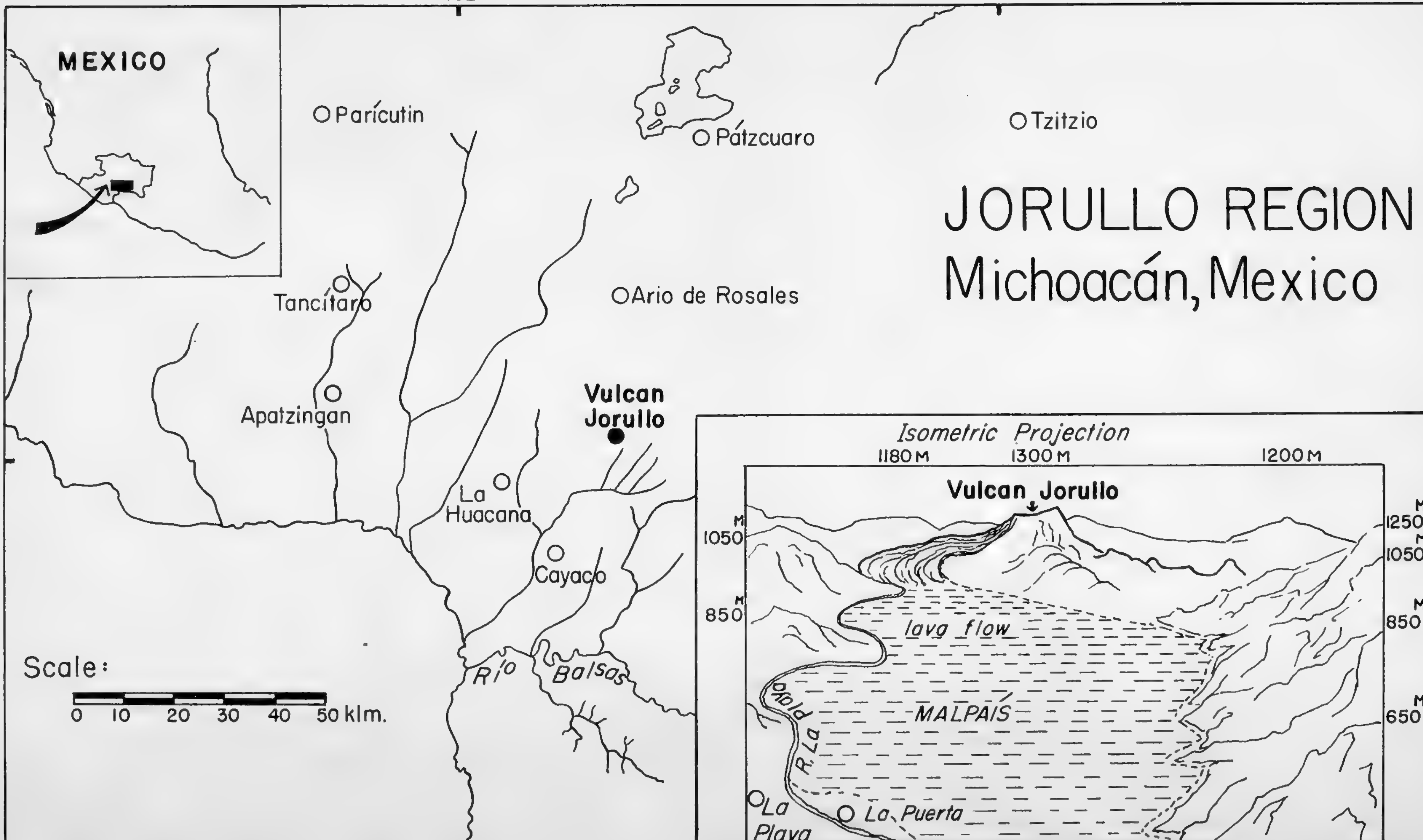
Fig. 1. Jorullo from the plain at La Puerta. Oct. 17, 1950.


Fig. 2. A portion of the *malpaís* as seen from the summit of Jorullo. Oct. 15, 1950.


JORULLO REGION
Michoacán, Mexico
MEXICO
Parícutin
Pátzcuaro
Tzitzio
Tancítaro
Apatzingan
Ario de Rosales
Vulcan Jorullo
La Huacana
Cayaco
Rio Balsas
102°
101°
19°
Scale:
0 10 20 30 40 50 klm.
Isometric Projection
1180 M
1300 M
1200 M
Vulcan Jorullo
1050 M
850 M
1250 M
1050 M
850 M
650 M
lava flow
MALPAIS
R. La Playa
La Playa
La Puerta

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 26 May 21, 1956 New Haven, Conn.

CUBAN BIRD NOTES

S. DILLON RIPLEY and GEORGE E. WATSON, 3RD

The following notes are the result of a collecting trip to Cuba by one of us (Watson), for the Yale Peabody Museum between August 6 and December 12, 1955. Nesting dates or other data are given where they may supplement Bond's definitive works, his *Check-List of Birds of the West Indies*, Philadelphia, 1956, and earlier *Field Guide of Birds of the West Indies*, New York, 1947. We are very grateful to Dr. R. A. Paynter, Jr. for comments and measurements on the collections at the Museum of Comparative Zoology at Harvard.

Podiceps dominicus dominicus (Linnaeus): rarely seen and shy. Young found in the Zapata Swamp, October 19. A male and female with enlarged gonads, taken on this date, weighed 182 and 167 grams respectively. The juvenal, which is in body down, has on the crown a developing median streak of light cinnamon-brown juvenal feathers, paler towards the forehead.

Podilymbus podiceps antillarum Bangs: an incubating bird was observed August 14, with young hatched two days later. A trio of adults weighed: ♂ 325, 345; ♀ 355 grams respectively, while a nearly full-grown female, in immature plumage, weighed 247 grams. These weights are notably less than those recorded by Paynter (Bull. Yale Peabody Mus., 9: 22, 1955) for the typical subspecies in Yucatán in winter.

Bubulcus ibis ibis (Linnaeus): a flock of 150 Cattle Egrets noted daily during September at Finca Dayaniguas in Pinar del Rio, always with the same herd of Brahman cattle. Three specimens from this flock are now in the Villalba Collection at the University of Havana. A few were seen about Lake Ariguanabo in mid-November. The species has since been found in Oriente.

Dendrocygna arborea (Linnaeus): becoming rarer in Cuba; formerly common, now rare in the Lanier Swamp, Isle of Pines. Young, beginning to assume feathers (perhaps six weeks old), were seen south of San Cristobal, Pinar del Rio, in early October. Adults were in extremely worn plumage at this time.

Aix sponsa (Linnaeus): downy young seen in Pinar del Rio in late September.

Oxyura dominica (Linnaeus): young of about eight weeks (heads still downy, primaries breaking sheaths) seen in Pinar del Rio, Sept. 16. Specimens taken at this time weighed: ad. ♂ 386, im. ♂ (in first year plumage) 387; ad. ♀ 445, im. ♀ (in first year plumage) 275 gm. The subadult birds have notably wider, paler margins to the feathers of the back and wing coverts, and more fluffy, almost downlike feathers on the underparts with distinct wide pale margins which, due to the relative sparseness of the feathering in this area, give a rather mottled effect.

Buteogallus anthracinus gundlachii (Cabanis): not a shy species and apparently becoming rarer. Two seen and two more heard during a day's walk to the south coast of the Isle of Pines.

Grus canadensis nesiotes Bangs and Zappey: said to be very common in the Zapata Swamp where they are a staple in the local diet. Two flocks of 13 and 16 seen in Pinar del Rio, south of Paso Real, in September and December.

Pardirallus maculatus inoptatus (Bangs): abundant in the Zapata Swamp. A female laying was taken Sept. 16. Heard (?) Isle of Pines, Nov. 6. Weight: ♂ ♂ 195, 198; ♀ ♀ 153, 167, 190 gm. Local name (at Santo Tomás = Las Mercedes, Zapata), "Gallinuela Color-Guineo." Call: infrequent deep, chesty grunting; also a clucking *tuk-tuk-tuk*, etc., gradually accelerating.

Among the rails, the breeding season seemed to be at its height in September. Half-grown young *Rallus elegans ramsideni* Riley, (local name; "Martillera"), were found in Pinar del Rio in December. *Porzana flaviventer gossii* (Bonaparte) was laying on Sept. 9.

Porzana carolina (Linnaeus): a subadult female taken Sept. 9 at Dayaniguas represents an early record for this species.

Porphyrula martinica (Linnaeus): a male Purple Gallinule in the subadult greenish-brown plumage was collected August 27 at Aguada de Passajeras, Las Villas, near the eastern edge of the Zapata Swamp. The bird had greatly enlarged gonads indicating that it might be capable of breeding, although in immature plumage. The forehead shield was swollen and tumid, although dull colored. Nests of this species were seen on Sept. 9.

Among other species, week-old young of *Gallinula chloropus cerceris* Bangs were found in early September. *Fulica americana* Gmelin, on the other hand, would seem to breed earlier, as nearly full-grown young were seen in September.

Chlidonias niger surinamensis (Gmelin): a male was taken from a flock of four on Sept. 16 at Dayaniguas in Pinar del Rio.

Geotrygon montana montana (Linnaeus) and *Geotrygon chrysia Salvadori*: both species were common on the Isle of Pines near the Lanier Swamp. Although found in the same forest, the former was more inclined to be near water and in damper places, while the latter was seen in slightly drier areas and was noted more often perched in trees.

Staroenas cyanocephala (Linnaeus): not encountered on the Isle of Pines although said to have been fairly common in the past. In Cuba found rather commonly on the hillsides north of Candellaria in Pinar del Rio. Call: two notes, fast and rather deep like a soft fog horn.

Aratinga euops (Wagler): a flock of 25 were noted at Santa Tomás in the Zapata Swamp, associated with a flock of *Amazona*.

Coccyzus americanus americanus (Linnaeus): a young bird out of the nest but not yet flying was found at Soledad on August 28.

Glaudicium siju siju (d' Orbigny): the collection of fifteen of these Owlets both on Cuba and the Isle of Pines shows that Ridgway's race, *vittatum*, from the Isle of Pines (Bull. U.S. nat. Mus., No. 50, Pt. 6:782,805, 1914) should be recognized. Eight birds from the Isle of Pines seem grayer, more heavily barred as Ridgway points out, and are larger: Cuba, wing ♂ ♂ 88-92; ♀ ♀ 98-103; Isle of Pines, wing ♂ ♂ 94, 95; ♀ ♀ 102-109 millimeters. In weight there is a distinct correlation; Cuba, ♂ ♂ 55, 55, 57 (one 75 gm. = ♀ ?); ♀ ♀ 66.5, 73.5 (one 55 = ♂ ?); Isle of Pines, ♂ ♂ 65, 68, ♀ ♀ 84 (2), 85, 89 (2), 92 gm. Thus there is a difference of as much or more than ten grams between the corresponding sexes, an average of twelve to fifteen per cent of the body weight of the birds. Call: a high squeaking. In December, a male on the Isle of Pines uttered a slowly repeated *too too, too.*

Gymnoglaux lawrencii Sclater and Salvin: common in the damp forests of Santo Tomás in the Zapata Swamp, common also in the forest near Paso Piedras on the Isle of Pines. The collection of a series of nine specimens shows that Bangs' race, *exsul*, from western Cuba and the Isle of Pines cannot be upheld. The race *exsul* (Proc. New Engl. Zool. Cl., 4:91, 1913) was separated on the basis of being less reddish and more dusky brown above, with the white spots on the dorsum being larger and more numerous. Dr. Paynter has assisted us by comparing Bangs' original series, which he notes show the characters enumerated by Bangs, but as in our series, these characters do not remain distinctive when additional specimens of later date are compared. Call: usual note (♂ ?) is a soft accelerating *Coooo-cooo-coo-cu-cu-cu*, etc., becoming somewhat higher pitched at the end. The reply (♀ ?) is an alto *hui, hui, hui, hui*, more clearly separable into syllables, and slower than the rather similar cry of the *Glaucidium.*

Caprimulgus cubanensis cubanensis (Lawrence): Nightjars were common in the region of Las Mercedes, Zapata Swamp, and near Lanier Swamp, Isle of Pines. The only specimen collected at the Zapata Swamp in mid-October, proved to be the migrant, *C. carolinensis* Gmelin.

Colaptes auratus chrysocaulosus Gundlach: noted commonly at one or two spots in the Sierra del Cristal in Oriente. A pair of specimens from this area are notably erythristic in coloration, apparently an uncommon characteristic of the Cuban population.

Riparia riparia riparia (Linnaeus): seen commonly in flocks during September in Pinar del Rio.

Corvus palmarum minutus Gundlach: found only at Finca La Manaja near Matahambre in Pinar del Rio where a flock of eight were seen. The "cao" is unknown now at Porto Experanza. Nearer the hills, through the pines to the bases of the sugar loaves, local information was that the crow (possibly this species) had been common in the past, but had disappeared along with the parrots and parakeets when the deciduous woods were lumbered. La Manaja has a deciduous grove. A pair weighed: ♂ 315; ♀ 263 gm. Call: a low *craa, craa.*

Vireo gundlachii Lembeye: a juvenal bird just ready to fly was taken at Soledad in mid-August. A gray specimen of this species, exhibiting the phenomenon of schizochroism, almost totally devoid of lipochrome pigment in the plumage, was collected on the Isle of Pines, Oct. 29, and another was seen. In color this specimen closely resembles the species *Vireo vicinior* Coues from the far western United States and northwest Mexico.

Dendroica pensylvanica (Linnaeus): a single specimen was taken in mangroves at Finca Dayaniguas Sept. 24.

Teretistris fernandinae (Lembeye): a common species in the lowlands at sea level from the eastern Zapata Swamp west, and also on the Isle of Pines. Weight: ♂ ♂ 11.5—13.75; ♀ ♀ 10.5, 10.75 gm. Not breeding at this time.

Teretistris fornsi Gundlach: seen only at 2500 feet above sea level in the mountains above Nicaro. Three females weighed: 10.5 (2); 11.25 gm.

Torreornis inexpectata Barbour and Peters: the Zapata Finch was seen three times in October near Las Mercedes, always in small flocks. The birds work over a low bush in much the same manner that warblers do, occasionally uttering a hissing note. Will respond to hissing by the observer. Local name "Gorrión." The following weights were recorded: ♂ ♂ 26.5, 27; ♀ ♀ 25, 27; ♀ 26 gm.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

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METEORITES IN THE COLLECTIONS OF YALE UNIVERSITY

KURT SERVOS[1]

ABSTRACT

More than 400 localities where meteorites fell are recorded in this first list compiled in more than fifty years. The list combines the catalogues of two major collections housed in Yale University: the Peabody Museum Collection and the Carl Bosch Collection, which has been catalogued and is now being published for the first time.

INTRODUCTION

H. S. Washington (1897, p. 83-87) was the last person to compile a catalogue of the meteorites in Yale collections. When he compiled that list the entire collection was a part of the Peabody Museum of Natural History and his list was essentially a revision and modernization of the catalogue that E. S. Dana had prepared in 1886. During the fifty years after Washington's compilation of the catalogue some accessions were added to the collection which did not find their way into other catalogues. In 1949, however, a great collection of minerals, the Bosch Collection, was provisionally deposited in the University and the meteorites in that collection are here listed for the first time. A short note previously called attention to the noteworthy specimens in that collection (Servos, 1954).

ACKNOWLEDGEMENTS

Professor Horace Winchell advised me in the compilation of this list and to him I express my sincere appreciation. Professor Harrison S. Brown and Mr. Walter Nichiporuk, both in the California Institute

[1] Present address: New York State Museum, Albany, New York.

of Technology, and Dr. E. P. Henderson of the U. S. National Museum gave valuable advice. Two undergraduate students, Richard F. LaGanza and Andrew N. Jergens, Jr., spent many hours working over the Peabody Museum Collection. The Department of Geology in Yale University generously gave financial aid in the form of the William E. Ford Scholarship and for this I express my profound gratitude.

Explanation of the List of Meteorites

The data in this list include merely the locality name, number of the specimen and the weight, with appropriate postillations in some cases. We have refrained from listing the synonymy, date of fall or find, and type of meteorite because that information is readily available in such standard references as Prior's *Catalogue of Meteorites*, as revised by Hey.

The assignment of serial numbers to specimens was arbitrary and these numbers do not represent either the number of falls or the number of individual fragments, but rather the approximate number of accessions to the collections. The meteorites in the Bosch Collection are identified by the prefix M (here listed under each individual locality); those in the Peabody Museum Collection have the prefix P; and the few meteorites in the Brush Mineral Collection are distinguished by the prefix B.

The guide for nomenclature of localities is Hey (1953). The synonymy established in that catalogue is followed here. Some obvious geographical errors appearing on the original labels have been corrected in making this list although, of course, the basic catalogue of the collections shows also the original data. Prior's Catalogue was useful in resolving such errors.

Many of the specimens in the Bosch Collection were originally acquired by trade or purchase from other collections or from supply establishments. In order to keep errors and confusion at a minimum, when these specimens can be traced directly to their source, the weights reported for these specimens are those given on the labels even though they may disagree slightly with the present weights of the specimens. For specimens that have more than one label showing different weights, the lower one is recorded here. The specimens in the Peabody Collection, on the other hand, were re-weighed and any discrepancy between the weight recorded here and the weight of the corresponding specimen in a previous list indicates that a portion of the specimen has been withdrawn from the Collection for trading or other use. Unless otherwise indicated, weights are given in grams.

Specific Notes in Reference to the List

Three pallasites from Mexico (M123, 2.29 g.; M551, 38 g.; and M552, 26.5 g.) in the Bosch Collection, found in 1893, have labels with insufficient information to assign them to specific localities.

About 26 specimens in the Peabody Museum Collection lack labels which would permit them to be assigned to specific localities.

The assignment of specimen P286 to Santa Rosa is made with more than a moderate amount of trepidation and uncertainty. The specimen was given by Wm. Huland, Esq. to Benjamin Silliman. H. S. Washington, in his Catalogue,[1] wrote that "G.J. Brush suggests that this is a specimen of the Otumpa Iron" but the original label has not been recovered. In an older catalogue, compiled in December 1868 by Professor G. J. Brush,[2] this specimen is described "Marked Meteoric Iron found in Columbia So. Am from Wm. Huland Esq London to B. Silliman. May this not be a specimen of the Tucuman (Otumpa) Iron? G.J.B."

Specimen P421 was acquired by Professor George R. Wieland in Mexico and was donated by him. Its assignment to Morito is uncertain but probably correct and is based on Wieland's reference to it as the "Humboldt Iron."[3]

The total weight of the Homestead fall in the Peabody Collection is 36,252 grams; the largest individual of this fall weighs 11,960 grams.

St. Augustine's Bay, Madagascar (P22) is listed despite the fact that it does not appear in most modern catalogues. Because information in the literature concerning the St. Augustine's Bay, Madagascar (P22) iron is scanty, the find is here tentatively listed under meteorites.

The specimen labelled Feroe Islands, North Sea (P204) is listed tentatively with the meteorites although precise information is lacking.

We consider Asheville (P20a) and Black Mountain (P20b) a "paired" fall but we list them separately because the information on their original labels does not permit more specific assignment.

Both the Bosch Collection and the Peabody Museum Collection contain some specimens of pseudometeorites which are not listed here because the information they offer has questionable value.

[1] Catalogue of the Collection of Meteoric Irons, Yale University, Peabody Museum. 1896. (MS in the Peabody Museum.)

[2] Meteoric Iron in Mineralogical Cabinet of Yale College. 1868. (MS in the Yale Peabody Museum.)

[3] Reference made at the time of donation.

LOCALITY	WEIGHT IN GRAMS
Admire, Lyon County, Kansas, U.S.A.	
M104	73.8
M455	85
M456	400
Agen, Lot-et-Garonne, France	
M105	0.80
P235	7
Ainsworth, Brown County, Nebraska, U.S.A.	
M214	11.2
P162 (1 pc—90 g., 1 vial—3 g.)	93
Akbarpur, Saharanpur district, India	
P173	1
Albareto, Modena, Italy	
M109	0.9
M114	0.1
Aleppo, Syria	
M113	0.95
Alessandria, Piedmont, Italy	
M107	15.05
Alfianello, Brescia, Italy	
M103 (2 pcs)	79.67
M539	81
P277 (3 pcs)	176
Algoma, Kewaunee County, Wisconsin, U.S.A.	
M233	12.4
Allegan, Allegan County, Michigan, U.S.A.	
M106	25.96
M518	18
P183	89
Alt Bela, Ostrava, Moravia, Czechoslovakia	
M218	10.22
Ambapur Nagla, Aligarh district, India	
M119	1.1
Anderson, Hamilton County, Ohio, U.S.A.	
M460	34.5
P85	6
Arispe, Sonora, Mexico	
M232	20
M402	590
Arlington, Sibley County, Minnesota, U.S.A.	
P128	10
Asheville, Buncombe County, North Carolina, U.S.A.	
P20a (vial with fragments)	36
Auburn, Lee County, Alabama, U.S.A.	
P281	2
Augustinovka, Ekaterinoslav, Ukraine	
M208	36.4
M212	6.2
M215	130
P135	103
Aumale, Alger, Algeria	
M205 (2 pcs)	35.55
Aumières, Lozère, France	
M120	17.34
Ausson, Haute Garonne, France	
M115	2.5
M499	19.8
P241	18
Babb's Mill, Greene County, Tennessee, U.S.A.	
M230	32.73
Bachmut, Ekaterinoslav, Ukraine	
P261	2
Bacubirito, Sinaloa, Mexico	
M311	65
M328	2.54
P155	98
Ballinoo, Murchison River, Western Australia	
M268	6.5
P114	75
Bandong, West Java	
M102	0.45
M545	4
Barbotan, Gers, France	
M534	51
P284 (2 pcs)	12

LOCALITY	WEIGHT IN GRAMS
BARRATTA, Deniliquin, County Townsend, New South Wales	
M100	113.5
M465	132
P28	106
BATH, Brown County, South Dakota, U.S.A.	
M98	200
M524	33
M562	16.7
P225 (2 pcs—42 g., 125 g.)	167
BATH FURNACE, Bath County, Kentucky, U.S.A.	
M101	4.95
BEAR CREEK, Jefferson County, Colorado, U.S.A.	
P53 (2 pcs—5 g., 151 g.)	156
BEARDSLEY, Rawlins County, Kansas, U.S.A.	
M457	37
P296a	42
P296b (2 pcs—6.9 g., 22.4 g.)	29.3
BEAVER CREEK, West Kootenay district, British Columbia	
M116	27.87
P180 (2 pcs)—12 g., 68 g.)	80
BELLA ROCA, Sierra de San Francisco, Santiago Papasquiaro, Durango, Mexico	
M209	135.58
M331	92
P99 (2 pcs—77 g., 328 g.)	405
BENARES, United Provinces, India	
P174 (2 pcs)	1
BENDEGÓ, Monte Santo, Bahia, Brazil	
M223	253
M229	53.97
P86 (2 pcs—2 g., 162 g.)	164
BERLANGUILLAS, Burgos, Spain	
P272	14
BIELOKRYNITSCHIE, Zaslavl, Volhynia, Ukraine	
M97	1.74
BILLINGS, Christian County, Missouri, U.S.A.	
M219 (3 pcs)	27.3
P203	15.5
BISCHTÜBE, Nikolaev, Turgai, Siberia	
M224	190.19
M432	1532
P133	361
BISHOPVILLE, Lee County, South Carolina, U.S.A.	
M87	1.65
M111	0.9
P50 (3 pcs—5 g., 58 g., 137 g.)	200
BITBURG, Trier, Germany	
M86 (37 pcs)	31.02
P8 (4 pcs)	64
BJURBÖLE, Borgå, Nyland, Finland	
M94	264.84
M411	635
M464	257
M541	33
P198	182
BLACK MOUNTAIN, Buncombe County, North Carolina, U.S.A.	
P20b	6
BLANSKO, Brno, Moravia, Czechoslovakia	
M110	2.38
BLUFF, Fayette County, Texas, U.S.A.	
M108	258.7
M418	950
P87a	338
P87b	434
P87c	61
P87d	78
BOHUMILITZ, Vimperk, Bohemia	
M211	130
M226	40.20
M259	54
P14	37
BORGO SAN DONINO, Parma, Italy	
P205	9

LOCALITY	WEIGHT IN GRAMS
BORI, Betul district, Central Provinces, India	
M95	12.32
M567	3.3
P160	30
BORKUT, Maramaros, Ruthenia, Ukraine	
M91	4.46
BOWDEN, Cape Province, South Africa	
M82	1.4
BRAUNAU, Trutnov, Bohemia	
M213	15
M216	4
P90	10
BREMERVÖRDE, Hanover, Germany	
M51	0.38
M495	1.5
BRENHAM TOWNSHIP, Kiowa County, Kansas, U.S.A.	
M72	249.2
M77	119
M79	28.55
M474	175
M475	113
M555	1.7
P101 (4 pcs—266 g., 567 g., 701.5 g., 1263.5 g.)	2798
P101b	21.5
P101c (dust)	4.8
P292	3671
P395	101.5 lbs.
B322	20.55
BRIDGEWATER, Burke County, North Carolina, U.S.A.	
M225	30.5
P107	19
BUR-GHELUAI, Bur-Hagaba district, Italian Somaliland	
M547	77
BURLINGTON, Otsego County, New York, U.S.A.	
P11	723
BUSCHHOF, Zemgale, Latvia	
M89 (12 pcs)	2.6
M533	1.2
BUSTEE, near Gorakhpur, Basti district, India	
P192	11.5
BUTLER, Bates County, Missouri, U.S.A.	
M231	12.17
P278	970
BUTSURA, Champaran district, Bihar, India	
P187	92
CACHIYUYAL, Atacama, Chile	
P260	2.5
CAÑON DIABLO, Coconino County, Arizona, U.S.A.	
M210	2378
M222	150
M228	80.25
M235	31.88
M237	122
M253	605
P103b	937
P103c	323
P103d	318
P103e	41
P103f	26
P103g	500
P103h	341
P103i (bottle with shavings)	1056.5
P103j (filings)	20.5
P103k (filings)	10
P103l (shavings)	20
P103m (shavings)	25.5
P103n (bottle with shavings)	1660
P103o (graphite nodule)	721
P400	374.6 kg.
B6134	429.5
CANTON, Cherokee County, Georgia, U.S.A.	
P111	82
CAPE GIRARDEAU, Cape Girardeau County, Missouri, U.S.A.	
P56 (10 fragments, 18 g., main mass, 1460 g.)	1478

LOCALITY	WEIGHT IN GRAMS
CAPE OF GOOD HOPE, Cape Province, South Africa	
M247	6.79
P5	8
CARLTON, Hamilton County, Texas, U.S.A.	
M243 (3 pcs)	13.43
M263	57.5
P100	172.5
CARTHAGE, Smith County, Tennessee, U.S.A.	
M238	12
M255	35.7
M257	370
P24	105
CASTALIA, Nash County, North Carolina, U.S.A.	
M88	0.2
P75	248
CASTINE, Hancock County, Michigan, U.S.A.	
P116	16
CHANDAKAPUR, Berar, Central Provinces, India	
P166	40
CHANTONNAY, Vendée, France	
M85	89.59
M396	176
M535 (4 pcs)	12.5
P283 (2 pcs—3 g., 41 g.)	44
CHARLOTTE, Dickson County, Tennessee, U.S.A.	
P404 (turnings)	1.5
CHARSONVILLE, Meung, Loiret, France	
M96	0.26
P250 (2 pcs)	16
CHASSIGNY, Haute Marne, France	
M92	1.3
CHÂTEAU-RENARD, Montargis, Loiret, France	
M15	41.34
M93	307
M498	26
P280 (2 pcs)	91
CHESTERVILLE, Chester County, South Carolina, U.S.A.	
M244	12.49
P27	751
CHINAUTLA, Guatemala	
M265	77.5
CHUPADEROS, Jimenez, Chihuahua, Mexico	
M439	2375
COAHUILA, Mexico	
M250 "Fort Duncan"	66.63
M251 "Bonanza"	293
M254 "Santa Estate," "Couch Iron"	53.5
M258	189.7
P49 "Bonanza"	48
P64a	1508
P64b	1502
P64c	2707
P88 "Sanchez Estate," "Couch Iron" (38 g., 379 g.)	417
P122 "Fort Duncan"	29
P122 "Fort Duncan" (dust)	1
COBIJA, Pampa of Santa Barbara, Antofagasta, Chile	
M90	35.04
P238	67
COLD BOKKEVELD, Cape Province, South Africa	
M548	1.6
P229 (2 pcs—13.1 g., 96.4 g.)	109.5
COLLESCIPOLI, Terni, Umbria, Italy	
M118 (2 pcs—7.2 g., 10.09 g.)	17.29
COOKEVILLE, Putnam County, Tennessee U.S.A.	
M260	85
COOPERTOWN, Robertson County, Tennessee, U.S.A.	
P231a (2 pcs)	120
P231b	695

LOCALITY	WEIGHT IN GRAMS
Cosby's Creek, Cocke County, Tennessee, U.S.A.	
M221	1
P17a	917
P17b (small fragments)	8.2
P17c (small fragments)	262
Costilla Peak, Taos County, New Mexico, U.S.A.	
M394	135
P150	172.5
Covert, Osborne County, Kansas, U.S.A.	
M458	1365
P405	1419
Crab Orchard Mountains, Rockwood, Cumberland County, Tennessee, U.S.A.	
M59	115.6
M473	8
P226	96
Cranberry Plains, Poplar Hill. Giles County, Virginia, U.S.A.	
P62	22
Cranbourne, Victoria, Australia	
M240	1
P134 "Beaconsfield"	148
P146 (2 pcs)	109
Cross Roads, Wilson County, North Carolina, U.S.A.	
P165	8
Cullison, Pratt County, Kansas, U.S.A.	
M74	85.6
Cumberland Falls, Whitley County, Kentucky, U.S.A.	
M470	155
Dalton, Whitfield County, Georgia, U.S.A.	
M241	8.2
P94	34
Dandapur, Gorakhpur district, India	
P211	32
Danville, Morgan County, Alabama, U.S.A.	
P193	11
Deep Springs, Rockingham County, North Carolina, U.S.A.	
M248	27.4
Denton County, Texas, U.S.A.	
P42	66
Deport, Red River County, Texas, U.S.A.	
M264	300
Descubridora, Catorce, San Luis Potosí, Mexico	
M413	363
P58	192.5
Dhurmsala, Kangra district, Punjab, India	
M60	217.5
M544	59
P233 (2 pcs)	93
Djati-Pengilon, Ngawi district, Java	
M69	1.27
P228 (2 pcs—0.5 g., 240 g.)	240.5
Drake Creek, Nashville, Sumner County, Tennessee, U.S.A.	
M34	1.2
P220 (2 pcs—4 g., 426 g.)	430
Duel Hill (1854), Walnut Mountains, Madison County, North Carolina, U.S.A.	
M278	14.17
P41a	4224
P41b	45
P41c	22
Dundrum, County Tipperary, Ireland	
P77	69
Dungannon, Scott County, Virginia, U.S.A.	
M262	250
Durala, Punjab, India	
M36	0.4
P213 (6 pcs)	2.5
Eagle Station, Carroll County, Kentucky, U.S.A.	
M62	76
M471	60
P95	70

LOCALITY	WEIGHT IN GRAMS
EHRENBERG, Yuma County, Arizona, U.S.A.	
P43	11
ELBOGEN, Bohemia	
M220	12
P7	8
EL CAPITAN RANGE, Lincoln County. New Mexico, U.S.A.	
M245	59.84
P113	252
ELM CREEK, Admire, Lyon County, Kansas, U.S.A.	
M76 (2 pcs—7.34 g., 8 g.)	15.34
P210	74
ENSISHEIM, Alsace, France	
M527	1.2
P118 (2 pcs)	18
ERGHEO, Brava, Italian Somaliland, East Africa	
M65	143.55
M496	183.5
M546	232
P406	57
ERXLEBEN, Magdeburg, Prussia	
P207	13
ESTACADO, Hale County, Texas, U.S.A.	
M64	162.87
M459	310
M479	1.8
M540	1.27
P200	410
ESTHERVILLE, Emmet County, Iowa, U.S.A.	
M61 (3 pcs)	40.26
M476	9.5
M477 (2 pcs—8 g., 22 g.)	30
P168 (2 pcs)	30
P168 (679 pcs)	48449
B320 (10 pcs)	93.05
FARMINGTON, Washington County, Kansas, U.S.A.	
M70	133.5
FARMINGTON—Continued	
M557	23.9
P230 (3 pcs—31 g., 45 g., 216 g.)	292
FEROE ISLANDS, North Sea	
P204	2
FINMARKEN, Arctic Norway	
M404	244.5
FISHER, Polk County, Minnesota, U.S.A.	
M63	46.4
M71	10
M408	680
FOREST CITY, Winnebago County, Iowa, U.S.A.	
M401	204
M440	720
M441	166
M560	27.3
M561	8
M575	47.6
P37a (3 pcs—7 g., 14 g., 74 g.)	95
P399 (991 pcs)	28066.5
B321	22.7
FORSYTH, Monroe County, Georgia, U.S.A.	
P196	132
FORSYTH COUNTY, North Carolina, U.S.A.	
M249	150.5
M261	487.2
FORT PIERRE, Stanley County, South Dakota, U.S.A.	
P36	346
P36 (shavings)	9.8
FRANKFORT (STONE), Franklin County, Alabama, U.S.A.	
P46	186
FRANKFORT (IRON), Franklin County, Kentucky, U.S.A.	
P54	37.5
FUTTEHPUR, Allahabad district, India	
P227	36

LOCALITY	WEIGHT IN GRAMS
GIBEON, Great Namaqualand, South-West Africa	
M287 "Mukerop"	435.5
M289 "Goamus Farm"	134
M294 "Mukerop"	380
M297 "Great Fish River"	195
M299 "Mukerop"	53.1
M300 "Lion River" (2 pcs—4 g., 26.3 g.)	30.3
M303 "Amalia Farm"	563.55
M304 "Gröndorn Farm"	2790
M308 "Mukerop"	296
M309 "Goamus Farm"	270
M414 "Mukerop"	852
M416 "Great Fish River"	1400
M417 "Amalia Farm"	1290
M579 "Mukerop"	*ca.* 100 lbs.
P33 "Lion River"	40
P45 "Amalia Farm"	6974
P141 "Mukerop"	950
GILGOIN STATION, Brewarrina, County Clyde, New South Wales	
M38	104.96
M410	701
M428	1316
P424	229
GIRGENTI, Sicily, Italy	
M68	1.35
M537	43
P170	66
GLORIETA MOUNTAIN, Santa Fe County, New Mexico, U.S.A.	
M239	40.2
P79a	2636.5
P79b	1091
P151	45
GNADENFREI, Silesia, Germany	
M32	0.75
GRAND RAPIDS, Kent County, Michigan, U.S.A.	
M242	36.2
M246	27.79
M301	82.2
P82a	624
P82b (2 pcs)	55
GROSNAJA, Mekensk, Terek, Caucasus	
M58	0.56
GROSSLIEBENTHAL, Odessa, Kherson, Ukraine	
M532	32.2
GRUVER, Hansford County, Texas, U.S.A.	
P409	17.4
GÜTERSLOH, Westphalia, Germany	
P32	4
GUILFORD COUNTY, North Carolina, U.S.A.	
P12	16
HAINHOLZ, Minden, Westphalia, Germany	
M73	68.5
M503	34.5
P38	8.5
HAMMOND TOWNSHIP, St. Croix County, Wisconsin, U.S.A.	
P96e	89.5
P96g	304
P396	22,730
HARRISON COUNTY, Indiana, U.S.A.	
P194	17
HARRISONVILLE, Cass County, Missouri, U.S.A.	
P407	1878
HENBURY, McDonnel Ranges, Central Australia	
M283 (6 pcs)	198
M284 (4 bombs)	169
M286	1180
P408a	385.5
P408b (4 pcs—37 g., 41 g. 45.5 g., 204.7 g.)	328.2
P408c	128.5
P408d (4 scoriaceous bombs)	151.2
P408e (4 iron-shale balls)	183.7
P408f (10 drops black silica glass)	7.7
P408g	1214

LOCALITY	WEIGHT IN GRAMS
Hessle, Upsala Sweden	
M43	132.2
M47 (2 pcs—4.85 g., 5.4 g.)	10.25
M507	32
P74 (2 pcs)	58
Hex River Mountains, Cape Province, South Africa	
M277	118
P108	46
Hoba, Grootfontein, South-West Africa	
M571 (shattered fragments in limestone)	631
Holbrook, Navajo County, Arizona, U.S.A.	
M425	78
M480 (3 pcs)	4
P51 (2 pcs)	75
P51 (4 pcs)	21
P51 (8 pcs)	82
P51 (6 pcs)	492
P51	1191
P51 (7 pcs	184
P51 (43 pcs)	223
Holland's Store, Chattooga County, Georgia, U.S.A.	
M269	34.6
P148	92
Homestead, Iowa County, Iowa, U.S.A.	
M40	48.25
M559	35.5
M576	105.8
P56 (21 pcs)	35,890
P267	362
Honolulu, Oahu, Hawaiian Islands	
M37 (3 pcs)	2.25
M42	14.75
P188	567
Hraschina, Zagreb, Croatia, Yugoslavia	
M234	0.4
P1	3
Huizopa, Temosachic, Guerrero district, Chihuahua, Mexico	
P293	294
Hungen, Hesse, Germany	
M542	21
Hvittis, Åbo, Finland	
M54 (3 pcs)	121.4
P212	76
Ibbenbühren, Westphalia Germany	
M56	0.5
Ilimaes (iron), Taltal, Atacama, Chile	
P158	172
Imilac, Desert of Atacama, Chile	
M52	34.29
M57 (2 pcs—13.96 g., 28.4 g.)	42.36
M415	1600
M434	16900
M481	10
M482	43
P13 (4 pcs—17 g., 34 g., 82 g., 177 g.)	310
P157 (2 pcs)	61
B319 (7 pcs)	26.75
Indarch, Shusha, Elisavetpol, Transcaucasia	
M31	135.9
M467	16
Indio Rico, Buenos Aires, Argentina	
M35 (2 pcs)	4.7
Itapicuru-Mirim, Maranhão, Brazil	
P248	6
Ivanpah, San Bernadino County, California, U.S.A.	
P70	4
Jackalsfontein, Beaufort West, Cape Province, South Africa	
M46	30.2
Jamestown, Stutsman County, North Dakota, U.S.A.	
M266	68.65

LOCALITY	WEIGHT IN GRAMS
JELICA, Serbia	
M44	125.37
M570	7.04
P179	29
JENNY'S CREEK, Wayne County, West Virginia, U.S.A.	
P279 (vial)	6
JEROME, Gove County, Kansas, U.S.A.	
M7 (2 pcs—2.52 g., 26.41 g.)	28.93
P181	242
P256 (7 fragments)	45
P256	501
P394	62 lbs.
JHUNG, West Punjab, Pakistan	
P25	16
JOE WRIGHT MOUNTAIN, Independence County, Arkansas, U.S.A.	
M270 (3 pcs)	149.58
M282	74
P97	104
JOHNSTOWN, Weld County, Colorado, U.S.A.	
P410	90
JONZAC, Charente-Inférieure, France	
P266 (2 pcs)	2
JUVINAS, Libonnès, Entraigues, Ardèche, France	
M501	21.6
P169 (2 pcs)	38
KABA, Debreczen, Hungary	
M18	0.27
P195 (vial)	4
KANSAS CITY, Missouri, U.S.A.	
P422	1.12
KENDALL COUNTY, Texas, U.S.A.	
M285	123.5
P112	186
KENTON COUNTY, Kentucky, U.S.A.	
M273	164.9
M409	447
P264	5670
KERILIS, Mäel Pestivien, Callac, Côtes-du-Nord, France	
M10	0.89
P271	4
KERMICHEL, Vannes, Morbihan, France	
P159	70
KERNOUVÉ, Morbihan, France	
M6	172.6
M497	12
P282 (vial)	3
P282 (14 pcs)	14
KESEN, Iwate, Honshū, Japan	
M22	5.27
M543	5
P239	423
KHAIRPUR, Bahawalpur State, Pakistan	
P215	8
KISSIJ, Chistopol, Kazan, Russia	
M5	22.48
KNYAHINYA, Nagy-Bereszna, Ungvar, Czechoslovakia	
M4	87.3
M8 (2 pcs—9.96 g., 10.95 g.)	20.91
P218 (2 pcs)	66
KODAIKANAL, Palni Hills, Madura district, Madras, India	
M271	74.21
M397	31.9
KRÄHENBERG, Zweibrücken, Rhenish Bavaria	
M25	2.65
M568	0.4
P268	1.5
KRASNOJARSK, Yeniseisk, Siberia	
M11	24.4
M207	3.5
M469	16
M488	94.2
M492	6
P110 (2 pcs—16 g., 432 g.)	448
P110a	1346
B306	126
B307 (2 pcs—7 g., 15.3 g.)	22.3

LOCALITY	WEIGHT IN GRAMS
Kyushu, Japan	
M126	96.55
M516	37.8
P176	12
Laborel, Drôme, France	
M27	1.15
P246	8
La Caille, Grasse, Alpes Maritimes, France	
M281	24.7
P411 (dust)	0.5
La Grange, Oldham County, Kentucky, U.S.A.	
M276	28.79
P60	46
L'Aigle, Orne, France	
M28	115.45
M538	20
P199 (2 pcs—2 g., 907 g.)	909
Lancé, Vendôme, Loir-et-Cher, France	
M13	36.7
M563	35
P276	26
Lançon, Bouches-du-Rhône, France	
M20	0.64
La Primitiva, Santa Catalina, Desert of Tarapaca, Chile	
M325	25
Lénártó, Sáros, Czechoslovakia,	
M272	18.4
M275	39.69
P9	121
Le Pressoir, Indre-et-Loire, France	
M17	0.1
P275	4
Lexington County, South Carolina, U.S.A.	
P68	49.5
Lime Creek, Claiborne, Monroe County, Alabama, U.S.A.	
M274	59.94
P15	64
Limerick County, Ireland	
P273	0.5

LOCALITY	WEIGHT IN GRAMS
Lissa, Bunzlau, Bohemia	
M1	48.38
M506	11
Little Piney, Pulaski County, Missouri, U.S.A.	
P177	24
Lixna, Dvinsk, Latvia	
M2	8.7
Locust Grove, Henry County, Georgia, U.S.A.	
M279	187.22
M431	1824
Long Island, Phillips County, Kansas, U.S.A.	
M122	138.3
M522	296
P209	150
Losttown, Cherokee County, Georgia, U.S.A.	
P121	3
Lucky Hill, Bellevue, St. Elizabeth, Jamaica	
M267 (2 pcs—15.04 g., 21.2 g.)	36.24
M280	3.8
Luis Lopez, Socorro County, New Mexico, U.S.A.	
M292	34.5
P153	57
Luotolax, Viborg, Finland	
M125	0.5
Macáu, Rio Grande do Norte, Brazil	
M124	2.75
P136	9.5
Madoc, Hastings County, Ontario, Canada	
P35	26
Magura, Árva, Czechoslovakia	
M288	79.95
M298	8.8
M307	105
P18a	822

LOCALITY	WEIGHT IN GRAMS
MAGURA—Continued	
P18b	300
P18c (2 small fragments—3 g.)	3
P18d (dust)	2.8
MANBHOOM, Bengal, India	
M121	4.48
MARION, Linn County, Iowa, U.S.A.	
M39	39.8
M558	17.5
P163 (2 pcs—368.5 g., 652 g.)	1020.5
B310	9.6
MARJALAHTI, Viipuri, Finland	
M137	65.57
M462	61
MASCOMBES, Corrèze, France	
P253	21.9
MAUERKIRCHEN, Upper Austria	
M138	29.45
M569	4.3
P98	12
McKINNEY, Collin County, Texas, U.S.A.	
M127	184.26
M128	13.55
M395	260
M436	717
M478	264
P184	104
P208	135
MENOW, Alt-Strelitz, Mecklenburg, Germany	
M131	7.1
MERCEDITAS, Chañaral, Atacama, Chile	
M295	10
M317	16.38
M366	173.7
P115	18
MERN, Praesto, Denmark	
M78	15
M129	170.35
M485	19.9
MEZÖ-MADARAS, Transylvania	
M135	66.79
M564	32.6
P244	20
MIGHEI, Olviopol, Kherson, Ukraine	
M132 (2 pcs—0.92 g., 14.63 g.)	15.55
M442	2
M443	20
M531	3
P242	27
MILENA, Varazdin, Croatia, Yugoslavia	
M139	51.39
P219	6.8
MINAS GERAIS, Brazil	
P223	30
MINCY, Taney County, Missouri, U.S.A.	
M130	118.92
M574	82.4
P140	7
P217	67
MISSHOF, Courland, Latvia	
M146	1.95
P190	24
MISTECA, Oaxaca, Mexico	
M302	179.62
M412	145
P124	10
Mocs, Cluj, Transylvania	
M136	115.41
M430	735
M493	128
M504	32
P243	23
P247 (2 pcs)	92
MODOC (1905), Scott County, Kansas, U.S.A.	
M520 (2 pcs)	6
P164	121
MONROE, Cabarrus County, North Carolina, U.S.A.	
M19	0.45
P186	232

LOCALITY	WEIGHT IN GRAMS
MONTE MILONE, Macerata, Italy	
P245	3.5
MOORANOPPIN, County Lansdowne, Western Australia	
M290	26.2
P117	4
(?)MORITO, Chihuahua, Mexico	
P421	*ca.* 17 lbs.
MORRISTOWN, Hamblen County, Tennessee, U.S.A.	
M134	90.73
M472	8
P252	114
MOTTA DI CONTI, Casale, Piedmont, Italy	
M148	0.9
MOUNT BROWNE, County Evelyn, New South Wales	
M141 (2 pcs—0.8 g., 80.5 g.)	81.3
MOUNT DYRRING, Singleton district, County Durham, New South Wales	
M133 (2 pcs)	64.95
M572	444
MOUNT EDITH, Ashburton district, Western Australia	
P137	205
MOUNT JOY, Adams County, Pennsylvania, U.S.A.	
M296	50
M305	264.75
P120 (12 pcs)	280
MOUNT STIRLING, York, South-West Division, Western Australia	
M334	113
P144	249
MOUNT VERNON, Christian County, Kentucky, U.S.A.	
M140 (4 pcs)	81.15
MUNGINDI, County Benarba, New South Wales	
M314	111.20
P287	37
MUONIONALUSTA, Kiruna, Norrbotten, north Sweden	
M323	207
M438	915
MURPHY, Cherokee County, North Carolina, U.S.A.	
P130 (2 pcs)	202
NAKHLA, Abu Hommos, Alexandria, Egypt	
P214	25
NANJEMOY, Charles County, Maryland, U.S.A.	
P127	879
NARRABURRA CREEK, Temora, County Bland, New South Wales	
M329	0.1
NEJED, Central Arabia	
M315	106.9
P92	30
NELSON COUNTY, Kentucky, U.S.A.	
M322	6.6
M327	97.95
P40	112
B309 (2 pcs—12.05 g., 79.05 g.)	91.10
NENNTMANNSDORF, Pirna, Saxony	
P66	47.5
NERFT, Courland, Latvia	
M154 "Swajahn"	8.37
M155 "Swajahn"	14.2
M505 "Swajahn"	38
P216 "Swajahn"	48
NESS COUNTY (1894), Kansas, U.S.A.	
M151	134.87
M521	7
P197 (4 pcs—4 g., 30 g., 174 g., 493 g.)	701
NETSCHAËVO, Tula, Russia	
M313 (2 pcs—3 g., 16.3 g.)	19.3
M321	38
P69	31

LOCALITY	WEIGHT IN GRAMS
NEW CONCORD, Muskingum County, Ohio, U.S.A.	
M149	74.4
M519	22.3
P167a	284
P167b	6718
B301	447.05
NGAWI, Madioen, Java	
M145	6.03
N'GOUREYMA, Jenne, Massina, French West Africa	
M320	148.3
M435	396
P152	87
NIAGARA, Grand Forks County, North Dakota, U.S.A.	
P93	19
NOBLEBOROUGH, Lincoln County, Maine, U.S.A.	
M143	0.1
P201	6
NOCOLECHE, Wanaaring, County Ularara, New South Wales	
M316	40
P76	7
NOGOYA, Entre Rios, Argentina	
M166 (2 pcs)	1
P139 (4 pcs)	9
NOVO-UREI, Karamzinka, Nizhni-Novgorod, Russia	
M147	14.32
OAKLEY (STONE), Logan County, Kansas, U.S.A.	
M152	242.07
M407	732
M573	197
P234	102
OBERNKIRCHEN, Bückerberg, Rinteln, Hesse-Nassau, Germany	
P91	90
OCHANSK, Perm, Russia	
M198 (3 pcs)	123.43
M513	96
P142 (3 pcs)	190
ODESSA, Ector County, Texas, U.S.A.	
P294	85
OESEL ISLAND, Esthonia, Baltic States	
M53	7.55
M528	2.9
P257 (5 pcs)	7
OKTIBBEHA COUNTY, Mississippi, U.S.A.	
P84	0.5
OLIVENZA, Badajoz, Spain	
M429	525
M511	51
ORANGE RIVER (IRON), South Africa	
P39	18
ORGUEIL, Montauban, Tarn-et-Garonne, France	
M164	4.59
M167	3.92
P425	1.5
ORNANS, Doubs, France	
P258 (1 pc—86 g., vial—3 g.)	89
ORVINIO, Rome, Italy	
M162	4.33
OTTAWA, Franklin County, Kansas, U.S.A.	
M168	4.7
OTUMPA, Gran Chaco Gualamba, Argentina	
M227	8
PACULA, Jacala, Hidalgo, Mexico	
M174	8.39
P290 (2 pcs)	2.5
PARAGOULD, Greene County, Arkansas, U.S.A.	
P297	6
PARNALLEE, Madura district, Madras, India	
M156	20.1
M515	8
P191 (2 pcs—1899 g., 9 fragments—44 g.)	1943

LOCALITY	WEIGHT IN GRAMS
PAVLODAR (PALLASITE), Semipalatinsk, Siberia	
M157	7.79
M491	4.2
PAVLOGRAD, Ekaterinoslav, Ukraine	
M144 (2 pcs)	1.31
P251 (2 pcs)	19
PERSIMMON CREEK, Cherokee County, North Carolina, U.S.A.	
M332 (2 pcs—3.4 g., 18.82 g.)	22.22
PETERSBURG, Lincoln County, Tennessee, U.S.A.	
M171	1.05
P171 (stone—14 g., 2 vials—10 g.)	24
PILLISTFER, Estonia	
M170 "Aukoma"	12.9
M489 "Aukoma"	35
P224	12
PIPE CREEK, Bandera County, Texas, U.S.A.	
M160	25.38
P288 (3 pcs)	54
PITTSBURG, Allegheny County, Pennsylvania, U.S.A.	
P26	158
PLAINVIEW (1917), Hale County, Texas, U.S.A.	
P285	276
P412a	2029
P412b	285.5
P412c	148.5
PLYMOUTH, Marshall County, Indiana, U.S.A.	
M318	44.6
M403	393
P105a	111
P105b	94
PONCA CREEK, Holt County, Nebraska, U.S.A.	
P48	4
POTTER, Cheyenne County, Nebraska, U.S.A.	
P413	486
PRAIRIE DOG CREEK, Decatur County, Kansas, U.S.A.	
M169	96.1
PRICETOWN, Highland County, Ohio, U.S.A.	
M173	1.05
PULTUSK, Warsaw, Poland	
M26 "Lerici"	0.14
M158	252.55
M159 (18 pcs)	86.8
M163	2.4
M426	87
M468	54.5
M490	17
M512	141
M529	400
P237 (13 pcs)	675
B303	69.15
B304	44.4
PUQUIOS, Copiapo, Atacama, Chile	
M293	70.1
P102 (2 pcs)	39
PUTNAM COUNTY, Georgia, U.S.A.	
M310	2.2
M330	22
P16a	290
P16b (dust)	1.2
B311	82.5
QUENGGOUK, Bassein district, Lower Burma	
M165	2.09
RAKOVKA, Tula, Russia	
P414	0.3
RED RIVER, Texas, U.S.A.	
P401a	1635 lbs.
P401b (chips)	16.3
P401c (dust)	2.3
REED CITY, Osceola County, Michigan, U.S.A.	
M326	122.9
RENAZZO, Cento, Ferrara, Italy	
M161	0.85

LOCALITY	WEIGHT IN GRAMS
Richardton, Stark County, North Dakota, U.S.A.	
M398	198
P415	1428
Richmond, Chesterfield County, Virginia, U.S.A.	
P129	254
Rochester, Fulton County, Indiana, U.S.A.	
P202 (2 pcs—6 g., 8 g.)	14
Rodeo, Durango, Mexico	
M319	163.05
M422	100
Roebourne, Hamersley Range, North-West Division, Western Australia	
M291	315
M399	265
P126	33
Rosario, Honduras	
P125	8
Roy, Harding County, New Mexico, U.S.A.	
P416	462.2
Ruff's Mountain, Lexington County, South Carolina, U.S.A.	
M333	47.45
P30	510
Russel Gulch, Gilpin County, Colorado, U.S.A.	
P55	121
Sacramento Mountains, Eddy County, New Mexico, U.S.A.	
M324	123
M335	195
M336 (2 pcs—2.07 g., 133.95 g.)	136.02
M406	250
P274	4692
St. Augustine's Bay, Madagascar	
P22	7
St. Caprais-de-Quinsac, Gironde, France	
M175	0.45
St. Francois County, Missouri, U.S.A.	
P47	68
St. Genevieve County, Missouri, U.S.A.	
M339	413
P149	174
St. Mark's Mission Station, Transkei, Cape Province, South Africa	
M176 (2 pcs—2.57 g., 26.45 g.)	29.02
St. Mesmin, Aube, France	
M178	8.45
M500	5.6
St. Michel, Finland	
M463	95
Saline Township, Sheridan County, Kansas, U.S.A.	
M188	66.9
M189	146.1
M523	43.2
Salt Lake City, Utah, U.S.A.	
P221	631
Salt River, Bullitt County, Kentucky, U.S.A.	
P29	751
P29 (dust)	7
San Angelo, Tom Green County, Texas, U.S.A.	
M337	60.19
M341	800
M351	61
P123	66
San Cristobal, Antofagasta, Chile	
M306	129.3
M338	0.2
M348	14.2
M454	355
Sandia Mountains, Albuquerque, New Mexico, U.S.A.	
P423	10
San Emigdio Mountains, Kern County, California, U.S.A.	
P249 (2 pcs)	6

LOCALITY	WEIGHT IN GRAMS
SANTA APOLONIA, Natívitas, Tlaxcala, Mexico	
M236	23.4
SANTA CATHARINA, Brazil	
M187	275.9
M346	342.1
P67 (5 pcs)	145
P67 (164 pcs)	370
SANTA ROSA, Tunja, Boyaca, Colombia	
M312 "Rasgata" (2pcs—2.11 g., 2.54 g.)	4.65
M343 "Tocavita" (2 pcs—16.6 g., 19.42 g.)	36.02
M357 "Tocavita"	10
M419 "Rasgata"	255
P78 "Tocavita" (2 pcs)	13
P286	56
SÃO JULIÃO DE MOREIRA, Ponte de Lima, Minho, Portugal	
M342	36.87
M345	415.5
M352	23.7
M354	1180
M370	139.8
P132	45
SAREPTA, Saratov, Russia	
M347	19.12
M353	101
SCHÖNENBERG, Pfaffenhausen, Swabia, Bavaria	
M177	0.27
SCHWETZ, Kwidzyn, Poland	
P289	257
SCOTT CITY, Scott County, Kansas, U.S.A.	
M405	52
SCOTTSVILLE, Allen County, Kentucky, U.S.A.	
M349	276.77
P80 (2 pcs)	52
P80b	33
SEARSMONT, Waldo County, Maine, U.S.A.	
M553	1.5
P138 (4 pcs)	12
SEELÄSGEN, Schwiebus, Brandenburg, Germany	
M340	37.56
M350	10.4
M356	32.85
P291 (2 pcs—4 g., 75 g.)	79
P291	88
P291 (dust)	4.6
SEGOWLIE, Bettiah, Champaran district, Bihar, India	
P232	45
SELMA, Dallas County, Alabama, U.S.A.	
M184	0.5
SENECA FALLS, Cayuga County, New York, U.S.A.	
P31	382
SERES, Macedonia	
M193	0.28
M200	1.85
SHALKA, Bishnupur, Bankura district, west Bengal, India	
M179	10.29
P189 (1 pc—1 g., 1 vial—3 g.)	4
SHELBURNE, Grey County, Ontario, Canada	
M180	50.93
M461	49
M517	56.2
P182	165
SHINGLE SPRINGS, El Dorado County, California, U.S.A.	
P59a	433.5
P59c (turnings in bottle)	9.3
SHREWSBURY, York County, Pennsylvania, U.S.A.	
P259	90
SIENA, Tuscany, Italy	
M185	4.68
P270 (3 pcs)	9
SILVER CROWN, Laramie County, Wyoming, U.S.A.	
M368	133.5
P109	46

LOCALITY — WEIGHT IN GRAMS

Sioux County, Nebraska, U.S.A.
P417 .... 28.5

Slobodka, Yukhnov, Smolensk, Russia
P255 (2 pcs) 23

Smithland, Livingston County, Kentucky, U.S.A.
P418 (dust) 0.9

Smith's Mountain, Rockingham County, North Carolina, U.S.A.
P419 (dust) 6

Smithville, DeKalb County, Tennessee, U.S.A.
M359 .... 10.83
M360 .... 77.48
M377 48
M378 37
P21 61

Soko-Banja, Aleksinac, Serbia
M203 .... 1.3
M509 43
M510 .... 54.5
P254 (2 pcs) 22

Ställdalen, Nya Kopparberg, Örebro, Sweden
M202 .... 36.4
P145 23

Stannern, Iglau, Moravia, Czechoslovakia
M186 .... 162.17
M466 80
M526 .... 14.3
P6 (3 pcs) 109

Staunton, Augusta County, Virginia, U.S.A.
M365 .... 119.03
M400 .... 356.5
P61a 74
P61b 879

Steinbach, Erzgebirge, Saxony
M172 .... 29.4
M424 .... 34.5
P2 (2 pcs) 3
P71 23

LOCALITY — WEIGHT IN GRAMS

Tabor, Bohemia
M182 .... 44.7

Tadjera, Sétif, Constantine, Algeria
P10 .... 27.5

Tambo Quemado, Peru
B6109 .... 42.5

Tarapaca, Chile
M355 .... 18.5
P402 17

Tazewell, Claiborne County, Tennessee, U.S.A.
M358 .... 130.77
P34 407
B308 (2 pcs—9.45 g., 27.35 g.) 36.80

Tennasilm, Esthonia, Baltic States
M437 3825
P175 143

Thunda, Windorah, County Grey, Queensland
M363 .... 49.1
P106 (3 pcs) 168

Thurlow, Hastings County, Ontario, Canada
M373 .... 21.09

Tieschitz, Přerov Moravia, Czechoslovakia
M14 (2 pcs—2.5 g., 7.13 g.) 9.63

Tjabé, Padang, Rembang, Java
M514 .... 0.8
P65 (3 pcs) 1

Tocopilla, Antofagasta, Chile
M392 .... *ca.* 36.4 lbs.

Toluca, Mexico State, Mexico
M362 .... 338.9
M367 .... 323.63
M371 .... 26.1
M374 1602
M376 38
M380 420
M433 3475
M565 10
P3a 968
P3b 444

LOCALITY	WEIGHT IN GRAMS
TOLUCA—Continued	
P4 (3 pcs—8 g., 11 g., 865 g.)	884
B302	26.2
B318 (shavings in vial)	
B5221	35.5
B6129 (Poinsett Iron)	0.2
TOMBIGBEE RIVER, Choctaw and Sumter County, Alabama, U.S.A.	
M252	263.5
M393	157
P143	497
TOMHANNOCK CREEK, Rensselaer County, New York, U.S.A.	
M48	0.6
P185	13
TONGANOXIE, Leavenworth County, Kansas, U.S.A.	
M375	40
P131	128
TOUBIL RIVER, Achinsk, Yeniseisk, Siberia	
M379	67.7
P156	28
TOURINNES-LA-GROSSE, Tirlemont, Belgium	
M45	15.95
M508	2.4
TRENTON, Washington County, Wisconsin, U.S.A.	
M364 (2 pcs—22.77 g., 80.6 g.)	103.37
P63a	48
P63b	65
P63c	19
P63d (dust)	2
TRENZANO, Brescia, Italy	
M190	33.29
M194	64.5
M486	2.3
P269	42
TRYON, McPherson County, Nebraska, U.S.A.	
P420	446.8

LOCALITY	WEIGHT IN GRAMS
TUCSON, Pima County, Arizona, U.S.A.	
M369 "Signet Iron"	160.37
P52 (?)	31
P83a "Signet Iron"	79.5
P83b "Carleton"	158
P83c "Signet Iron" (dust)	12.8
TYSNES ISLAND, Hardanger fiord, Norway	
M530	2
UMBALA, Punjab, India	
P222	1
UNION COUNTY, Georgia, U.S.A.	
P154	216
UTRECHT, Holland	
M536	3.9
P172	4
VACA MUERTA, Taltal, Atacama, Chile	
M16 "Doña Inez"	15.6
M23 "Llano del Inca"	41.8
M33 "Llano del Inca"	26.24
M67 "Doña Inez"	86.5
M192 "Cerro la Bomba"	12.21
M195 "Cerro la Bomba"	151.2
M196 (6 pcs)	2.2
M197 "Mejillones"	1
M199	62.7
M201	46.25
M206	29.6
M483 "Doña Inez"	53.7
M484 "Llano del Inca"	37.6
M549 "Cerro la Bomba"	55
M550 "Cerro la Bomba"	19
P72 "Sierra de Chaco"	40
P236 "Doña Inez" (3 pcs)	57
P403 "Llano del Inca" (3 pcs)	92
VAVILOVKA, Kherson, Ukraine	
M191	3.04
VERAMIN, Karand, Tehrān, Persia	
M487	35

LOCALITY	WEIGHT IN GRAMS
VERKHNE UDINSK, Transbaikal, Siberia	
P119	22
VICTORIA WEST, Cape Province, South Africa	
M372	16.2
VIGARANO, Ferrara, Italy	
M204	44.29
M427	1398
P240	87.5
VOUILLÉ, Poitiers, Vienne, France	
M55	0.55
M502	3.3
P265 (3 pcs)	74
WACONDA, Mitchell County, Kansas, U.S.A.	
M41 (2 pcs—11.57 g., 15.07 g.)	26.64
M49	38.47
M556	46.5
P262 (7 pcs)	160
WALKER COUNTY, Alabama, U.S.A.	
M361	7.92
P23a	350
P23b	21
WARRENTON, Warren County, Missouri, U.S.A.	
P57 (5 pcs—2 g., 4 g., 6 g., 68 g., 107 g.)	187
WEAVER MOUNTAINS, Wickenburg, Maricopa County, Arizona, U.S.A.	
M385	88.4
WELLAND, Welland County, Ontario, Canada	
M383	44.67
M387	28
M388	55
P104	57
WESSELY, Hradisch, Moravia, Czechoslovakia	
M12 (3 pcs)	0.27
WESTON, Fairfield County, Connecticut, U.S.A.	
M554	3.8
WESTON—Continued	
P81a	32.3 lbs.
P81b	160
P81c (11 small pcs and vial)	47
B305	17.35
WHITMAN, Grant County, Nebraska, U.S.A.	
M81 (3 pcs)	3.59
WICHITA COUNTY, Texas, U.S.A.	
M386	46.21
P89	167
WILLAMETTE, Clackamas County, Oregon, U.S.A.	
M381 (2 pcs—34.09 g., 242.5 g.)	276.59
WILLIAMSTOWN, Grant County, Kentucky, U.S.A.	
M389	38.7
P161	80
WOLD COTTAGE, Thwing, Scarborough, Yorkshire, England	
P73	1
YATOOR, Nellore, Madras, India	
M9	0.1
P178	27
YOUNDEGIN, Avon, South-West Division, Western Australia	
M384 (2 pcs—1.46 g., 101.33 g.)	102.79
M391	756.8
P147	124
ZABORZIKA, Zhitomir, Volhynia, Ukraine	
P206	22
ZACATECAS, Mexico	
M382 (2 pcs—15 g., 21.75 g.)	36.75
M390	30
ZAVID, Zvornik, Bosnia, Yugoslavia	
M24	74.95
M29	69
M566	66.5

LOCALITY	WEIGHT IN GRAMS
ZEBRAK, Hořovice, Beraun, Bohemia	
M21	19.91
M494	3
ZSADÁNY, Temes district, Romania	
M3	1.42

THIN SECTIONS

P277 Alfianello, Brescia, Italy
P225 Bath, Brown County, South Dakota, U.S.A.
P56 Cape Girardeau, Cape Girardeau County, Missouri, U.S.A.
M65 Ergheo, Brava, Italian Somaliland, East Africa
P230 Farmington, Washington County, U.S.A.
P51 Holbrook, Navajo County, Arizona, U.S.A.
P282 Kernouvé, Morbihan, France
P239 Kesen, Iwate, Honshū, Japan
P218 Knyahinya, Nagy-Bereszna, Ungvar, Czechoslovakia
P247 Mocs, Cluj, Transylvania
P186 Monroe, Cabarrus County, North Carolina, U.S.A.
P167 New Concord, Muskingum County, Ohio, U.S.A.
P171 Petersburg, Lincoln County, Tennessee, U.S.A.
P237 Pułtusk, Warsaw, Poland
P221 Salt Lake City, Utah, U.S.A. (2 sections)
P6 Stannern, Iglau, Moravia, Czechoslovakia
P262 Waconda, Mitchell County, Kansas, U.S.A.
Kansas, U.S.A. (2 sections without further information)

POLISHED SECTIONS

P296 Beardsley, Rawlins County, Kansas, U.S.A.
P101 Brenham Township, Kiowa County, Kansas, U.S.A.
P103 Cañon Diablo, Coconino County, Arizona, U.S.A.
P168 Estherville, Emmet County, Iowa, U.S.A.
Gladstone, Union County, New Mexico, U.S.A.
P409 Gruver, Hansford County, Texas, U.S.A.
P51 Holbrook, Navajo County, Arizona, U.S.A.
Hugoton, Stevens County, Kansas, U.S.A.
LaLande, De Baca County, New Mexico, U.S.A.
B309 Nelson County, Kentucky, U.S.A.
P142 Ochansk, Perm, Russia
P294 Odessa, Ector County, Texas, U.S.A.
P297 Paragould, Greene County, Arkansas, U.S.A.
P412 Plainview, Hale County, Texas, U.S.A.
B311 Putnam County, Georgia, U.S.A.
P416 Roy, Harding County, New Mexico, U.S.A.
B9252 São Julião de Moreira, Minho, Portugal (schreibersite)
B308 Tazewell, Claiborne County, Tennessee, U.S.A.
P420 Tryon, McPherson County, Nebraska, U.S.A.
Weldona, Morgan County, Colorado, U.S.A.

MISCELLANEOUS

I. *Tektites*

LOCALITY	WEIGHT IN GRAMS
australite	
M80 (3 pcs)	9.69
M421 (3 pcs)	48.13
M453	12.83
billitonite	
M217 (3 pcs)	66.77
M423	31.75
M450	2.58
M451 (4 pcs)	
Darwin glass	
M80 (3 pcs)	7.78
M452	5.82

LOCALITY	WEIGHT IN GRAMS
moldavite	
M420	16.03
M444 (2 pcs—0.80 g., 39.57 g.)	40.37
M445	12.11
M446	23.98
M447	5.85
M448	21.73
M449 (2 pcs)	29.59
B6844	6.95
II. *Meteoritic minerals*	
cohenite	
P9253 Cranbourne	1.5
P9253 Magura	1
kamacite	
P9254 Cranbourne	2
rhabdite	
B177 France	0.6
schreibersite	
P9252 São Julião de Moreira	12.8
taenite	
P9255 Cranbourne	2
P9255 Toluca	2.5
III. *Impactite*	
impactite (15 pcs)	
P103z Meteor Crater, Coconino County, Arizona, U.S.A.	24.57

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Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

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THE SPECIES OF *NOTHARCTUS* FROM THE MIDDLE EOCENE

PETER ROBINSON[1]

Granger and Gregory (1917) recognized eight species of *Notharctus* from the middle Eocene of North America. These were all recorded from the Bridger formation. In the light of recent studies of natural populations this seems too high a number. The material has been restudied to discover if there are significant differences in morphology between *Notharctus* specimens from the same locality; if populations from various localities differ significantly within a given member; if there are stratigraphically separable variations; and if non-Bridger middle Eocene *Notharctus* specimens belong to the same species as Bridger specimens. These studies show that there are only three valid species of *Notharctus* in that part of the middle Eocene, represented by Bridger B, C, and D.

Osborn (1902, p. 191) considered that the genus *Notharctus* Leidy was separable from the lower Eocene genus *Pelycodus* Cope by the following characters, "Jaw stout. Symphysis typically coössified. Superior molars quadrate, with pronounced hypocone; a mesostyle." This distinction breaks down: *Pelycodus jarrovi* has quadrate molars and a pronounced hypocone. The genera *Pelycodus* and *Notharctus* need thorough revision.

Since lower jaws are the commonest mammalian remains, the statistical studies have been based mainly on them. The mor-

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phology of all teeth has been studied. Species are differentiated solely on dental characters, as there is not sufficient skeletal material for any statistical study.

I have used the following abbreviations:

A.M.N.H. . . .	American Museum of Natural History
Y.P.M.	Yale Peabody Museum
Univ. Wyo. . .	University of Wyoming
U.S.N.M. . . .	United States National Museum
OR	observed range
N	number in sample
M	mean
M	(with a superscript or subscript) molar
S	standard deviation
V	coefficient of variability
W tr	width of trigonid
W tal	width of talonid
W max	maximum width
L	length
P	(with a superscript or subscript) premolar

ACKNOWLEDGEMENTS

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Dr. Joseph T. Gregory of the Yale University geology department has helped and guided this project since he first suggested it in 1952.

I am greatly indebted to my wife for typing the manuscript.

Stratigraphic Occurrence

THE BRIDGER FORMATION

The Bridger formation of southwestern Wyoming was divided by Mathew (1909) into five members, A-E in ascending order. Wood (1934) included A and B in the Black's Fork member, C and D in the Twin Buttes member, and omitted the unfossiliferous E from the discussion of faunal correlation or member rank. The specimens of *Notharctus* that have been studied come from B and C and D.

Twin Buttes member localities listed below have produced 81 specimens of *N. robustior* and 6 specimens of *N. gracilis*:

Beaver Creek
Birch Creek
Burnt Fork
Burnt Fork Post Office
Dry Creek
Henry's Fork
Henry's Fork Divide
Henry's Fork Hill
Lane Meadows
Lonetree
Sage Creek
Summers Dry Creek
Twin Buttes

Black's Fork member localities yielded 86 specimens of *N. tenebrosus* and 7 specimens of *N. gracilis*:

Black's Fork
Church Buttes
Cottonwood Creek
Granger Station
Five miles south of Granger
Six miles south of Granger
Grizzly Buttes
Little Dry Creek
Millersville
Five miles east of Millersville

In Bridger B, *N. gracilis* and *N. tenebrosus* occur at all levels. In Bridger C and D, *N. tenebrosus* is replaced by its descendant *N. robustior* and *N. gracilis* is present and apparently unchanged. *N. tenebrosus* and *N. gracilis* also occur at the same localities in Bridger B and *N. robustior* and *N. gracilis* are found together in Bridger C and D. There are no changes in *N. tenebrosus* or *N. robustior* from locality to locality. There is apparently no change in *N. robustior* between the Bridger and Washakie formations; there is no significant variation in *N. gracilis* over its entire geographic or vertical range.

THE HUERFANO FORMATION

More than 600 feet of middle Eocene rocks are present in the upper part of the Huerfano formation of south central Colorado. The upper strata contain a fauna which is younger than the Lost Cabin and older than the Bridger B and therefore could represent stratigraphically the sparsely fossiliferous Bridger A. The lack of Bridger A fossils makes direct correlation impossible. The upper Huerfano has many species which are of lower Eocene affinity and many of middle Eocene relationship. *Notharctus* is represented by *N. nunienus*, a species usually found in lower Eocene deposits. It seems, therefore, that it would be better to omit it from this discussion.

THE GREEN RIVER FORMATION

N. gracilis has been collected from two widely separated localities in the Green River formation. One locality is in the Morrow Creek member, Green River Basin of Sweetwater County, Wyoming. The other locality is questionably in the Evacuation Creek member, Uinta Basin, Uintah County, Utah. The relationship of these localities to the Bridger formation is not known exactly: McGrew (personal communication) considers the Morrow Creek locality to be upper middle Eocene; Burke (1935) considered the questionable Evacuation Creek locality perhaps equal to the lower Bridger. Dane (1954) places the Evacuation Creek member directly below the Uinta formation. This would indicate an upper Bridger (upper middle Eocene) age.

THE WASHAKIE FORMATION

Middle Eocene deposits in the lower Washakie formation of south central Wyoming are termed Washakie A. These deposits are equivalent to Bridger C and D and contain *N. robustior*. No specimens of *N. gracilis* have been reported from the lower Washakie.

Systematic Revision and Descriptions

Family ADAPIDAE Trouessart

Subfamily NOTHARCTINAE Trouessart

Genus **Notharctus** Leidy

Type species: *Notharctus tenebrosus* Leidy

Notharctus gracilis (Marsh)

Plate I, figs. 1-2, 4-8, Plate II, figs. 2-3, 6

Hyopsodus gracilis; Marsh, 1871, p. 242
?Microsyops gracilis; Leidy, 1872A, p. 20
Notharctus gracilis; (Marsh) Cope, 1872, p. 471
Smilodectes gracilis; (Marsh) Wortman, 1903, p. 362
Notharctus matthewi; Granger and Gregory, 1917, p. 847-848
Pelycodus relictus; Gregory, 1917, p. 631
Notharctus gracilis; (Marsh) Troxell, 1926, p. 423-428

Type: Y.P.M. #11800. Broken left lower jaw with P_4-M_1. From Grizzly Buttes, Wyoming. Bridger B. Lower middle Eocene.

Range: Entire middle Eocene, found in Green River formation of Wyoming and Utah and in upper and lower Bridger formation.

Hypodigm: A.M.N.H. #12011 (Type of *P. relictus* and *N. matthewi*), 11471, 13030, 12566; Y.P.M. #11800, 12904, 12965, 12966, 12969, 12970; Univ. Wyo. #965, 966. Some numbers have more than one specimen included and several have both upper and lower dentitions, and right and left side of upper and/or lower tooth rows.

Description: Smaller than *N. tenebrosus* and *N. robustior*. Two ridges enclosing a basin on posterior half P_3. Ridge runs from the hypoconid of M_3 to the protolophid. Single external cusp on P^4.

Discussion: the lower third premolar has a single central cusp. Three ridges are present on the cusp: one runs forward and joins the cingulum; the other two go posteriorly and join the cingulum at the corners, forming a basin between them. A small cusp is present on the cingulum between the junctions of the posterior ridges. There is a swelling on the lingual cingulum directly below the position where the metaconid would arise.

The fourth lower premolar has a large protoconid located slightly forward of center. It has a smaller metaconid which seems to have been formed by the fusion of a projection from the protoconid and a swelling on the lingual cingulum. This projection occupies the place of the interior posterior ridge on P_3. There may be a small "hypoconid."

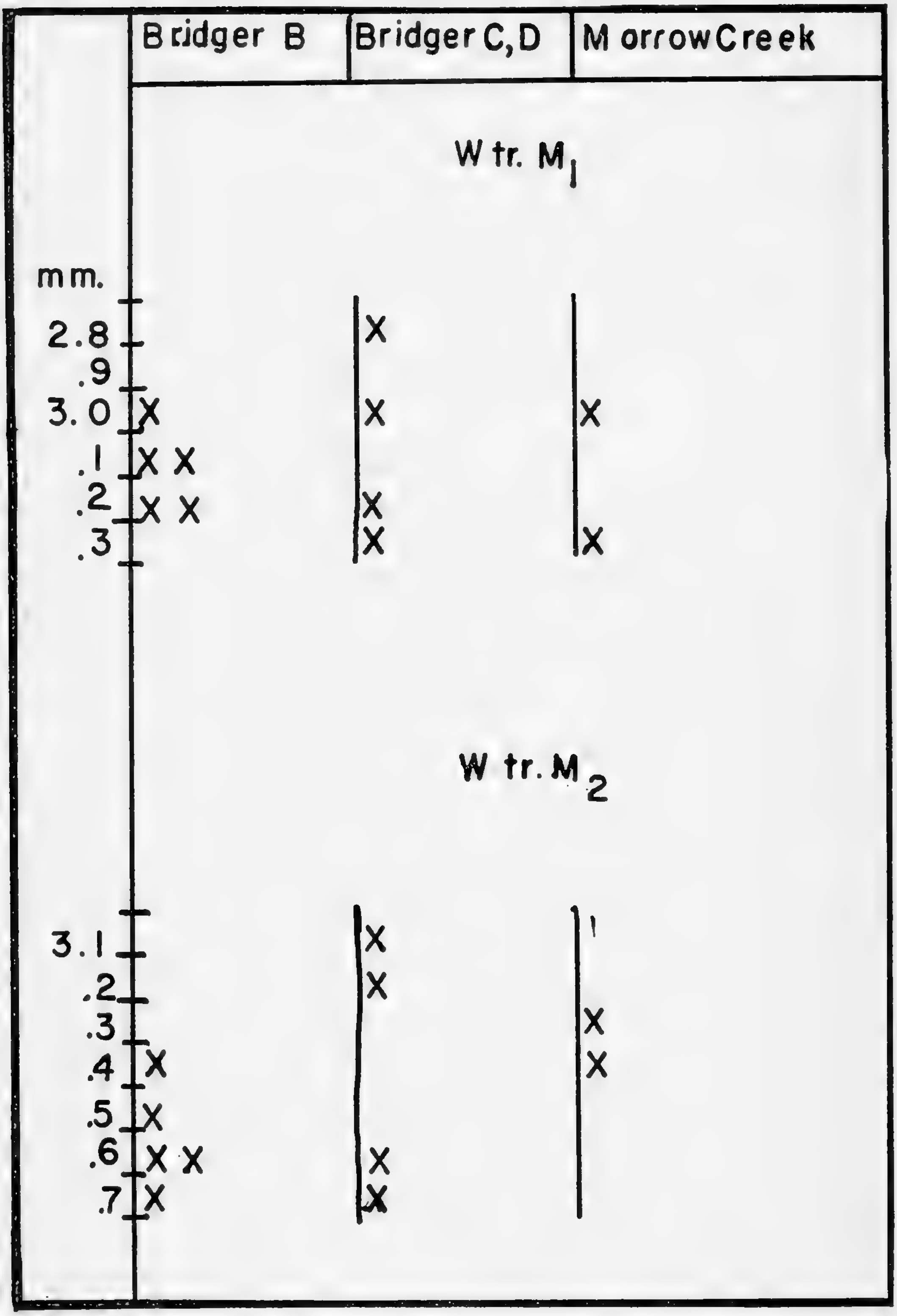

Figure 1

Frequency diagrams of trigonid widths of first and second lower molars of *Notharctus gracilis* specimens from lower and upper Bridger faunas and Morrow Creek (Green River) fauna.

The first two lower molars are not morphologically distinct from those of *N. tenebrosus.* They are considerably smaller. There may or may not be a paraconid. If it is present, it is largest on M_1. The third lower molar is quite distinct. On the M_3 of *Notharctus* a ridge joins the protoconid and metaconid. In *N. gracilis* this ridge is connected to the hypoconid by a ridge running from the hypoconid to this ridge (see pl. 1, fig. 2), whereas in *N. tenebrosus* and *N. robustior* it joins a ridge running back from the protoconid.

The fourth upper premolar bears a single external cusp and a single internal one. The external cusp shows no evidence of dividing.

The first and second upper molars are similar to, but smaller than, those of *N. tenebrosus.* The third upper molar has a rectangular outline but lacks a hypocone. It has a prominent lingual cingulum and a prominent mesostyle.

This species is distributed throughout Bridger time. It has been found in the Black's Fork and Twin Buttes members of the Bridger formation and Morrow Creek and Evacuation Creek members of the Green River formation. It is not common.

Leidy considered Marsh's "*Hyopsodus*" *gracilis* to be the same as his *Microsyops gracilis,* and named the latter for that reason (1872). He later changed his mind and considered it separate (1873). In his original description he noted that if *H. gracilis* = *M. gracilis,* Marsh's type would take precedence. It appears from illustrations that *M. gracilis* is distinct. This is fortunate for if it were not, *Notharctus gracilis* would become the type of the genus *Microsyops,* thus producing much confusion.

Notharctus tenebrosus Leidy

Plate I, figs. 9-10, Plate II, figs. 7-8

Notharctus tenebrosus; Leidy, 1870, p. 114; type: U.S.N.M. No. 3752
Limnotherium tyrannus; Marsh, 1871, p. 43; type: Y.P.M. No. 11856
Hipposyus formosus; Leidy, 1872, p. 37; 1873, p. 90; type: U.S.N.M. No. 3757
Tomitherium rostratum; Cope, 1872, p. 470; type: A.M.N.H. No. 5009
Thinolestes anceps; Marsh, 1872, p. 205; type: Y.P.M. No. 11786 A and B

TABLE 1

MEASUREMENTS IN MILLIMETERS OF *Notharctus gracilis* (MARSH)

LOWER TEETH

		O R	N	M	S	V
P_3	L	2.8 - 3.4	5	3.08	0.22	7.14
	W	2.1 - 2.4	5	2.26	0.12	5.31
P_4	L	3.3 - 4.5	11	3.85	0.33	8.57
	W	2.7 - 3.2	11	2.90	0.21	7.24
P_1-P_4	L	12.1 ..	1	....	....	....
M_1	L	4.3 - 4.8	9	4.50 ± 0.047	0.14 ± 0.053	3.13 ± 0.738
	Wtr	2.8 - 3.3	11	3.11 ± 0.043	0.14 ± 0.031	4.63 ± 0.987
	Wtal	3.2 - 3.6	9	3.44 ± 0.037	0.11 ± 0.027	3.08 ± 0.770
M_2	L	4.3 - 5.5	11	4.84 ± 0.094	0.30 ± 0.066	6.11 ± 1.366
	Wtr	3.1 - 3.7	11	3.46 ± 0.061	0.19 ± 0.043	5.55 ± 1.240
	Wtal	3.4 - 4.0	11	3.73 ± 0.044	0.15 ± 0.034	4.12 ± 0.921
M_3	L	5.6 - 6.4	10	6.03 ± 0.059	0.18 ± 0.042	2.97 ± 0.699
	W max	3.0 - 3.8	11	3.47 ± 0.065	0.21 ± 0.046	5.90 ± 1.319
M_1-M_3	L	15.1 -15.5	3	15.23	0.37	2.43

UPPER TEETH

		O R	N	M	S	V
P_3	L	2.9	1	....	....	....
	W	3.5	1	....	....	....
P^4	L	3.0 - 3.2	2	3.10	....	....
	W	4.1 - 4.4	2	4.25	....	....
P^1-P^4	L	12.2	1	....	....	....
M^1	L	3.8 - 4.5	5	4.32	0.27	6.25
	W	4.6 - 5.5	7	5.23	0.28	5.35
M^2	L	4.4 - 4.9	7	4.70	0.19	4.04
	W	5.5 - 6.3	8	6.01	0.32	5.32
M^3	L	4.0 - 4.4	4	4.27	0.16	3.75
	W	5.2 - 5.8	4	5.53	0.20	3.61
M^1-M^3	L	12.7 -13.8	3	13.36	0.63	4.74

Limnotherium affine; Marsh, 1872, p. 207; type: Y.P.M. No. 11795
Notharctus osborni; Granger and Gregory, 1917, p. 848; type: A.M.N.H. No. 11466
N. anceps; (Marsh) Granger and Gregory, 1917, p. 849
N. affinis; (Marsh) Granger and Gregory, 1917, p. 850
N. tyrannus; (Marsh) Granger and Gregory, 1917, p. 851
N. tenebrosus Leidy; Granger and Gregory, 1917, p. 851
N. pugnax; Granger and Gregory, 1917, p. 853; type: A.M.N.H. No. 11461

Type: U.S.N.M. No. 3752. Right lower jaw with C_1, P_2-M_3, from Black's Fork, Bridger Basin, Wyoming. Bridger B. Lower middle Eocene.

Range: Lower middle Eocene of Bridger formation.

Hypodigm: A.M.N.H. #5009, 11449, 11452, 11454, 11456-57, 11460-61, 11463-11467, 11469, 11472, 11475, 12002, 12568, 12569, 12572, 12575, 12578, 12583, 12586, 13022, 13024-13027, 13029, 13031, 13130, 14567, 14568, 18985-87, 18989, 18990; Y.P.M. #11786, 11795, 11856, 12151, 12153, 12911, 12923, 12932, 12935, 12939, 12941, 12948, 12957-12959, 12963; U.S.N.M. #3752, 3757 (Casts of these specimens are available in Peabody Museum.) Some numbers include several specimens.

Description: Size larger than *N. gracilis.* Posterior ridge on P_3 divides halfway down protoconid. No ridge from hypoconid to center of metaconid-protoconid ridge on M_3. P^4 has two external cusps or indications of them.

Discussion: The third lower premolar has a single cusp with anterior and posterior ridges. The posterior ridge divides about halfway down the cusp. The interior branch joins the cingulum at the postero-interior corner; the exterior branch joins internally to the external corner. The enclosed basin is small and does not show on worn teeth.

The fourth lower premolar has a more pronounced "hypoconid" than that on the P_4 of *N. gracilis.* It is joined to the protoconid by a ridge which divides the heel of the tooth into more or less equal parts. In worn specimens, the heel appears as a shelf.

The first lower molar teeth are similar to those of *N. gracilis,* except for larger size. On M_3 the ridge running forward from the hypoconid joins a ridge running backward from the protoconid. It does not join the protoconid-metaconid ridge. There is rarely a complete external cingulum on the molars of *N. tenebrosus.* Occasionally it extends backwards onto the heel.

The fourth upper premolar of *N. tenebrosus* shows a divided external cusp, or furrows running down the internal

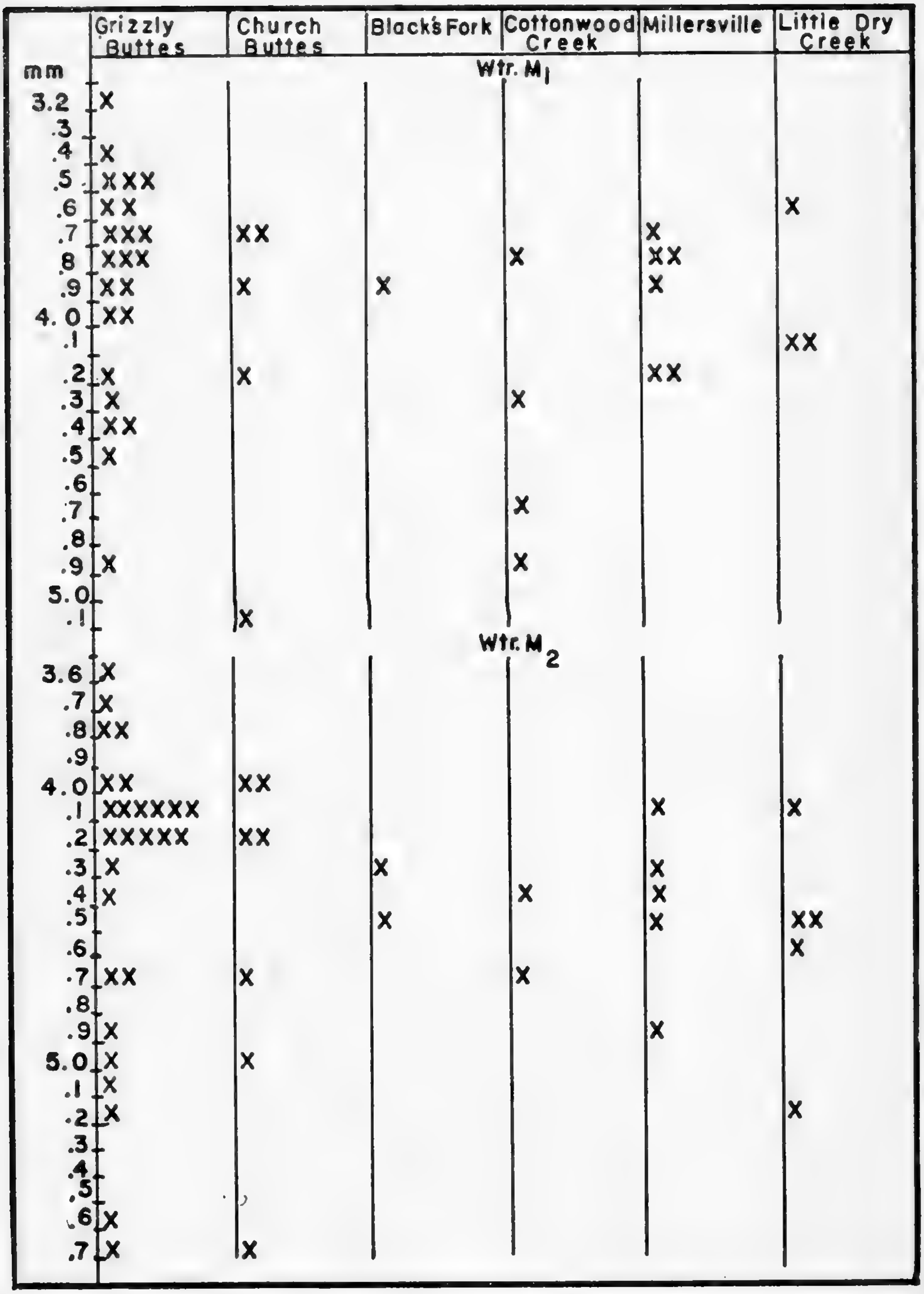

Figure 2

Frequency diagrams of trigonid widths of M_1 and M_2 of *Notharctus tenebrosus* from various localities in Bridger B beds.

and external sides of the cusp suggesting a division (see pl. 1, fig. 9). The third upper premolar is near an equilateral triangle in shape.

The upper molars are larger than those of *N. gracilis*, but smaller than the average molars of *N. robustior.* The M^3 is not rectangular.

Granger and Gregory (1917) included *Tomitherium rostratum* Cope and *Hipposyus formosus* Leidy in their description and concept of *N. tenebrosus.* This writer also includes *N. anceps* (Marsh), *N. affinis* (Marsh), *N. tyrannus* (Marsh), *N. osborni* (Granger and Gregory), and *N. pugnax* Granger and Gregory.

	Length in millimeters	Condition of paraconids		
	M_1-M_3	M_1	M_2	M_3
N. tenebrosus	18.5	strong	weak	weak
N. pugnax	20.7	present	absent	absent
N. osborni	16.6	small	vestigial	absent
N. anceps	17.5	present	vestigial	absent
N. affinis	18.0	present	vestigial	absent
N. tyrannus	18.0 (est.)	low	absent	absent

After Granger and Gregory, 1917

Listed above are some of the characters which Granger and Gregory considered pertinent in their classification of the lower Bridger *Notharctus* specimens now included in *N. tenebrosus.* As stated above, in *Notharctus* if a paraconid is present it is always more pronounced on the first molar. The data quoted here (taken from types) bear this out. On five of the types there is no paraconid on M_3; on two, there is none on M_2; on one there is a strong paraconid on M_1. Development of the paraconid is variable, under influence of a gradient which diminishes to the rear.

Modern studies of populations have shown that there is a variation in living forms of the same species. There is no reason why this should not be true for fossil forms and Simpson and others have applied this reasoning to studies of fossils (Simpson and Roe, 1939). The range in lengths of the lower molar series of the types is 16.6-20.7 mm., a distance of 4.1

TABLE 2

MEASUREMENTS IN MILLIMETERS OF *Notharctus tenebrosus* LEIDY

LOWER TEETH

		O R	N	M	S	V
P_3	L	3.2 - 4.2	9	3.82	0.30	7.85
	W	2.2 - 3.0	10	2.65	0.28	10.57
P_4	L	3.8 - 5.3	15	4.49	0.41	9.13
	W	2.9 - 3.8	14	3.26	0.31	9.51
P_1-P_4	L	13.7 -15.8	4	14.85	....	....
M_1	L	5.2 - 7.0	47	5.74 ± 0.061	0.43 ± 0.045	7.54 ± 0.786
	Wtr	3.2 - 5.1	45	3.98 ± 0.061	0.41 ± 0.044	10.30 ± 1.078
	Wtal	3.8 - 5.5	45	4.35 ± 0.066	0.44 ± 0.046	10.02 ± 1.068
M_2	L	5.0 - 7.2	54	5.96 ± 0.075	0.55 ± 0.053	9.14 ± 0.888
	Wtr	3.6 - 5.7	54	4.41 ± 0.064	0.47 ± 0.045	10.58 ± 1.028
	Wtal	4.0 - 5.9	54	4.71 ± 0.066	0.48 ± 0.046	10.17 ± 0.988
M_3	L	6.2 - 9.3	32	7.35 ± 0.154	0.84 ± 0.107	11.45 ± 1.454
	W max	3.4 - 4.7	34	4.12 ± 0.057	0.33 ± 0.041	7.98 ± 0.983
M_1-M_3	L	16.1 -22.2	15	18.07 ± 0.37	2.14 ± 0.404	11.84 ± 2.237
		UPPER TEETH				
P^3	L	3.7 - 3.8	2	3.75	....	....
	W	4.2	2	4.20	....	....
P^4	L	4.0 - 4.5	4	4.20	....	....
	W	5.4 - 6.6	4	6.00	....	....
P^1-P^4		....	..	....	....	....
M^1	L	4.7 - 6.3	17	5.47	0.44	8.04
	W	5.8 - 7.7	16	6.46	0.66	10.21
M^2	L	5.1 - 6.6	16	5.76	0.51	8.85
	W	5.8 - 8.7	16	7.24	0.83	11.46
M^3	L	4.0 - 5.3	10	4.60	0.42	9.13
	W	5.2 - 6.6	10	5.87	0.53	9.03
M^1-M^3	L	14.5 -17.1	8	15.68	0.87	5.52

mm. The observed range of all specimens is 16.1-22.2 mm. or 6.1 mm. The lengths of the individual teeth all vary at least 1 mm. between limits. Assuming that all teeth were packed end to end, the possible range (from observed specimens) is 16.4—23.5 mm. As there is some overlapping of teeth in a row, the figures for natural rows are smaller.

Notharctus tenebrosus?

Plate 1, fig. 3

A specimen of *Notharctus* in the American Museum of Natural History (#11481) has a peculiar lower third molar. The length of the tooth is less than that of the second molar. It lacks the enlarged hypoconulid. Due to its similarity to typical specimens of *N. tenebrosus* in the characters of its anterior molars and premolars, it is classified as *N. tenebrosus?*. Granger and Gregory thought that it might represent the jaw of *Aphanolemur gibbosus*, but no teeth are known for this species. It is considered an aberrant form of *N. tenebrosus*, and has not been included in the hypodigm of that species.

A.M.N.H. #11481, Grizzly Buttes, Bridger Basin, Wyoming, Bridger B

	M_1	M_2	M_3
Length	5.3	5.?	5.1
W max	....	....	3.4
W tr	....	3.6	....
W tal	3.2	3.6	....

Notharctus robustior Leidy

Plate II, figs. 1, 4-5

Notharctus robustior; Leidy, 1872, p. 364; type: U.S.N.M. No. 3750

Telmatolestes crassus; Marsh, 1872, p. 206; type: Y.P.M. No. 11782

Hipposyus robustior; (Leidy), 1873, p. 93

Notharctus crassus; (Marsh) Granger and Gregory, 1917, p. 854-856

Notharctus robustior Leidy; Gazin, 1934, p. 71

Type: U.S.N.M. No. 3750. Henry's Fork, Bridger Basin, Wyoming. Bridger C or D. F. V. Hayden collection M_2.

Range: Upper middle Eocene of Bridger formation (Bridger C and D) and of Washakie formation (Washakie A) of southwestern Wyoming.

Hypodigm: A.M.N.H. #11451, 11982-11987, 11990-93, 11995-97, 11999, 12000, 12003, 12005-12010, 12564, 12565, 12567, 13023, 13133, 13134; Y.P.M. #11782, 12900, 12905, 12908, 12909, 12911-12916, 12918, 12920, 12925-12931, 12933, 12934, 12937, 12940, 12945, 12953; U.S.N.M. #3750 (Cast in Peabody Museum. Many numbers have several specimens included, especially in the Peabody Museum collections.)

Description: Larger than *N. tenebrosus*, otherwise quite similar. P^4 has pronounced double peak to external cusp.

Discussion: It is extremely difficult to tell some specimens of *N. tenebrosus* from some of *N. robustior*. The two ranges overlap and where the age data are unknown, the determination can be difficult, if not impossible.

A few pertinent measurements of *N. tenebrosus* and *N. robustior* are quoted below for comparison.

N. tenebrosus

	Range in millimeters	Mean	N
Length M_3	6.2-9.3	7.35 ± 0.154	32
W. max. M_3	3.4-4.7	4.12 ± 0.057	34
W trigonid M_1	3.2-5.1	3.98 ± 0.061	45
W trigonid M_2	3.6-5.7	4.41 ± 0.064	54

N. robustior

	Range in millimeters	Mean	N
Length M_3	7.7-9.6	8.66 ± 0.068	39
W. max. M_3	4.3-5.7	5.01 ± 0.045	41
W trigonid M_1	4.2-5.4	4.72 ± 0.041	47
W trigonid M_2	4.6-6.3	5.42 ± 0.050	62

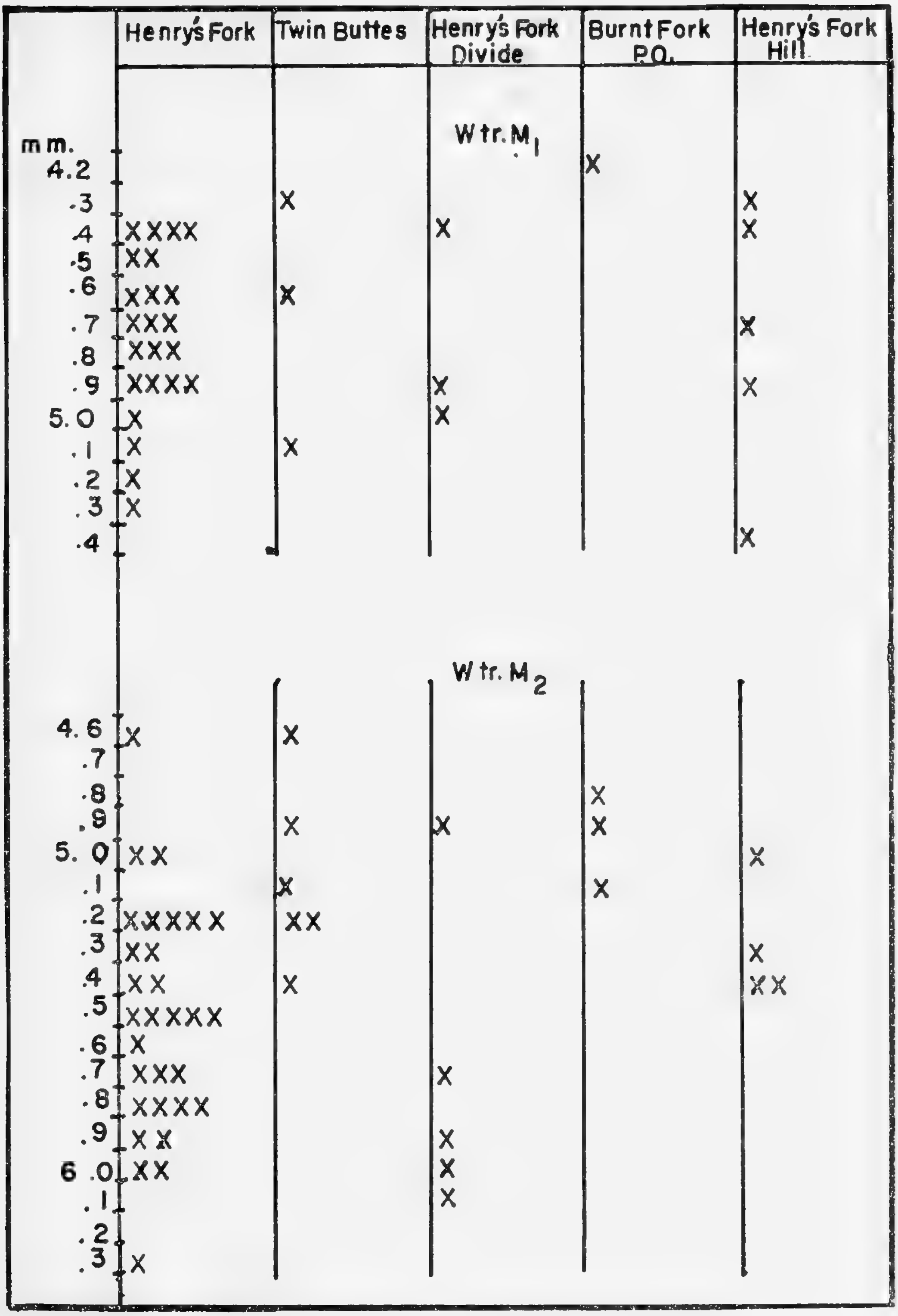

Figure 3

Frequency distributions of trigonid widths of M_1 and M_2 of *Notharctus robustior* from various localities in upper Bridger formation. Specimens from both Bridger C and D divisions are included at all localities.

The most significant distinction between these species is the width of M_3. The ratio of the difference of the means to the standard error of the difference ($^d/\sigma_d$) is 12.59, a highly significant figure. *N. robustior* certainly arose from *N. tenebrosus* but the samples shown here prove there is a statistical difference in the populations. A similar test proves that there is no difference in the populations of *N. gracilis* during Bridger time.

Specimens of *N. robustior* from the Washakie formation fall near the middle of the range of the Bridger specimens. They have been included in the statistical analysis of the species. The measurements are, for the characters used above:

	A.M.N.H.* #13133	#13134	Mean of all *N. robustior* specimens*
L M_3	8.7	8.4	8.66
W max. M_3	4.4	4.7	5.01
W trigonid M_1	4.6	4.5	4.72
W trigonid M_2	5.3	5.2	5.42

VARIATION

Histograms for measurements of teeth of *N. tenebrosus* are distinctly bimodal. The separation of the peaks is not great; 1 mm. is the maximum. The areas under the peaks are not equal, but are not sufficiently unequal to be significant. It is my opinion that this bimodality is due to sex differences. The animals are morphologically similar; one would expect a morphological dissimilarity if more than one species was present. The coefficients of variability for the lower teeth vary from 11.45 mm. for the length of M_3 to 7.54 mm. for the length of M_1. The average is 9.772 mm. This is high but not too high for a variable species. It has been pointed out that rarely do more than one species of a genus inhabit a given area and when two congeneric species do live in one habitat, one greatly outnumbers the other. This is the case in both the upper Black's Fork member and in the Twin Butte member of the Bridger formation. *N. gracilis* is one-tenth as common as *N. tenebrosus* or *N. robustior*.

* All measurements given in millimeters.

TABLE 3

MEASUREMENTS IN MILLIMETERS OF *Notharctus robustior* (LEIDY)

LOWER TEETH

		O R	N	M	S	V
P_3	L	3.8 - 4.7	8	4.32	0.31	7.18
	W	2.5 - 3.5	7	3.09	0.24	7.77
P_4	L	4.9 - 6.3	18	5.67	0.40	7.05
	W	3.5 - 4.5	17	4.01	0.18	4.49
P_1-P_4		....	..		....	....
M_1	L	5.8 - 7.5	50	6.59 ± 0.061	0.43 ± 0.043	8.62 ± 0.871
	Wtr	4.2 - 5.4	47	4.72 ± 0.041	0.28 ± 0.029	5.95 ± 0.620
	Wtal	4.7 - 5.9	52	5.26 ± 0.040	0.29 ± 0.026	5.47 ± 0.495
M_2	L	6.1 - 8.5	64	7.04 ± 0.071	0.56 ± 0.050	7.95 ± 0.708
	Wtr	4.6 - 6.3	62	5.42 ± 0.050	0.39 ± 0.035	7.19 ± 0.651
	Wtal	4.9 - 6.5	64	5.62 ± 0.044	0.35 ± 0.031	6.26 ± 0.558
M_3	L	7.7 - 9.6	39	8.66 ± 0.068	0.42 ± 0.048	4.83 ± 0.554
	W max	4.3 - 5.7	41	5.01 ± 0.045	0.29 ± 0.032	5.71 ± 6.380
M_1-M_3	L	20.9 -23.6	15	22.25 ±	0.94	4.22
		UPPER TEETH				
P^3	L	4.1 - 5.4	3	4.63	0.66	14.63
	W	5.3 - 6.0	3	5.60	0.29	5.18
P^4	L	4.6 - 5.4	13	4.98	0.32	6.43
	W	6.5 - 7.5	7	7.29	0.32	4.39
P^1-P^4		....	..	....	....	....
M^1	L	5.8 - 7.2	20	6.74	0.21	3.12
	W	7.8 - 8.8	19	8.44	0.24	2.83
M^2	L	5.9 - 7.7	25	6.82	0.44	6.45
	W	6.8 -10.2	25	9.09	0.69	7.59
M^3	L	4.8 - 6.2	18	5.68	0.41	7.22
	W	5.8 - 7.9	19	7.40	0.49	6.62
M^1-M^3	L	17.9 -20.4	9	19.19	0.81	4.20

When the deposition of the Bridger formation began, the area had just emerged from the Green River Lakes. *Notharctus tenebrosus* was a new species in the Bridger B time. The source area for this species could have been any one of several inter-mountain basins of the Wyoming, Colorado, Utah area.

The Bridger environment was similar to the source area, but different enough that *N. tenebrosus* had to adjust to it. It is natural for a species to be variable in a new environment. Simp-

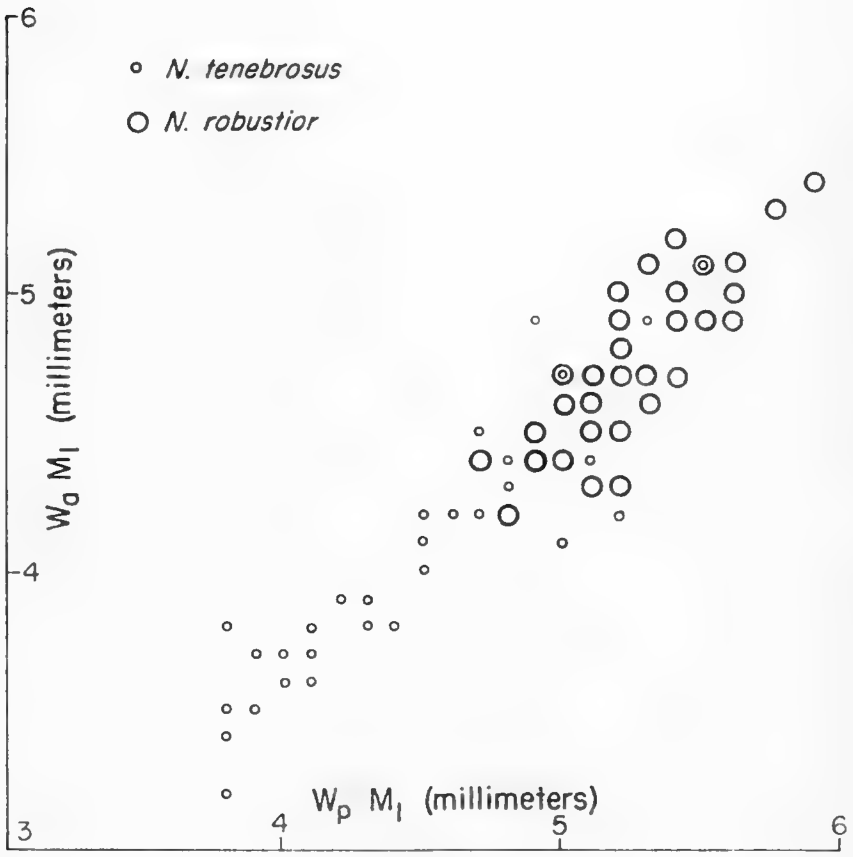

Figure 4

A scatter diagram comparison of anterior and posterior tooth widths of first lower molars of *Notharctus tenebrosus* and *N. robustior.*

son states (1953, p. 140), "In a group not already at the selective optimum, selection should, given a sufficient store of appropriate variation, move the group to that optimum."

Notharctus tenebrosus was a species not at the selective optimum; neither was its descendant, *N. robustior,* evidently, but it was closer to it.

The variation of the *N. tenebrosus* — *N. robustior* line decreased in time. The average size of *N. robustior* was larger than that for *N. tenebrosus;* however, the maximum size of *N. robustior* is within the probable limits for *N. tenebrosus.*

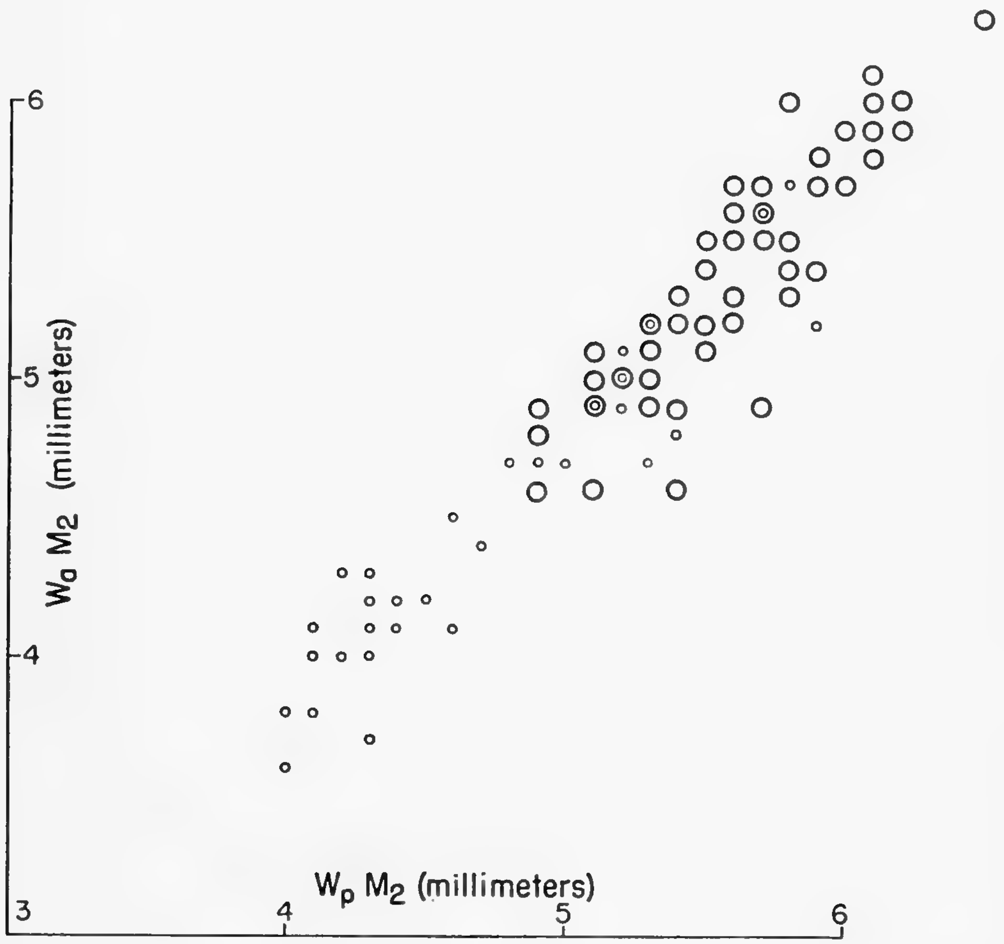

Figure 5

Scatter diagram comparison of anterior (trigonid) and posterior (talonid) widths of M_2 of *N. tenebrosus* and *N. robustior.*

N. robustior is therefore a more highly adapted species than its ancestor *N. tenebrosus.*

The scatter diagrams for anterior/posterior widths of M_1 and M_2 of *N. tenebrosus*—*N. robustior* on figures 4, 5 show that the variability is greater for *N. tenebrosus.* The maximum values of measurements of *N. robustior* are only 0.3 mm. greater for M_1 and 0.6 mm. greater for M_2 than the maximum values for *N. tenebrosus. N. robustior* represents the maximum size for the evolutionary line that could live in the environment at the time.

N. robustior also has somewhat bimodal histograms. Why the tendency toward bimodality should be less is not known although it is partly caused by the general tendency for a decrease in variability. Perhaps the smaller sex was tending to become as large as the other for adaptive reasons.

It is interesting to contrast the data for *N. gracilis* with that of the *N. tenebrosus* — *N. robustior* line. *N. gracilis* remained practically unchanged during the entire middle Eocene. The greatest coefficient of variability for the lower molars is 6.11 mm.; the smallest 2.97 mm. The average is 4.437 mm. These data were compiled from 16 specimens from Bridger B, C, and D, and the Green River Morrow Creek locality.

The recorded geographic range of *N. gracilis* includes southwestern Wyoming and northeastern Utah; *N. robustior* is found only in the Bridger and Washakie basins of Wyoming. *N. tenebrosus* was restricted to the Bridger basin. At its maximum, the area of the *N. tenebrosus* — *N. robustior* group was less than half that of *N. gracilis.* In none of the localities in which *N. gracilis* occurs is it common. The combined wide distribution and infrequent occurrence of *N. gracilis* is interesting Possibly *N. gracilis* inhabited the higher areas and only occasionally visited the plain. If this were true it would account for its ability to spread to other areas more easily than *N. tenebrosus* — *N. robustior.*

The statistical data for these species have been compiled fully only for measurements of the lower teeth as these are the most common remains. Certain problems were encountered in measuring. The measurement of a tooth length will be different if measured alone or in place in a row. The maximum error for this is perhaps 0.2 mm. This would not be considered harmful for large teeth (Simpson, 1949A). When dealing with an animal which has small teeth, the chances of a significant error are increased. For example, the mean length M_2 of *N.*

robustior is 7.04 ± 0.071 mm. The means of four groups of M_2's, determined by their association with other teeth, are as follows:

Lengths in millimeters of M_2

M_2 isolated	Mean = 7.19	N = 10
M_1 M_2	7.08	26
M_2 M_3	6.79	12
M_1 M_2 M_3	7.10	16

The means of these subgroups are within one standard deviation from the means of the entire sample. This is not too significant but it suggests that single teeth would give larger parameters (in absolute values).

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Plate I

Figure 1. *Notharctus gracilis* (Marsh). Right P^4-M^2, A.M.N.H., no. 12011, part of type specimen of *N. matthewi* Granger and Gregory. Grizzly Buttes, Wyoming, Bridger B horizon. Crown view of teeth, x3.

Figure 2. *Notharctus gracilis* (Marsh). Left lower jaw with C_1-M_3, A.M.N.H., no. 12011, part of type of *N. matthewi* Granger and Gregory. Crown view of teeth, x3.

Figure 3. *Notharctus tenebrosus?* Right jaw with P_3-M_3, A.M.N.H., no. 11481, Grizzly Buttes, Wyoming, Bridger B. Crown view of teeth, x2.

Figures 4-8. *Notharctus gracilis* (Marsh). A.M.N.H. no. 13030, Bridger B formation, Cottonwood Creek, Wyoming. Figs. 4-7, crown views. Fig. 4, right P_3-M_2; Fig. 5, left M_1-M_3; Fig. 6, left M^1-M^3; Fig. 7, right P^1-M^3; Fig. 8, externo-lateral view of right maxillary P^1-M^3, same specimen as fig. 7. All x2.

Figures 9-10. *Notharctus tenebrosus* Leidy. Right maxillary with P^4, M^1, and M_3. A.M.N.H., no. 13027, Grizzly Buttes, Wyoming, Bridger B formation. Fig. 9, externo-lateral view; Fig. 10, crown view. Both x2.

Photographs by permission of the American Museum of Natural History.

Plate I

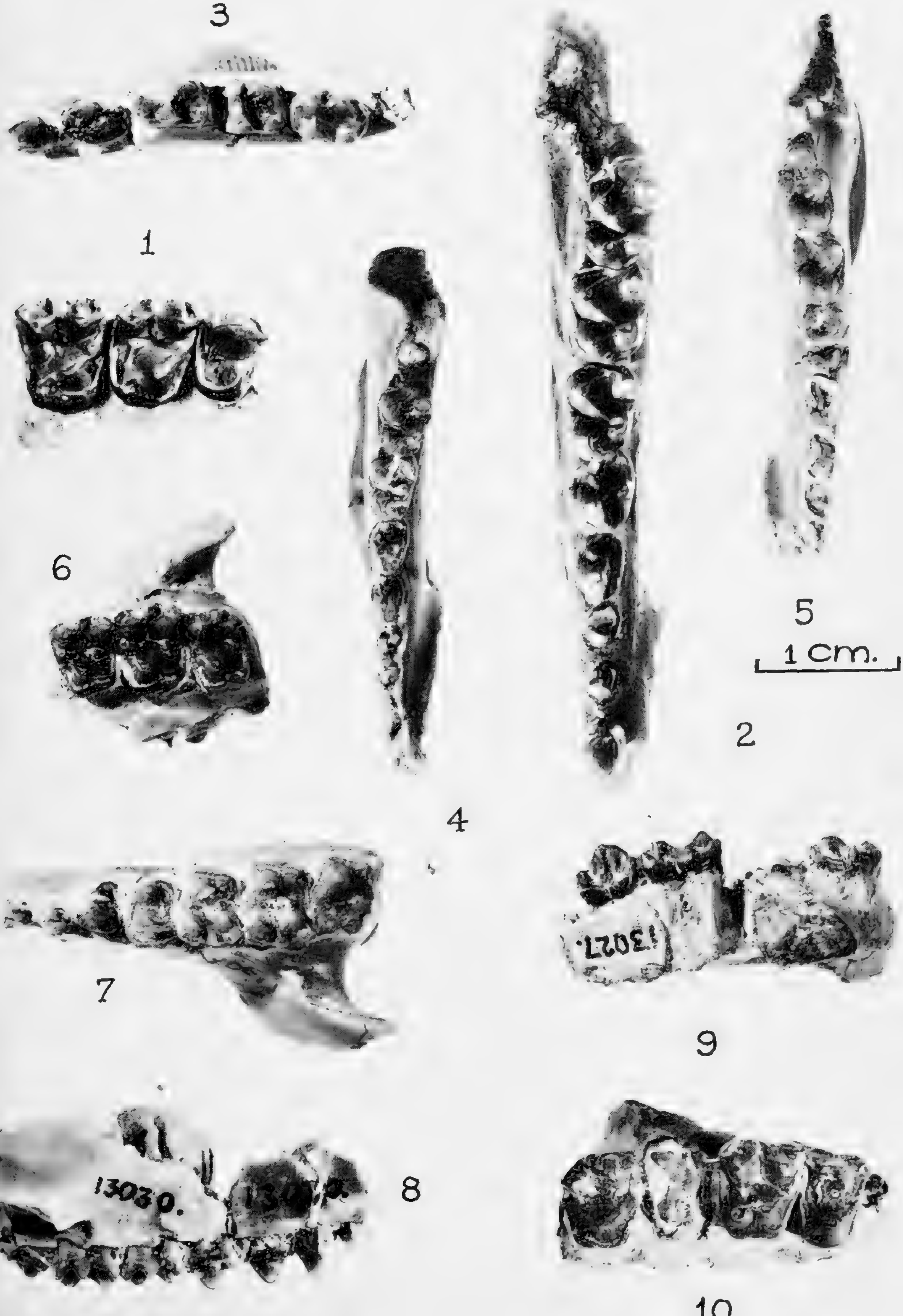


Plate II

Figure 1. *Notharctus robustior* Leidy. Y.P.M., no. 11782, right lower jaw with P_3-M_3, type of *Telmatolestes crassus* Marsh. Henry's Fork, Wyoming, Bridger C or D. Crown view of teeth, x2.

Figures 2-3. *Notharctus gracilis* (Marsh). Y.P.M., no. 12970, Twin Buttes, Wyoming, Bridger C or D. Fig. 2, right maxillary with P^2-M^3; Fig. 3, left jaw with P_4-M_3. Crown views, x2.

Figures 4-5. *Notharctus robustior* Leidy. Y.P.M., no. 12905, Lone Tree, Wyoming, Bridger C or D. Fig. 4, left maxillary with M^2-M^3; Fig. 5, left lower jaw with P_3-M_3. Crown views, x2.

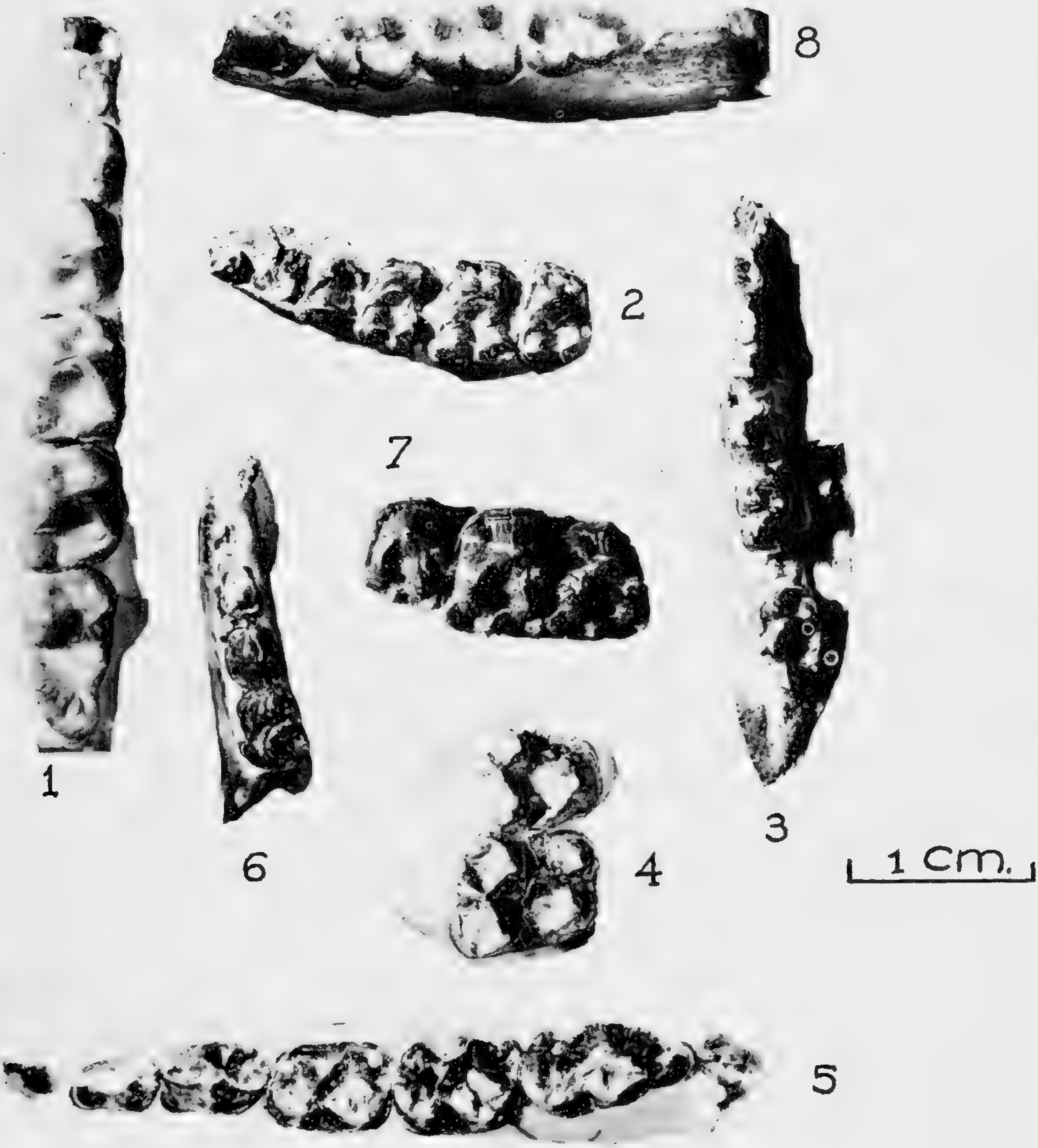
Figure 6. *Notharctus gracilis* (Marsh). Type specimen, Y.P.M., no. 11800, Grizzly Buttes, Wyoming, Bridger B. Left jaw with P_3-M_1, crown view, x2.

Figure 7. *Notharctus tenebrosus Leidy*. Y.P.M., no. 11786A, Grizzly Buttes, Wyoming, Bridger B. Cotype of *Thinolestes anceps* Marsh. Left maxillary with M^1-M^3, crown view, x2.

Figure 8. *Notharctus tenebrosus* Leidy. Y.P.M., no. 11786B, Grizzly Buttes, Wyoming, Bridger B formation. Cotype of *Thinolestes anceps* Marsh. Left jaw with P_4-M_3, crown view, x2.

Photographs by permission of the Yale Peabody Museum.

Plate II



Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 29 February 12, 1957 New Haven, Conn.

A REDEFINITION OF THE SUBSPECIES OF *FODIATOR ACUTUS*

James E. Morrow*

ABSTRACT

Analysis of characteristics of 11 Atlantic and 54 Pacific specimens of *Fodiator acutus* showed that the two subspecies *F. a. acutus* and *F. a. pacificus* could not be distinguished on the basis of the original diagnosis, but that such distinction could be made on the basis of the eye and the snout expressed as a percentage of head length. It was also shown that *F. a. pacificus* Bruun and *Hemiexocoetus caudimaculatus* Fowler are synonyms of *Fodiator acutus rostratus* (Günther).

Introduction

The primitive flying fish species, *Fodiator acutus* (Cuvier and Valenciennes), was divided into two subspecies, *F. a. acutus* from the Atlantic and *F. a. pacificus* from the Pacific, by Bruun (1933) on the basis of 38 or 39 vertebrae in Atlantic specimens and 41 vertebrae in a single specimen from the Pacific, "along with a number of other smaller, yet distinct differences in proportions and fin-ray characters." Breder and Nichols (1934) noted vertebral counts of 39 in two specimens of *F. acutus* from the Pacific coast of Panama and therefore rejected the validity of the new subspecies. They also considered *pacificus* to be a *nomen nudum* because of the incomplete description. Later, Bruun (1935) gave a complete tabular description of

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the type of *F. a. pacificus*, comparing it with four specimens from the Atlantic Ocean off the coast of Angola, and with the type of Günther's *Exocoetus rostratus* (Günther, 1866) from Hawaii. Bruun's differential characteristics may be summarized as follows:

	ATLANTIC	PACIFIC
Dorsal rays	10 — 11	9
Anal rays	11	10
Pectoral rays	14 — 16	13
Predorsal scales	21 — 24	24 — 26
Vertebrae	38 — 39	41
Gill rakers	7 + 22	8 + 24

Subsequently, Breder (1938, p. 12-16) accepted the validity of this diagnosis, and noted several additional characters, as shown in his key:

"A. Gill rakers 7+22; predorsal scales 21 to 24; dorsal 10 or 11; anal 11; body depth 4.1 to 4.8; dorsal insertion 1.32 to 1.38; interorbital 3.6 to 3.7; pectoral rays 14 to 16. *Fodiator acutus acutus*

AA. Gill rakers 8+24 or 25; predorsal scales 24 to 26; dorsal 9 or 10; anal 10 or 11; body depth 4.85 to 6.0; dorsal insertion 1.31; interorbital 3.9 to 4.0; pectoral rays 13. *Fodiator acutus pacificus*."

However, a specimen of *F. acutus* taken by the Yale South American Expedition at Cabo Blanco, Peru, on April 1, 1953, could not be ascribed to either subspecies on the basis of the characteristics given by Bruun and by Breder. This at once raised the suspicion that the two subspecies might not be valid, but might be merely the result of examining too few specimens. Accordingly, a study of a larger number of individuals was attempted. As far as Pacific specimens were concerned, the result was gratifying, but, although nearly every museum in the United States and western Europe was canvassed for material, the combined efforts of all could produce but 11 specimens from the Atlantic Ocean.

Materials

The following material has been available. The numbers in parentheses indicate the number of individuals included in each sample.

Pacific Material

Bingham Oceanographic Collection, Peabody Museum of Natural History

No. 704 (3) No locality
1004 (9) Concepcion Bay, Mexico
1011 (5) Concepcion Bay, Mexico
1012 (5) Concepcion Bay, Mexico
1040 (2) San Jose del Cabo, Baja California
1101 (3) Las Perlas Islands, Gulf of Panama
1193 (1) San Felipe Bay, Baja California

British Museum (Natural History)

No. 1898.12.31.40-41 (2) Sta. Elena Bay, Ecuador
1903.5.15.298 (1) Panama
1938.12.12.44 (1) Galapagos Islands
1938.12.12.45 (1) Galapagos Islands
1938.12.12.46-47 (2) Galapagos Islands
1939.7.10.17 (1) Galapagos Islands
1939.7.10.18 (1) Tehuantepec, Mexico

United States National Museum

No. 82006 (5) Chame Point, Panama
119729 (2) Concepcion Bay, Mexico

Chicago Natural History Museum

No. 2580 (2) Gulf of California
41516 (1) Galapagos Islands
41517 (1) Galapagos Islands
41703 (1) Galapagos Islands
49217 (3) Bahia Honda, Panama

Academy of Natural Sciences, Philadelphia

No. 7484 (1) No locality
7508 (1) Mazatlán, Mexico (Type of *H. caudimaculatus* Fowler)

Atlantic Material

American Museum of Natural History

No. 9023 (2) Angola

British Museum (Natural History)

No. 1906.8.24.128 (1) Angola
1938.10.10.23 (1) Nigeria
1938.10.20.24 (1) Nigeria

Chicago Natural History Museum

No. 4913 (2) Caribbean Sea, 14° 30′ N, 80° 30′ W

Zoologische Staatsinsitut und Zoologische Museum Hamburg

Nos. H1, 2,3,4 (4) West Africa (Measurements from Bruun, 1935).

There have thus been 54 specimens from the Pacific Ocean and 11 from the Atlantic available for study. It early became apparent that a considerable degree of allometric growth existed in most body proportions among the smaller individuals, but that this allometry had largely ceased at a standard length of about 100 mm. Consequently, the smallest specimen utilized in the comparison of these factors was 95 mm. in standard length. Hence, there were 39 Pacific and nine Atlantic specimens available for this purpose. Even though the size of the Atlantic sample still leaves much to be desired, it is more than twice as great as the amount of material that was available to Bruun. All the material, regardless of size, was utilized in analysing meristic characters.

Discussion

In the analyses of the various characteristics of the two groups, it was found that only two of the characteristics on which the subspecies were erected actually showed a significant difference between the groups ($P<0.02$). These characteristics were the number of predorsal scales and the width of the interorbital space. For the latter, it was found that a greater degree of separation could be effected by expressing the width of the interorbital as a function of the length of the head rather than as a function of the standard length. In addition, there may be a difference in the number of pectoral rays. However, as will be shown later, the differences shown in these characters are not sufficient to warrant subspecific rank for the two groups. On the other hand, the length of the snout and the anterior-posterior diameter of the eye, in relation to head length, appear to be valid characters upon which the subspecies may be based.

The number of pre-dorsal scales varies between 20 and 25 in the Atlantic material, and between 22 and 28 in the Pacific, with mean counts at 22.3 and 24.5 respectively (Fig. 1A). It will be observed, however, that the standard deviations of the two distributions overlap by an amount equal to about 33 per cent of the smaller. Such a high degree of overlap is indicative of a corresponding degree of intergradation and is generally considered as indicating less than subspecific differentiation.

The width of the interorbital space, expressed as a percentage of the head length (Fig. 1B), ranges between 24.7 and 28.8, with a mean at 27.0 in the Atlantic material. In the Pacific specimens, however, these values are somewhat lower, the range spreading from 22.2 to 26.8, with the mean at 25.4. This distribution is skewed by the inclusion of a single specimen whose interorbital was only 22.2 per cent of the head length, the next lowest value being 24.0 per cent. Eliminating the single low value produces a considerable reduction in the range of the sample and almost entirely eliminates the skewness, but has no other marked effect. However, whether the sample is taken whole or without the one individual, the standard deviations again show considerable overlap, actually equal to 58.7 per cent of the smaller standard deviation. Clearly, this cannot be considered as indicating subspecific differentiation.

The distribution of the counts of pectoral fin rays in the Atlantic material is such that graphical representation is meaningless. A total of 16 counts showed 15 fins with 14 rays each and one with 16 rays. In the Pacific material, 94 counts showed 4.3 per cent of the sample with 12 rays, 63 per cent with 13 rays, and 33 per cent with 14 rays. The mean counts were 14.1 for the Atlantic specimens and 13.3 for the Pacific.

The distribution in the Atlantic material suggests that in a larger sample, more lower counts would be expected. Therefore, although the number of rays in the pectoral may actually be a good indicator of the subspecies, this cannot be determined from the present samples.

Some most interesting results were derived from a comparison of the snout as percent of head length in the two samples. The Atlantic and Pacific groups are clearly different (Fig. 1C), the former having a mean value of 36.3 per cent as compared with 39.6 per cent for the latter. The standard deviations of the two distributions do not overlap at all, even though the upper limit of range of the Atlantic sample includes the whole standard deviation of the Pacific material. This skewness of the Atlantic material is caused entirely by two individuals from the Caribbean Sea, whose snout lengths were 39.7 per cent and 41.4 per cent of their head lengths. As may be seen from a comparison of the upper and middle distributions in Fig. 1C, inclusion of these two specimens (the only ones from the western Atlantic) results in a discontinuous distribution. When the two Caribbean specimens are removed from consideration, the Atlantic material has the distribution shown in the upper line of Fig. 1C. There can be no doubt that the upper Atlantic group and the Pacific group are different. It also appears as though the Caribbean material may represent a population that is distinct from that of the west African coast, although the material is not large enough to draw reasonably reliable conclusions. However, this possibility is certainly not out of the realm of probability, especially when it is realized that *F. acutus* is generally confined to coastal waters and is therefore extremely unlikely to undertake long movements back and forth across the Atlantic. This is precisely the situation that could lead to separate, distinct races on either side of the ocean.

It will be seen from Fig. 1C that the standard deviations of the Pacific sample and the whole Atlantic sample do not quite meet, indicating a separation of a little more than 84 per cent. This degree of separation seems fully adequate to indicate subspecific differentiation. Comparing the west African material alone with the Pacific specimens. they are separated by a large gap, indicating a pronounced degree of differentiation. With a larger sample, this could be interpreted as showing full specific rank for each group, but with the number so small this assumption is not warranted here.

The diameter of the eye, again expressed as a percentage of the head length (Fig. 1D), also provides a reliable character for the distinction of the two subspecies. The Atlantic material covers a range from 27.1 to 31.5 per cent, with the mean at 29.2 per cent. By contrast, in the Pacific material the eye is only 22.7 to 28.1 per cent of the head length, with the mean at 25.4 per cent. As with the length of the snout, the standard deviations of the two samples do not meet, showing that here, too, the samples represent separate subspecies.

Synonymy

The synonymy of the subspecies of *Fodiator* is no less involved than are the characters upon which the separation may be based. Bruun named his Pacific subspecies *pacificus*, and in his 1935 paper noted that there also occurred in the Pacific the at-least-nominal species, *Hemiexocoetus caudimaculatus* Fowler and *Exocoetus rostratus* Günther, both of which are clearly *Fodiator*. The type (and only) specimen of *H. caudimaculatus* is a juvenile, so that comparison with the adult material used here would be of no value. However, this specimen does not differ in any significant way from other juveniles of comparable size that are labelled *Fodiator acutus*. Bruun (1935) gave measurements of the type specimen of *Exocoetus rostratus*. It is undoubtedly a *Fodiator*, and almost certainly belongs in the Pacific subspecies. Thus, the eye is 24.3 per cent of the head, a Pacific characteristic; the snout, at 36 per cent of the head, could fall within either category; pectoral rays 13, while not a clear cut character, also suggests the Pacific subspecies; and the locality of capture, the Hawaiian Islands, prohibits any other conclusion.

Conclusions

The subspecies of *Fodiator acutus* have been shown to be inaccurately diagnosed, but analysis of various characteristics permits a redefinition of the subspecies, as follows:

A. Atlantic Ocean. Eye 29.2% (27.1 – 31.5%) of head: snout 35.1% (33.6 – 36.9%) of head in west African specimens, 40 – 41% in Caribbean.

Fodiator acutus acutus (Cuvier and Valenciennes)

AA. Pacific Ocean. Eye 25.4% (22.7 – 28.1%) of head; snout 39.6% (36.1 – 42.7%) of head.

Fodiator acutus rostratus (Günther)

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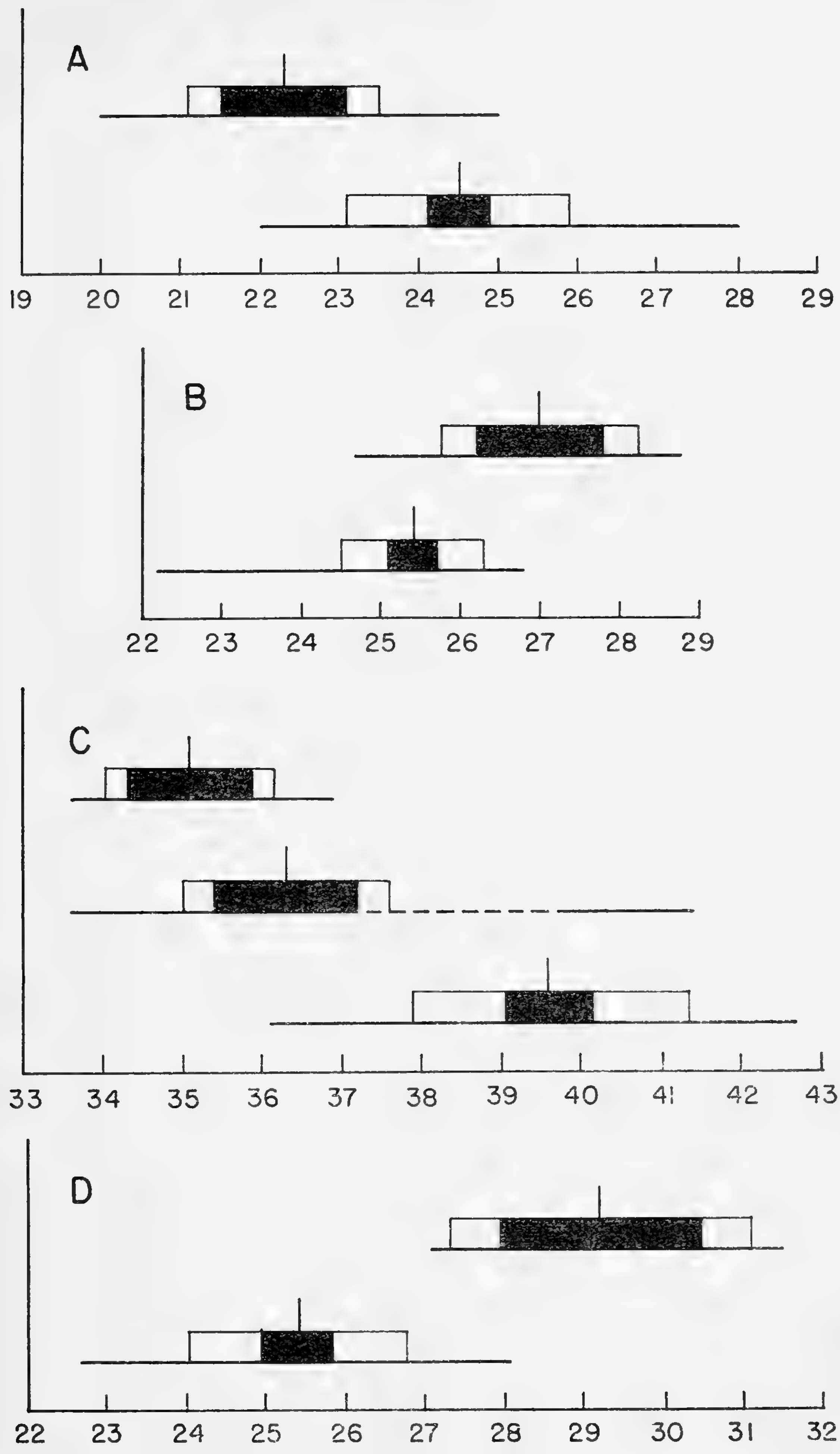
LEGEND FOR FIGURE

Figure 1. Distribution of several characteristics in *Fodiator acutus*. A. Pre-dorsal scales. Upper line, Atlantic sample; lower line, Pacific sample. B. Interorbital width expressed as percent of head length. Upper line, Atlantic; lower line, Pacific. C. Snout as percent of head length. Upper line, West African specimens; middle line, all Atlantic material (dashed base line shows discontinuity in sample); lower line, Pacific specimens. D. Eye as percent of head length. Upper line, Atlantic; lower line, Pacific specimens.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Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 30 February 28, 1957 New Haven, Conn.

NOTES ON THE HORNED COOT, *FULICA CORNUTA* BONAPARTE*

S. DILLON RIPLEY

In May, 1956, while on a visit in South America on behalf of the International Committee for Bird Preservation, I was fortunate enough to meet Senor Luis E. Peña G. through the good offices of Dr. R. A. Philippi, the well-known Chilean ornithologist. Senor Peña, an entomologist, has recently spent two seasons in the highlands of northern Chile, in the mountains of eastern Antofagasta just south of the Bolivian border. His trip has been well described in his own words (1954).

On his trips, Senor Peña has been lucky enough to observe one of the rarest and least known birds of the world, the Horned Coot, *Fulica cornuta.* The other naturalist who has seen them, also a Chilean, is Senor William R. Millie, who found the species and the first known nests on Laguna Grande in the high region of Huasco in 1936, 1945, and 1946. Some of Millie's observations are given in "Las Aves de Chile" by Goodall, Johnson and Philippi (1951). Both these gentlemen have been kind enough to furnish me with notes on the species, and from Senor Peña, I have obtained a pair of his specimens which are now in the Yale Peabody Museum Collection.

Fulica cornuta was described by Bonaparte from a single specimen collected in the highlands of Bolivia, in 1853, and for many years this skin remained unique. It was illustrated in a drawing of the head in a paper by Sclater and Salvin (1868). Hellmayr and Conover (1942) list eight specimens of the

* An informal synopsis of this paper was presented at the Seventy-fourth Stated Meeting of the American Ornithologist's Union in September, 1956.

species in museum collections, all from the highlands of southern Bolivia or northwestern Argentina in Tucuman. Besides these, there was apparently one other specimen collected at Laguna Blanca, Catamarca Prov. Argentina, 1918, now in New York, and five specimens from northern Chile subsequently taken by Millie and Peña, making a total of fourteen in museum or private collections.

Fulica cornuta and *Fulica gigantea*, the Giant Coot, are the two largest coots in the world, measuring up to 19 or 20 inches in total length. The Giant Coot also has a restricted range to the north of the Horned Coot, in the cordillera of central and southern Peru, Bolivia and extreme northern Chile. The two species are apparently allopatric.

The Horned Coot, however, differs from all other members of its family in the extraordinary wattle which arises in the frontal area. Where all other species of the tribe of coots and gallinules characteristically possess a horny shield or cutaneous structure in the area of the forehead, posterior to the bill this species possesses a wattle which is identical in both sexes, and which is flanked by a pair of smaller wattles. The central, large wattle, which in our specimens measures ♂ 29, ♀ 33 mm. in total length in the dry skins, is fleshy and perhaps somewhat extensible or erectile, although neither Peña nor Millie noticed this in life. In these specimens, in breeding condition taken on October 9, 1955, the wattle is far more developed than in the other museum skins which I have examined; some of which certainly were immature birds. It may be, however, that out of the immediate breeding cycle, the wattles shrink in size. The female in Dr. Philippi's collection, secured by Millie and said to be on the nest, has a poorly developed fleshy protuberance, about the size of the drawing of the type in Sclater and Salvin (*op. cit.*), and similar to three immature specimens in the American Museum of Natural History's collection in New York.

The two small flanking wattles in our specimens stand erect on either side of the large wattle, and measure; ♂ 4, ♀ 6 mm. in length. All three wattles terminate in tufts of thick celluloid-like filoplumes, further extending the length of the structure by some 15-20 mm. In addition, the large wattle which lies forward over the bill, pointing in an anterior direction, is cov-

Senor Peña at a nest site on Laguna Verde, 4200 m. alt.

One of Senor Peña's specimens of the Horned Coot contrasted with *Larus serranus* for size.

Photos by L. E. Peña G.

ered irregularly on the dorsal surface with small tufts of down. All of this is well illustrated in the accompanying plate by Robert Clem.

A strange feature which is apparently more obvious in life, for Millie's field notes mention it specifically, is a small patch, appearing white in life, lying below the wattle, at the base of the maxilla. Under examination with low power magnification, this is revealed to be a fleshy caruncle, the rugose skin distended into minute patches which appear to be filled with a fatty mass, for in the dried skin, the color has changed from white to a dull, pale yellow.

The bill color, as shown in the plate, appears to be olive-yellow in life, brightening towards the base of the mandibles to dull orange. There is a black patch along the culmen, wider at the base including the depression in which the external nares lie, and extending out, more narrowly to the tip of the culmen.

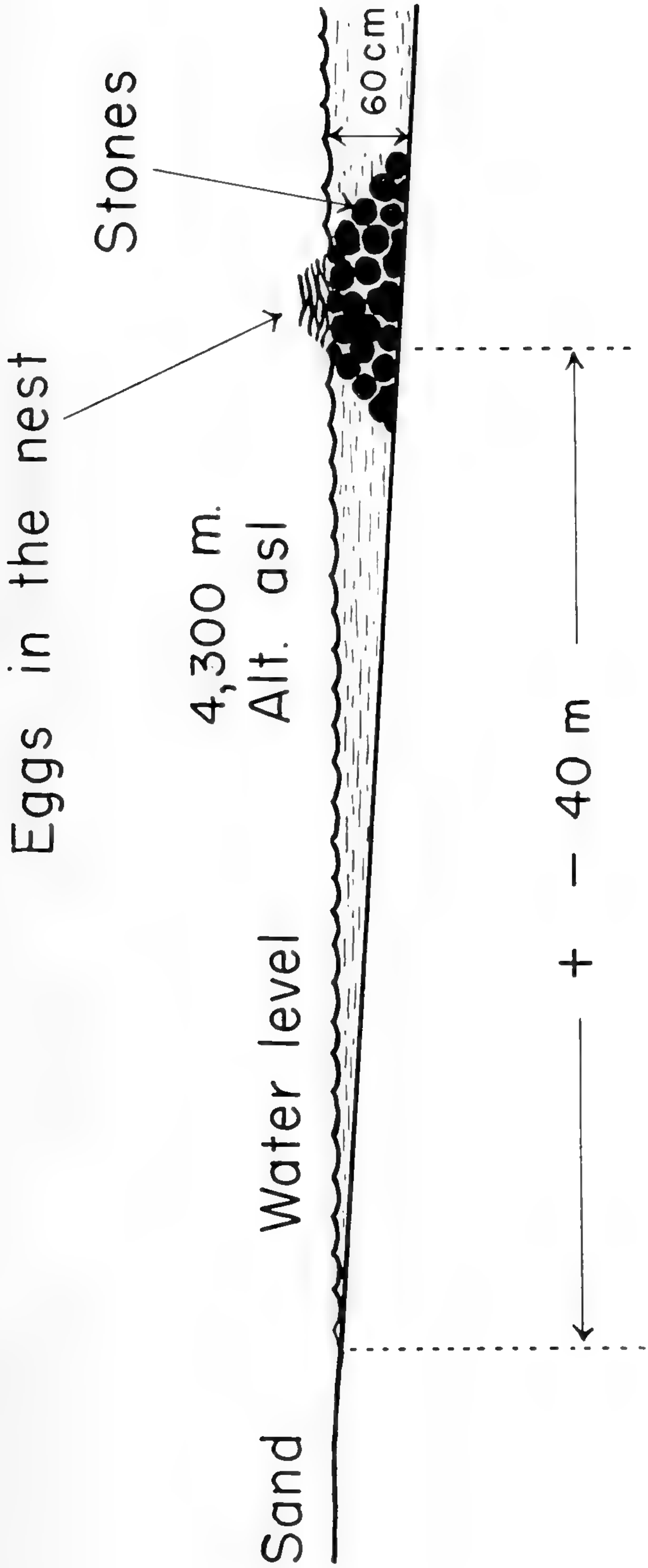
The other unique feature of the Horned Coot is its nest. Nesting has been observed by both Millie and Peña. Peña found nests with incubated eggs in December on Laguna Verde (alt. 4300 m.) on the slopes of Vulcan Hecar, in the northeast of Salar de Loyoquis. Millie found nests with young in December and January and a nest with eggs in late November. He also found nest building in progress on November 27, 1946, at Lagunita de Encierro (alt. 4200 m.). I quote from Millie's letter:

> "I watched a pair constructing their nest for about three hours. They, too, had selected a sheltered place with comparatively shallow water. They were just finishing the stone structure made of stones of the size of small potatoes, carried there by them in their beaks. On this mound which I later measured to be about 1 mt. in diameter and 60 cms. high and which I calculated to consist of at least 1. ½ tons of pebbles they then proceeded to place algae* carried to and fro in rapid journeys.

* Mr. Millie has subsequently been again to the high cordillera of the Atacama, and at my request sent me on November 24, 1956, a specimen of plant material from the lake, which he asserts the coots use in nest building, and also feed on. I am grateful to Professor Gilbert M. Smith of Stanford University, who has examined this specimen and reports that it is in fact not alga, but *Myriophyllum*, a flowering plant, and a far more probable source of nest building material than an alga.

Robert V. Clem

Head of *Fulica cornuta*



The nest of *Fulica cornuta*, Bonap.
in Laguna Verde

> This was accomplished by swimming out to where they found the slime whence they would tip up with head down and come up with a load of the material and carry it to their nest, first making a sort of landing ramp. When I left that evening they had made quite a large portion of the nest. Both birds worked in this home building project. Several old nests from previous years were also seen and all had these stone mounds as a foundation."

Peña describes a similar nest on Laguna Verde, 40 meters from the shore and in water 40 centimeters deep, covered with vegetable material and based on a truncated cone of stones. A diagramatic sketch of the nest is given.

The eggs of *Fulica cornuta* are roughly similar to those of the Giant Coot, about the size of a turkey's egg, and vary from 58.5 to 78 mm. in length and 38.2 to 58 mm. in width, stone gray to buff in ground color, speckled or blotched with dark gray or brown. The clutch consists of three to four eggs.

Fulica gigantea of Peru, like other members of the family, makes a more typical nest of a mat of floating water weeds. The Giant Coot also nests twice a year, in August and again in December. No other known bird constructs its own island of stones on which to nest. All authors who have studied the natural history of this xerophytic area in the high Andes of northern Chile and Bolivia, speak of the paucity of vegetation. It seems possible to speculate that this stone platform nest habit has evolved in response to the lack of vegetation, and also perhaps to the presence of predators on the shores. The local Black-headed Gull, *Larus serranus* found breeding on Laguna Verde by Peña was nesting on a projecting stone, two meters out from the shore of the lake.

Other associated bird species seen by Peña in December besides the gull, were the Andean Flamingo, *Phoenicoparrus andinus*, and in October, the Junin Grebe, *Colymbus occipitalis juniensis*, and Puna Teal, *Anas versicolor puna* and the Andean Crested Duck, *Lophonetta speculoides alticola.*

The October birds, taken by Peña were paired and courting, thus possibly explaining the enlargement of the wattles. Peña reports that the weather is ferocious at this altitude in October, the wind almost ceaseless from the WSW. At 11 A.M. part of the lagoon was covered with ice which he had to break and swim in to retrieve his specimens. The only moderate season in this area is from December to February, and this probably determines the nesting cycle which differs from that of *Fulica gigantea*.

No definite information is available about the territorial behavior of *Fulica cornuta*. Goodall, Johnson and Phillipi (t. c.: 187) report 36 nests of *Fulica gigantea* on all parts of Lake Cotacotani. Neither Mr. Millie nor Mr. Peña have reported more than a single pair of *Fulica cornuta* on any one lake, though they have spoken of abandoned and old nest sites. From the meager evidence available, it would appear that *Fulica cornuta* tends to be territorial and ungregarious.

Summary

From the above observations it appears that the Horned Coot, unlike the Giant Coot, nests only once a year, from the end of November to the beginning of January, that its preferred nesting area is small lakes in northern Chile, southern Bolivia and northwestern Argentina above 12,000 feet, more commonly above 13,000 feet in essentially a xerophytic zone.

During the courtship period there is a considerable development in both sexes of elaborate frontal wattles with an associated local caruncle. Actual courtship behavior has not been observed, but must involve use of these highly developed appendages, as the frontal shield is used in other coots, described by Gullion (1953).

Unlike other birds, Bonaparte's Horned Coot builds its own Elba, a nest composed of an island of stones erected by the pair, and covered with a mass of plant material.

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Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 31 March 28, 1957 New Haven, Conn.

NEW BIRDS FROM THE WESTERN PAPUAN ISLANDS

S. DILLON RIPLEY

As a preliminary to further publications on the work of the 1954 Yale Peabody Museum Expedition to the Moluccas, I should like to describe the following new forms of birds collected on the trip undertaken by myself and my wife. Following our departure from Netherlands New Guinea in December, 1954, my assistant, Jusup Khakiaj, made a small collection of birds on the Islands of Misool, the Schildpads, Kofiau and Waigeu in early 1955. In addition to funds from Yale, my work was financed by a Fellowship from the Guggenheim Foundation as well as a Grant from the National Science Foundation. To the authorities of these organizations I am deeply grateful. I must also record my thanks to Drs. Dean Amadon and Charles Vaurie of the American Museum of Natural History, and Mr. R. M. de Schauensee of the Philadelphia Academy of Natural Sciences for help in examining specimens in their care.

Aepypodius arfakianus misoliensis subsp. nov.

Type: ♀ ad. (Y.P.M., no. 36560), collected November 22, 1954, by S. Dillon Ripley ten kilometers W.N.W. of Tamulol, Misool Island, Netherlands New Guinea.

Diagnosis: Compared to *arfakianus*, a series of three specimens, have more slender, slimmer bills which appear not so highly arched as in the mainland population from New Guinea. In addition, the feathers of the vent are tipped with slaty-gray, paler and lighter than in New Guinea birds, and the chestnut of the upper and under tail coverts is duller, less rich in appearance. This population appears to be smaller in size also.

Measurements:

arfakianus 9 ♂ ♂ ♀ ♀

wing	tail	bill (from ext. naris)
260-272 (267.8) mm.	130-149 (141.9)	20-22 (21.4)

misoliensis 3 ♂ ♀ ♀

wing	tail	bill (from ext. naris)
243, 261.5, 264 mm.	131.5, 141.5	19, 20, 21.5

Range: Misool Island, Netherlands New Guinea.

Remarks: The occurrence of this large Bush Turkey on Misool Island as well as Cuvier's Bush Turkey, *Talegalla cuvieri*, is a remarkable discovery. It is planned to publish detailed comments on these species at a later date.

Eos squamata attenua, subsp. nov.

Type: ♀ ad. (Y.P.M. no. 36561) collected March 22, 1955, by Jusup Khakiaj on Kamoa I. Schildpad Is. north of Misool.

Diagnosis: From *squamata* this form differs by having a much reduced nuchal collar. Only one specimen of three shows a patch on the nape of the neck, and in all the specimens the prominent patch on the foreneck and upper breast extending to the throat is lacking or only lightly indicated with a few purplish blue tips to the feathers. The under surface of the tails of these birds tends to be rather brighter and more reddish, more like *obiensis*. From this form as well as *guenbiensis* it differs, however, in lacking the purplish occipital spot, the pronounced collar, and, in *obiensis*, the black scapulars and greater wing coverts.

Range: Kamoa, Lophon and presumably in the rest of the group of the Schildpad Is., north of Misool.

Crateroscelis murina fumosa subsp. nov.

Type: ♂ ad. (Y.P.M. no. 36562) collected Nov. 18, 1954, by S. Dillon Ripley inland from Tamulol, Misool Island, Netherlands New Guinea.

Diagnosis: This form is nearest *capitalis* from Waigeu from which it differs in the male in the head being darker, more blackish brown. Below in both sexes Misool birds are much more reddish on the underparts. Compared to *C. m. monarcha* from the Aru Islands this population appears to be much more richly colored. Like *capitalis* the Misool birds are smaller than typical *murina* of New Guinea with the top of the head in the male darker, more richly colored.

	wing	tail	culmen
Measurements: ♂, ♀ ♀	53, 52.5, 55	33, 33.5, 35	16, 15(2)

Weight: ♂, ♀ ♀ 15, 12, 13 grams.

Range: Misool Island, Netherlands New Guinea.

Gerygone magnirostris occasa subsp. nov.

Type: ♂ ad. (Y.P.M. no. 36563) collected May 2, 1955, by Jusup Khakiaj on Kofiau Island, Netherlands New Guinea.

Diagnosis: From *cobana*, *brunneipectus* and *conspicillata*, this form differs by being much more richly yellow on the abdomen, belly and under tail coverts, in this character approaching the form, *rosseliana* from the Lousiade Archipelago, from which it differs in having the throat whitish and with a brownish tinge on the pectoral area. On the upperparts it is darker, more brownish olive than the geographically neighboring forms mentioned above. Above it is close to *affinis* from northern New Guinea, although again it is much more brightly colored on the lower surface than that form.

	wing	tail	culmen
Measurements:	53.5	37	11.5 mm.

Range: Kofiau Island, Netherlands New Guinea.

Remarks: This form is described from a single specimen unfortunately, but a specimen which is so strikingly different from its geographical neighbors that it would seem to require recognition.

Xanthotis chrysotis austera, subsp. nov.

Type: ♂ ad. (Y.P.M. no. 36564) collected Nov. 15, 1954, by S. Dillon Ripley at Tamulol, Misool Island, Netherlands New Guinea.

Diagnosis: From *chrysotis* this form differs by being darker and possibly somewhat smaller in size. The tone of the upperparts is darker olive, brownish. The throat is dark gray, tinted at the lower edges with olive green. The lower parts are dark, considerably darker than *chrysotis*, and much darker than *fusciventris*. This form is much brighter, more yellowish-tinted on the breast and more olive-tinted on the back than *saturatior*, differing from that form as does *chrysotis*.

Measurements: 2 ♂ ♂, 2 ♀ ♀

wing	tail	culmen
♂ 96,103.5 (moult)	♂ 83,84 (moult)	♂ 29,31
♀ 92,94 (moult)	♀ 73,77 (moult)	♀ 25.5,26

Weight: ♂ 49, ♀ 38 grams.

Range: Misool Island, Netherlands New Guinea.

Remarks: The wing measurements of typical *chrysotis* fall within the range of 100-110 mm. for males and 95-100 for females. It would appear that the Misool birds are smaller than the form from the mainland of New Guinea, although lack of material and moult in two specimens prevents complete certainty in this case.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 32 June 20, 1957 New Haven, Conn.

ADDITIONAL NOTES ON THE HORNED COOT, *FULICA CORNUTA* BONAPARTE

S. Dillon Ripley

Subsequent to the publication of the notes on this curious species contained in *Postilla* No. 30, Feb. 28, 1957, new information has come to light which seems worth printing here. Again I am indebted for these added observations to Sr. William R. Millie of Vallenar, Chile, as well as to Sr. A. W. Johnson of Santiago, who have recently returned from a trip to the high altiplano of extreme northern Chile and western Bolivia.

Mr. Johnson and Mr. Millie found a group of twelve Horned Coots on an artificial lake called Tranque Caritaya, altitude 3600 metres, in the south of the Department of Arica, Chile. This extends the range of *Fulica cornuta* north more than 500 kilometres from the previously known range in Chile. Lake Caritaya is only 60 miles from Lake Cotacotani where *Fulica gigantea* has been observed (1951, Goodall, Johnson and Philippi, *Las Aves de Chile*, **2**: 185-188), although it is 1200 metres lower in altitude.

At this lake Messrs. Johnson and Millie found three nests on February 9 and 10, 1957, of which one was occupied by a female brooding a clutch of eggs, about one-third advanced in incubation, and the others gave evidence of having been recently occupied. A point of great interest was that the nests were constructed entirely of vegetation, apparently *Myriophyllum*, *vide* Millie, in the usual coot fashion, but that the shape of these nests was similar to those made of stones far to the south, being cone-shaped with the greater part under water apparently resting on the bottom, unlike the mat-shaped, largely floating nests of *Fulica gigantea* and the smaller species.

It seems possible to speculate, therefore, that the nests made of stones in the alpine xerophytic zone where *Fulica cornuta* has previously been observed, which have only a coating of *Myriophyllum* on the surface, have been developed as a unique nest building habit in direct response to the lack of vegetation, and that where vegetation is abundant this species will build a nest using traditional materials, although in a particular shape, peculiar to itself.

Three further points of interest emerge from these observations of extension of range of this species. The presence of several birds on Lake Caritaya implies at least that *Fulica cornuta* is more tolerant than its occurrence in the south would suggest. Perhaps the local abundance of food and nesting materials allows compression of territories in this situation. In addition it would appear that *Fulica gigantea* and *Fulica cornuta* are at least geographically sympatric, although the species may be altitudinally or ecologically isolated in this zone of presumed overlap.

Finally, the lateness of this nesting date in February might allow the Horned Coot to nest twice in the year. The Giant Coot nests in August, and again in November-December. *Fulica cornuta* has been known to breed only from late November to early January, now to February. Further investigation is needed to determine whether a double nesting cycle may occur in this species in the northern part of the range.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 33 Nov. 1, 1957 New Haven, Conn.

ON A NEW SPECIES OF *ANISOPS* (HEMIPTERA, NOTONECTIDAE) FROM THE MOLUCCAS

G. E. Hutchinson[1]

In a small collection of aquatic insects made by Dr. S. Dillon Ripley in the Moluccas, two specimens of the genus *Anisops* are present. One of these is a female specimen from Misool which is possibly referrable to *A. stali* Kirk.; in the absence of a male it is obviously impossible to make a precise identification. The second specimen appears to represent a new species.

Anisops sylvia sp. n.

Stramineous with dark venter abdominis, no special pigmentation.

A moderately small, fairly wide-headed species with a long pronotum, anterior half of body subparallel, widest just before the middle.

♂ Head wide (1.84mm), almost as wide as pronotum, about four times the anterior width of the vertex (0.36mm) which is just over twice the width of the synthlipsis. Anterior margin

[1] *Department of Zoology, Yale University.*

of head between eyes very slightly rounded and hardly projecting, frontal interocular region hardly visible in lateral view, no longitudinal roll-like ridge between eyes (fig. 1).

Pronotum just over twice (1.47mm) the length of the head (0.67mm) as seen from above and three fourths as long as wide (1.95mm); sides slightly diverging from anterior to humeral angles, posterior margin very slightly flattened centrally; exposed portion of scutellum about half (0.70mm) the length of pronotum.

Facial tubercle low, simple, glabrous, with traces of slight lateral depressions just inside postero-ventral corners of eyes. Labrum very short, much wider than long (fig. 2); prong of third rostral joint very slightly longer than the joint itself, apex subacute.

Anterior femur subparallel, suddenly constricted apically, tibia with comb in two sections, of eleven small proximal tooth-like irregularly set elements and sixteen distal lamelliform elements; tibial chaetotaxy as in figure 3; claw one-third the length of tarsus.

Intermediate claws equal and regularly curved. Dimensions of joints of legs in millimeters:

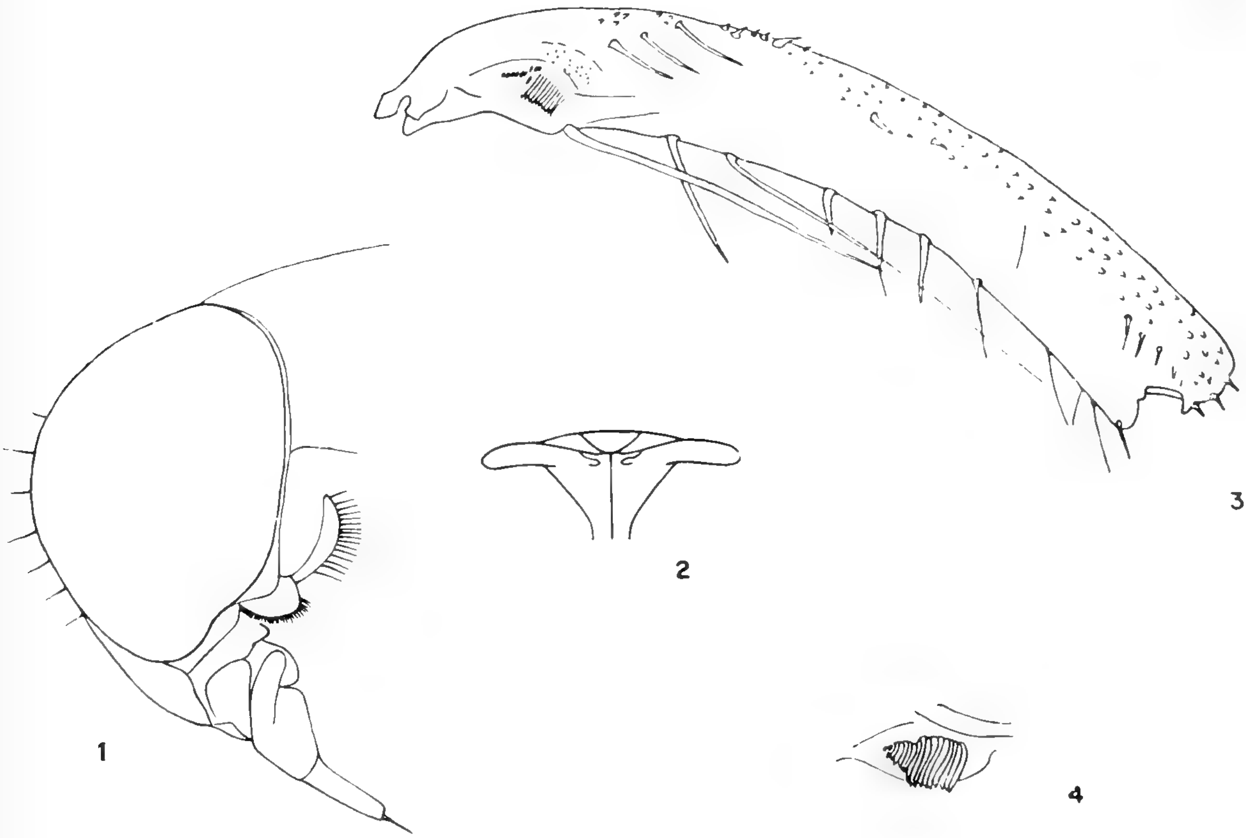
	Femur	Tibia	Tarsus	
Anterior	1.38(100)	1.24(90)	0.86(62)	
Intermediate	1.60(100)	1.46(91)	0.66(41)	0.54(34)
Posterior	2.72(100)	2.16(80)	1.18(43)	0.73(27)

Length 6.4mm, maximum breadth 2.0mm.

INDONESIA: Molucca Archipelago; Gng Sibela, Batjan Is.

Sept. 19, 1954. 1 ♂. S. Dillon Ripley (*holotype* P.M.)

In the structure of the tibial comb, with a series of short proximal followed by long distal elements, *A. sylvia* resembles, among the ninety well-known (Brooks, 1951) species of the genus, only *A. nigrolineata* Lundblad (1933) from Java, India,



Anisops sylvia, sp. n. holotype

1. Lateral view of head.
2. Labrum and rostral prong.
3. Anterior tibia.

Anisops nigrolineata Lundblad, Sohawa, Pakistan

4. Tibial comb of ♂.

Pakistan, Burma and the Philippine Islands. The new species differs strikingly from *A. nigrolineata* in lacking the longitudinal rounded ridge between the eyes on the antero-ventral region of the head; the seriation of the elements of the comb is even better developed, with more numerous but more reduced distal elements in *A. sylvia* than in *A. nigrolineata* (fig. 4). The new species resembles both *A. nigrolineata*, and *A. paranigrolineata* Brooks from the uplands of central and south India, in the excessively short labrum, and in the long pronotum. The three species clearly form a natural group and are certainly more closely allied to each other than to any other members of the genus.

I am greatly indebted to my friend Dr. Ripley for the opportunity to describe this species, and to Mrs. Nancy S. Kimball for professional assistance with the figures.

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Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 34 March 7, 1958 New Haven, Conn.

NOTES ON AN ADDITIONAL EXAMPLE OF THE FRUIT BAT, *SCOTONYCTERIS OPHIODON* POHLE

Alvin Novick[1]

In the Peabody Museum collection of bats there is a single specimen of a fruit bat which appears to be closely allied with *Scotonycteris ophiodon* Pohle (1943) and *Scotonycteris ophiodon cansdalei* Hayman (1945), both of which are known only from the type specimens.

Scotonycteris ophiodon Pohle. Skin and part of skull, Y.P.M. #9442, collected in Liberia, 1928(?), by G. P. Cooper.

Most of the cranial portions of the skull are missing, including the posterior and ventral borders of the orbits and the zygomata. This specimen is similar to *Scotonycteris ophiodon* Pohle and to *S. o. cansdalei* Hayman in general size and in external and dental characters. Like *cansdalei* it has conspicuous white patches at the posterior angles of the eye and extremely faint and inconspicuous white tufts at the anterior base of the ears (both spots lacking in *ophiodon*). The white border of the upper lips is conspicuous for only two-thirds of the way forward towards the nostrils but can be traced faintly

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all the way to the nostrils. In *ophiodon* the white border is said to include the nostrils; in *cansdalei* it reaches two-thirds of the way to the nostrils. These two forms have otherwise been distinguished by cranial features which can not be assessed in this specimen. Neither author has mentioned the conspicuous yellowness of the skin ventral and anterior to the orbit and the small bright yellow patches of fur ventral to the postorbital patches of white seen in this specimen. The skin of the rostrum is faintly yellow; the skin under the jaw and extending back to the breast is also yellow, darker anteriorly and fading to a faint yellow posteriorly. Otherwise Hayman's description of the fur and color of *cansdalei* agrees in detail with the present specimen.

The measurements of the three specimens are compared in Table 1. The present specimen differs markedly from the other two in total length but this measurement is unreliable in prepared specimens. The hindfoot is somewhat longer as are all of the metacarpals while the forearm and pollex are in the same range. The palate is similar in total length but the post dental palate is slightly longer. The breadth m^1—m^1 is greater but the breadth c—c and the interorbital constriction are only slightly greater. The mandible is distinctly longer and is also higher at the coronoid. The teeth are all but identical in size and form with those of the previously described specimens. Thus this bat differs most interestingly from *cansdalei* in having increased yellowness of the skin of the head with the appearance of yellow tufts of fur posterior to the eyes. Furthermore it differs in having a longer hind foot, longer metacarpals, and a longer and higher mandible.

REMARKS

In 1943, Pohle described *S. ophiodon* from Bipindi, Cameroons, as the second species of the genus, previously known only from the genotype, *S. zenkeri*, whose range included the Cameroons and Fernande Po. *S. ophiodon* was characterized by its much greater size and by striking dental peculiarities, of which the most important are the secondary cusps on the inner edges of upper and lower canines and the heightening of the canines and cheekteeth; the latter also being provided with prominent inner cusps. *S. o. ophiodon* also lacks the white spot behind the eye found in *zenkeri* but agrees in most other respects in markings and color.

Pohle considered that some of the characters of *ophiodon*, particularly those of the cheekteeth, showed affinity to *Casinycteris argynnis*, whose close external similarity to *Scotonycteris* has been discussed by Andersen (1912). Pohle felt that the palatal characteristics of *Casinycteris* by which the genus is principally defined were unstable and proposed to relegate the genus to synonomy with *Scotonycteris.* Hayman (1945), however, has convincingly defended the independent position of the genus *Casinycteris.* Thus the three species belonging to two genera—*Scotonycteris zenkeri*, *S. ophiodon*, and *Casinycteris argynnis*—present an interesting group. The heightening of the inner cusps of the cheekteeth of *ophiodon* is a feature very closely approaching the dentition of *Casinycteris argynnis*, rather than S. *zenkeri.* The normal palate is shared by the two species of *Scotonycteris* but not by *Casinycteris.* The secondary cusps of the canines of *ophiodon* are found neither in *zenkeri* nor in *Casinycteris.* Externally these three are very similar, being distinguished only by details (which may well be variable) of the facial markings. The white ear tuft which is characteristic of all other epomophorine bats disappears in *zenkeri* and *ophiodon* but reappears in *cansdalei*, in the present specimen, and in *Casinycteris*; the white spot behind the eye is not found in *ophiodon.* Yellow postorbital spots appear only in the present specimen.

It appears that these three species form a natural group as judged by external appearance, dentition, cranial characteristics, wing membrane insertion, and many other considerations. The material at present is too sparse to attempt a clear analysis of the larger group when so few specimens represent most of the forms. It appears that its aberrant palate justifies retaining the genus *Casinycteris.* I am not prepared any more than was Hayman to erect a new genus for *ophiodon* because of its dentition. I feel that its clear dental separation from *zenkeri* should be emphasized by the erection of a new subgenus.

Hayman chose to express the position of *cansdalei* as a subspecies of *ophiodon* with the comment that the differences might be of specific value. I am reluctant to name a new form from the present specimen in view of its incomplete skull and of its being a single specimen to be compared with only single specimens of both *ophiodon* and *cansdalei*. The differences, nevertheless, between the Peabody Museum specimen and the types of *ophiodon* and *cansdalei* appear to be slightly greater than the differences between the latter two. For the time, I suggest considering this specimen to be a variant of *Scotonycteris ophiodon* Pohle. Its discovery in Liberia increases the known range of this fruit bat to include Liberia, Gold Coast, and the Cameroons.

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TABLE 1

All measurements are in millimeters. Where a blank appears, the portion concerned could not be measured. The measurements of *ophiodon* and *cansdalei* are taken from Hayman (1945).

	Scotonycteris o. ophiodon	*S. o. cansdalei*	Y. P. M. #9442
Head and Body	105	115	143
Tail	1	...	palpable
Hindfoot	14	15	19
Ear	20.5	22	...
Forearm	75	76	73.8
Pollex	36.5	31	35.2
2nd metacarpal	39	35	43.2
3rd metacarpal	54	52	58.5
4th metacarpal	50	49	55.5
5th metacarpal	51	50	54.9
Skull, total length	36	36	...
Palation to inc. foramina	17.6	17	17.7
Palation to basion	12.2	13	...
Post-dental palate	6.4	6	7.0
Rostrum	9.2	10	9.6
Braincase at zygomatic root	16	15	...
Zygomatic breadth	21	22.5	...
Breadth m^1—m^1	12.6	12	13.4
Breadth c—c	6.7	7.5	7.8
Breadth of postorbital processes	11.2	14	...
Interorbital constriction	6.4	7	7.2
Diameter of orbit	9	9	...
Length of mandible	26.5	26.5	29.5
Height at coronoid	11.2	12	14
Upper tooth row c—m^3	11.9	12	11.9
Height c^1	6.1	5.5	6.0
Height p^3	3.8	4	4.1
Height p^4	3.1	3	2.8
Height m^1	2.3	2	2.3
Height c_1	4.1	4	4.1
Height p_3	4.1	4	3.9
Height p_4	3	3	3.2
Height m_1	2.4	2.1	2.2
Height m_2	1.1	1.2	1.3

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 35 April 21, 1958 New Haven, Conn.

NOTES ON INDIAN BIRDS. VII.*

S. Dillon Ripley

Pycnonotus leucogenys (Gray)

In my forthcoming hand-list of Indian birds, I have treated the White-cheeked Bulbuls as belonging to a single species. I have been interested, therefore, to read a disquisition on this interesting problem by Vaurie (1958, *Amer. Mus. Novit.* No. 1869:14-15) whose conclusions differ from mine. *Pycnonotus leucogenys leucogenys* is a sprightly, cockaded bulbul which ranges along the Himalayas from extreme eastern Afghanistan at medium altitudes up to 8000 feet, following the main river valleys such as the Kunar, Jhelum, etc., moving into such marginal areas as Hazara and Chitral with the advent of warm weather. Thence it extends east to Nepal, Sikkim and Assam north of the Brahmaputra River. It is a wandering species whereever it occurs in the northwest, addicted to cultivated areas and moving with the seasons. The distribution in the higher latitudes of its range (above 33° N. lat.) seems to be a marginal fluctuating one, implying that the species has reached the limit of its ecotolerance and is probably subject to sporadic occurrences and numerical fluctuations in this area. Such behavior may be shown some day to account for the two ques-

*The preceding number in this series appeared in *Postilla,* No. 20, July 9, 1954.

tioned sight records of Zarudny in the Tadzhik S.S.R. They may have been vagrants or strays during a warm weather post-breeding wandering season.

Whistler (unpublished MSS and *Popular Handbook of Indian Birds*, 1941, and subsequent dates) speaks of this form as occurring in Afghanistan, although he doubts its occurrence in his subsequent publication on Afghanistan (1944, *Jour. Bombay Nat. Hist. Soc. 44*:518); Baker also records it (1922, *Fauna Brit. India, Birds, 1*:390). The Afghan population has recently been described as a new subspecies, *picru*, by Koelz (1954, *Contrib. Inst. Regional Exploration*, No. 1:11) who collected a series near Laghman in extreme east Afghanistan in May, 1957. My own feeling is that these birds may well have recently arrived as summer visitors to the area from the lower valleys to the east. They do not appear to be separable from populations farther to the east, *vide* Vaurie, *op. cit. supra*, and Traylor (in litt.) who kindly examined specimens in the Chicago Museum for me.

Pycnonotus leucogenys leucotis is a lowland form, reaching 6000 feet in warm weather in the Kandahar area, more addicted to dry arid localities in tropical dry deciduous and semi-desert as well as desert facies. Like *leucogenys*, however, it frequents cultivated areas and spreads with the spread of gardens and groves, probably thereby extending its range. This form is the common White-eared Bulbul of West Pakistan and western India extending north to Kandahar and southern Afghanistan. West, the species extends to Iran, Iraq, and Arabia. *P. l. leucotis* lacks a crest and, therefore, appears quite distinct from *leucogenys*, especially in museum skins. Dr. Bowdler Sharpe was, at one time, inclined to separate the two forms into different genera (*vide* Whitehead, 1909, *Ibis*:113). My own reaction when I first saw *leucotis* and *leucogenys* separately in the field was that although in habits and behavior they were identical, nonetheless they were recognizable in terms of plumage differences as separate species.

However, there is an intermediate population which occurs at exactly the meeting place of the two forms, the upper Indus River in North West Frontier Province of West Pakistan in the Bannu and Kohat districts where the Kabul River joins the Indus. This population has been discussed by Whitehead (1909, *op. cit*:112-114) under the name *Molpastes leucogenys*. He does not seem to have been aware that he was discussing *Pycnonotus leucogenys humii* which differs from *leucogenys* in possessing a blackish head with reduced olive wash on the back. The range of *humii*, which was described by Oates in 1889 (*Fauna Brit. India, Birds, 1*:274), extends up the Kabul River at least to Jalalabad thence east in Bannu and Kohat districts to Cambellpur and Rawalpindi, Jhelum and the Salt Range of West Punjab.

Vaurie, on the basis of one specimen (1958, *op. cit*:16), has given a key to the species which implies that *humii* is closer to *leucotis* and so should be listed with it. Specimens in the Yale Collection and others I have examined in London show that Vaurie's description is at fault and that *humii* is, in fact, an intermediate.

Vaurie's characters are as follows:

	leucogenys	*leucotis*	*humii*
size	"larger, more robust, distinctly larger bill with more strongly developed rictal bristles"	smaller	small, but with a "slightly larger" bill than *leucotis*

[The above is not supported by the evidence. Typical *leucotis* has a smaller bill, but when the western, Persian Gulf forms are compared, their size becomes equal to *leucogenys*. As is so often the case with chains of subspecies, nearly contiguous forms tend to have more pronounced size differences than those more spatially separated.]

color	"greenish on the back and rump in fresh plumage"	"grayish brown" in fresh plumage	"identical with nominate *leucotis*"

[The above is not entirely accurate. The intermediate *humii*, in fresh plumage, has a faint greenish-olive tinge on the back, exactly intermediate between *leucogenys* and *leucotis*.]

	leucogenys	*leucotis*	*humii*
crest	"narrowly edged with white . . . more conspicuous above the eye thus forming a distinct superciliary streak"	"no crest . . . not edged . . . no streak"	"crest feathers black, not edged with white . . . broader and rounded"

[The above does not entirely describe the situation in *humii* which has the feathers of the head exactly intermediate between the condition of *leucogenys* and *leucotis*, the feathers slightly lanceolate but somewhat broader, with pale edgings to the feathers above and behind the eye and a distinct short white superciliary streak, more prominent in some specimens than others.]

crown color	"brown"	"black"	"black"

[In *humii* the crest feathers are brownish black, not pure black.]

I would prefer to list the variations in these forms as follows:

	Crest	Superciliary Streak	Back Color	Cheek Patch	Blackish edging to feathers at nape	Vent
leucogenys	long, brown	present	greenish-olive brown	smallest	present	lemon yellow
humii	moderate, brownish-black	present but reduced	dull olive brown	intermediate	present	lemon yellow
leucotis	lacking, black	lacking	grayish-brown	largest	nearly absent	chrome yellow

From the above it will be seen that *humii* occupies the position of an intermediate in morphological characters, and occurs in the area where the ranges of *leucogenys* and *leucotis* meet. As the form has intermediate and recognizable characters and possesses a discrete range, it would appear to qualify by every conservative definition as a subspecies linking two adjacent subspecies.

The possibility must not be neglected that *humii* is a hybrid, as Vaurie has noted. If it can be shown to be a hybrid, then it is strange that the 30-odd specimens which have been collected have not shown a great deal more variation. It could be that this is a case of interspecific hybridization as shown by Meise (1936, *Jour. f. Orn.*, *84*:631-672) for two species of *Passer* in the Mediterranean, or Chapin (1948, *Evolution*, *2*:111-126) for Paradise Flycatchers, *Terpsiphone* species in Africa. Both these cases have been due perhaps to disturbance of the environment. Similarly, in Ceylon (1946, *Spolia Zeylanica*, *24*:218-220), I have described hybridization in two well marked subspecies of Drongos. Bulbuls hybridize in the area, witness the hybrid specimens taken in Bannu District, between *Pycnonotus leucogenys leucotis* and *Pycnonotus cafer intermedius*.

I believe, however, that in this case *humii* represents a stable form, possibly derived from an original hybridization between two rather morphologically different ancestors, possibly merely one of a series of widely spaced steps in a discontinuous cline of originally geographically isolated and spatially evolved subspecies. Should the former supposition, with its implication of a stabilized hybrid swarm seem feasible, it would provide a most interesting subject of experimental study, as worthy of research as the provocative population known as the Marianas Mallard, *Anas oustaleti*, which has been described as a possible hybrid swarm by Yamashina, (1947, *Pacif. Sci. 11*:121-124).

The Name of the White-headed Babbler

The names of the White-headed Babbler and its close relative, the Bombay Babbler or Jungle Babbler from Ceylon and Peninsular India have been the subject of considerable confusion over the years.

Jerdon (1863, *Bds. of India*, *2*:59-63) listed the then-known forms of these babblers from India as: *Malacocircus terricolor* Hodgson from Bengal, the Nepal lowlands or *terai* and adjacent areas; *Malacocircus griseus* (Gmelin), in the Carnatic, with perhaps a closely allied form, *M. affinis* Jerdon, in the south of Malabar; *Malacocircus malabaricus* Jerdon in the Peninsula, and *Malacocircus somervillei* (Sykes) in Bombay. He mentions *M. striatus* Swainson of Ceylon which he says is very close to *terricolor*.

Oates (1889, *Fauna of Brit. India, Birds*, *1*:110-114) lists *Crateropus canorus* (Linnaeus) for the whole of India, with *Crateropus griseus* (Gmelin) in Southern India, *Crateropus striatus* (Swainson) in Ceylon, and *Crateropus somervillii* (Sykes) in the Western Ghats. This is the same arrangement as that of Sharpe, (1883, *Cat. Bds. Brit. Mus.*, *7*:480-483) who listed the same four species with equivalent ranges.

More recently, Baker (1922, *Fauna Brit. India, Birds*, *1*:190-195) listed three species with added subspecies for the area: 1) *Turdoides terricolor terricolor* (Hodgson) in northern India to Bengal, *Turdoides terricolor malabaricus* (Jerdon) in southern India, *Turdoides terricolor sindianus* (Ticehurst) in West Pakistan and western India; 2) *Turdoides griseus griseus* (Gmelin) in southern India north only to a line from Ellore, Secunderabad and Belgaum, and *Turdoides griseus striatus* (Swainson) in Ceylon; 3) *Turdoides somervillei* (Sykes) from Bombay south to Travancore. So in a period of fifty-nine years, these babblers had been reduced from five species to three, with at least eight names being used for the various forms.

In volumes 7 and 8 of his work (1930), Baker introduced two additional names for the first time (pp. 36, 601). These were the substitute name *Turdus polioplocamus* Oberholser, 1920, a new name for *Turdus griseus* Gmelin, preoccupied by *Turdus griseus* of Boddaert 1783. In addition he listed *Turdoides striatus* (Dumont) 1823, an earlier name than *T. striatus* of Swainson, 1832, and gave to it the type locality of Ceylon.

Unfortunately, Baker had apparently not consulted either the original volume of Levrault's *Dictionnaire* from which

Dumont's name came, nor the valuable early work of Jerdon, 1847, *Illustrations of Indian Ornithology.* In the latter volume (text to plate XIX) Jerdon discusses *M. striatus* Swainson from Cylon and says:

> "It was founded on a Ceylon species which Mr. Swainson identified with a bird in the Paris Museum labelled *Gracula striata.* It is *Cossyphus striatus* of Dumeril (Blyth), and *Philanthus striatus* of Lesson.
>
> "It is not impossible, however, that the *striatus* of the French Museum is one of the allied species, either *terricolor, malabaricus,* or *orientalis,* which Swainson might have readily enough mistaken for it. Lesson says it was from Bengal; if so it is probably *terricolor.*"

The most recent and far more biologically interesting treatment of these species is that of Whistler and Kinnear (1936, *Jour. Bombay Nat. Hist. Soc. 35*:737-741) who point out that there are in fact two species involved. One is the Jungle Babbler which ranges from West Pakistan and northern India in the Himalayan foothills, Nepal, east to Bengal and western Assam, and south throughout the Peninsula. The second species is the White-headed Babbler which occurs in Peninsular India as far north as Belgaum on the west, Chanda in the center, and Andhra in the east to the border of Bastar. In Ceylon also, the White-headed Babbler occurs with, in addition, the Rufous Babbler, which is combined nowadays with the Indian Jungle Babbler as a well marked subspecies. In the species *somervillei,* Whistler and Kinnear recognize four subspecies: *sindianus* (Ticehurst), *terricolor* (Blyth), *malabaricus* (Jerdon) and *somervillei* (Sykes). In the species *striatus* they list *polioplocamus* Oberholser and *striatus* (Dumont). Later Whistler (1944, *Spolia Zeylanica, 23*:131), discussing the species *striatus,* reintroduces the name *affinis* (Jerdon) for the Indian Peninsular race of the species, without saying that he evidently considers this an earlier name than that of Oberholser, as a substitute for the name *griseus* (Gmelin), preoccupied.

Out of this history of varying nomenclature and usage, one fact emerges. North of the Peninsula proper of India, in areas such as Bengal, only one form of this babbler occurs; it is the one which has normally been named *terricolor,* ascribed either to Hodgson or Blyth, but of whose proper appelation Jerdon (1845, *op. cit.*) had expressed a doubt.

The original description of Dumont (1823, *Dict. Sci. Nat.* [ed. Levrault], *29*:268) is of a bird which he calls *Cossyphus striatus* and of which he remarks that several individuals have been received, collected in "Bengale" by Macé and Dussumier, their size being that of a common thrush, and their color dominantly reddish gray. One specimen has some brown transverse striations on the breast, and among the others the striations are longitudinal and paler.

In response to a query about specimens at the Paris Museum, Professor Berlioz has kindly written me as follows (in litt.):

> "We have in our old mounted collection a specimen which *possibly might have been* the type of Dumont's description; but nothing is more doubtful as, in the register, it bears only the mention 'type' (but of which author?) and, without any label, the only mention, underneath—by a comparatively recent handwriting—'Bengale, Macé' . . . the head certainly does not show any sign of lighter, whitish color in front, and the culmen (18 mill.) is intermediate in size between our long-billed specimens from the Central Provinces in India and the short-billed from Southern India and Ceylon.
>
> "However, the most obvious remark is that *it is not* the typical white-headed bird with short bill from Ceylon; but nothing can be ascertained about it being Dumont's type of *Cossyphus striatus.*"

The above at least determines that in fact *Cossyphus striatus* as defined by Dumont came from Bengal (where only one species occurs), and that the sole specimen remaining of those collected by Macé corresponds to the Jungle Babbler, a bird approximately the size of a Thrush (over-all length 250 millimeters approximately), upper plumage brown, rather reddish brown on the head and rump, slightly fulvous on the upper tail-coverts, the back with dark streaks and paler shaft-stripes; tail brown, tipped paler and cross-rayed; lores whitish with a narrow black line above them, breast and underparts, fulvous-ashy to whitish, the sides tinged with brown. As lectotype, I select the specimen Paris Museum No. 8.614 labelled "type" from "Bengale" collected by Macé.

The following forms of Jungle and White-headed Babbler should thus be listed in India and Ceylon:

Turdoides striatus (*Dumont*): *Bombay Babbler or Jungle Babbler.*

Pakistan, India and Nepal.

Turdoides striatus sindianus (Ticehurst).

Crateropus Terricolor sindianus Ticehurst, 1920, Bull. Brit. Orn. Cl., *40*:156. (Karachi, Sind.)

Range.—West Pakistan south to India in Kutch, Rajasthan and Delhi, intergrading south of this line into neighboring subspecies.

Turdoides striatus orientalis (Jerdon).

M.(*alacocircus*) *orientalis* Jerdon, 1847, Ill. Ind. Orn. text to pl. 19. ("jungles of the Carnatic and more especially among those of the Eastern Ghauts," hereby restricted to Horsleykonda, west of Nellore.)

Range.—Intergrades with the preceding form in the little Rann of Kutch and Saurashtra, thence northeast to Agra, south and east to Narbada River, M.P., intergrades with *striatus* along the Jumna River in northwestern M.P. and southern U.P. and a line southeast to the Godavari Delta; Madras, Mysore.

Turdoides striatus somervillei (Sykes).

Timalia Somervillei Sykes, 1832, *Proc. Zool. Soc.* London:88. ("Ghauts" = Bombay Ghats).

Range.—Bombay State from Surat Dangs south along the coast, intergrading with the following form in Goa.

Turdoides striatus malabaricus (Jerdon).

M.(*alacocircus*) *malabaricus* Jerdon, 1847, *Ill. Ind. Orn.* text to pl. 19. ("forests of Malabar and on the sides of the Neilgherries" = Travancore *vide* Whistler 1935, J.B.N.H.S., *38*:72.)

Range.—Western Mysore and Goa where it intergrades with the preceding form, south through western coastal Mysore and Kerala, intergrading with *orientalis* at Tenmalai near the Ariankivu gap.

Turdoides striatus striatus (Dumont).

Cossyphus striatus Dumont, 1823, *Dict. Sci. Nat.* (ed. Levrault), *29*:268. (Bengale)

M. (*alacocercus*) *terricolor* "Hodgson" = Blyth, 1844, *Jour. Asiat. Soc. Bengal, 13*:367. (Nepâl.)

Range.—Northern and eastern India from U.P., Jumna River east through the Nepal *terai* along the Himalayan foothills to Assam, as far as Dibrugarh, southeast in the drainage of the Ganges and Brahmaputra rivers in West Bengal and East Pakistan, to Orissa, Andhra, and the Godavari delta.

Turdoides striatus rufescens (Blyth).

M. (*alacocercus*) *rufescens* Blyth 1847, *Jour. Asiat. Soc. Bengal, 16*:453. (Ceylon)

Range.—Low country wet zone and southwestern hill zone of Ceylon.

Turdoides affinis (Jerdon): White-headed Babbler

Peninsular India and Ceyon.

Turdoides affinis affinis (Jerdon).

M. (*alacocircus*) *affinis* Jerdon, 1847, *Ill. Ind. Orn.* text to pl. 19. (peninsula = Kanara dist., Mysore, restricted herewith.)

M. (*alacocircus*) *Elliotti* Jerdon, 1847, *Ill. Ind. Orn.* text to pl. 19. (Travancore)

Turdoides polioplocamus Oberholser, 1920, *Proc. Biol. Soc. Washington, 33*:84. New name for *Turdus griseus* Gmelin, 1789 (Coromandel Coast, India), *nec Turdus griseus* Boddaert, 1783.

Range.—From eastern Bombay (Chanda) and the Godavari River Valley (Ellore and Dumagudiam) south through Andhra, Madras, Mysore, and the drier parts of Kerala to Cape Cormorin, and on the west coast from Mangalore north to the Gaprabha River.

Turdoides affinis taprobanus subsp. nov.

Malacocircus striatus Swainson 1833, *Zool.* Illus ser. 2, 3, pl. 127 and text. (Ceylon.) *nec Cossyphus striatus* Dumont 1823 = *Turdoides striatus* (Dumont).

Range.—Ceylon.

Remarks.—This form differs from the Peninsula population as pointed out by Whistler (1944, *Spolia Zeylanica 23*:131) having a much grayer wash on the head and body, and with reduced or absent subterminal blackish spots. In addition, Ceylon specimens lack the grayish-white heads, characteristic for the birds of southern India.

There is a tendency for Ceylon birds to be larger than South Indian birds; wing: 104.5-110 mm. vs. 98-104 mm. in the Y.P.M. series. Whistler and Kinnear (1936, *Jour. Bombay Nat. Hist. Soc., 35*:739) give measurements for Peninsula birds from 94.5-109 mm., so it may be that there is too much overlap to be significant.

Type.—Y.P.M. No. 20220, ♂ ad. collected 13 September, 1950, by S. Dillon Ripley at Alawna, Ceylon.

Certhia himalayana Vigors

In the *Bulletin of the British Ornithogists' Club*, (*42*, 1922, p. 140) Col. Meinertzhagen states that the type of Vigor's *Certhia himalayana* "was undoubtedly collected in either Garhwal or Kumaon," and that the specimen from Pushut, Afghanistan designated as "type" in Gadow's handwriting in the British Museum collection, probably done when he was writing the

British Museum Catalogue, Volume 8, must be disregarded. Meinertzhagen then goes on to name the extreme northern and northwestern Himalayan population as *Certhia himalayana limes,* a name which is considered valid today.

Two years later, Ticehurst and Whistler, (1924, *Ibis*:468-473) discussing the area in which Vigor's birds were secured, stated that the principal collection came from the western Himalayas which "for our purpose must be considered as the area of Gahrwal (*sic*) and Kumaon, from Simla to the Nepalese border." They specifically state that there were no birds from Nepal in the collection.

It would thus seem that under the International Rules as amended at Paris and Copenhagen, 1948 and 1953, Col. Meinertzhagen's action in stating that Vigor's specimens must have come from Garhwal or Kumaon, can be interpreted as that of a first revisor, (see proposed Draft of the Règles by Professor Bradley, 1957, *Bull. Zool. Nomencl. 14* (1/6):115-116, Article 17, "Localities of Origin"). However, it would appear in view of the vagueness of Col. Meinertzhagen's ascription of locality and the fact that in 1830 when the collection came to Vigor's hand the geographical area from Garhwal to Kumaon could include the entire sweep of hills from Simla to the Nepal border, exclusive of the independent Raja's Hill States, that Messrs. Ticehurst's and Whistler's action of 1924 of narrowing the type locality to the Simla-Almora district is perfectly valid and proper. Such an action is envisaged in Paragraph (a) (3) of the Bradley Draft (*op. cit.*) . . . "*priority shall apply between two or more authors attempting to establish a designated typical locality for a species, but subsequent restriction of a designated typical locality shall be allowable.*"

I thus feel that Ticehurst and Whistler's action is correct in this instance, and that they have validly restricted the type locality of *Certhia himalayana* Vigors to Simla-Almora district, as it is understood today in strict political terms.

Vaurie (1957, *Amer. Mus. Novit.*, No. 1855:13) discusses this species and points out that Meinertzhagen's action antedates that of Ticehurst and Whistler, but does not attempt to re-restrict or designate a more specific type locality, apparently being unaware of the vagueness, especially in the usage of the

1830's of such a term as "Garhwal and Kumaon." He also casts doubt on my naming (*Proc. Biol. Soc. Washington 63*:106) of a darker population, *Certhia himalayana infima* from western Nepal, from whence it had not with certainty been previously recorded. (There is a Hodgson specimen, an immature bird labelled "Nepal," in the British Museum collection, of uncertain attribution and useless for subspecific analysis.) It would seem appropriate in view of the existence of comparative material at neighboring institutions for Vaurie to have borrowed specimens in order to compare them critically as, so far as I know, the American Museum of Natural History collection lacks material of this species from Nepal or eastern Kumaon. However, Vaurie, accepting a vague type locality of "Garhwal and Kumaon," merely states that with such a type locality, "the cline is not sufficiently steep to warrant in my opinion the nomenclatural separation of the population from western Nepal from that of neighboring Kumaon or Garhwal. I consider *infima* a synonym of nominate *himalayana*."

In this connection, it seems appropriate to record that Rand and Fleming (1957, "Birds from Nepal," *Fieldiana*:Zoology, *41*(1):121, working with actual specimens, state: "We have three Mussoorie birds . . . for comparison. The Nepal birds are darker on the flanks, back and tail, supporting Ripley's description for *C. h. infirma*" [*sic*: *infima*]. Mussoorie is certainly within the vague general locality of Garhwal and Kumaon, and their specimens should serve as a comparative series within the range as defined by any of these authors. I am in consequence listing *infima* as a valid subspecies in my Indian hand-list, and accepting the Ticehurst and Whistler restricted type locality for the nominate subspecies.

Postilla

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ON THE DOUBTFUL VALIDITY OF *TACHYPLEUS HOEVENI* POCOCK, AN INDONESIAN HORSESHOE CRAB (XIPHOSURA)[1,2]

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There are four undoubtedly valid species of living xiphosurans. One of these, *Limulus polyphemus* (L.), is from the western North Atlantic. The other three have different distributions in the western Pacific and the Bay of Bengal. They comprise *Carcinoscorpius rotundicauda* (Latreille), *Tachypleus tridentatus* Leach and *Tachypleus gigas* (Müller). All of these are well represented and recognized in collections. A third species of *Tachypleus*, *T. hoeveni*, was named by Pocock (1902) for certain figures in van der Hoeven's monograph on the Xiphosura (1838; Plate I, figs. 2, 10; Plate II, fig. 14). A key to recent species of Xiphosura is presented as an Appendix and in figs. 9-11.

[1] Respectfully dedicated to my colleague and friend Dr. Alexander Petrunkevitch.

[2] These studies were aided by a contract between the Office of Naval Research, Department of the Navy, and Yale University, NR163-091, and by a grant from the Pacific Science Board of the National Research Council.

According to its definition *Tachypleus hoeveni* resembles *T. gigas* in all known respects except that the median terminal segments of the genital operculum in *hoeveni* are separate and overlap asymmetrically, instead of being united, symmetrical and contiguous as in *gigas*. Apparently Pocock himself never saw a specimen of his species, and none have since been reported either in the field or in museums. It is of interest, therefore, to inquire whether or not *Tachypleus hoeveni* is a valid species, closely related to, but distinct from *T. gigas*. Doubt of such validity has already been raised on rather general grounds by Gravier (1929) in his review of specimens of Xiphosura in the Paris Muséum National d'Histoire Naturelle. Present attention to the problem was stimulated by the author's interest in speciation and distribution of horseshoe crabs particularly with relation to their eyes and visual physiology (Waterman, 1951; 1953a,b; 1954a,b,c; 1955; Waterman and Enami, 1953; Waterman and Wiersma, 1954).

In an attempt to settle this moot taxonomic point, a large number of *Tachypleus gigas* have been studied to determine whether any individuals could be found attributable to *T. hoeveni* as defined by Pocock. Specimens examined include the author's own material collected on Singapore Island in 1952; the collections of the Raffles Museum, Singapore; the Zoologisch Museum, Amsterdam; the Rijksmuseum van Natuurlijke Historie, Leiden; the Universitets Zoologisk Museum, Copenhagen; and the Museum of Comparative Zoology, Harvard University[3]. Relevant material was found in only three of

[3] It should be mentioned that visits or inquiries addressed to a number of other museums revealed that no specimens either of *Tachypleus gigas* or *Tachypleus hoeveni* were present: U.S. National Museum, Washington, D.C.; Peabody Museum, Yale University; American Museum of Natural History, New York; Museum Zoologicum Bogoriense, Bogor (formerly Buitenzorg), Indonesia; Institut Océanographique de Nhatrang, Vietnam; Natural History Museum, Manila, Philippine Republic; the National Museum, Sydney and National Museum of Victoria, Melbourne, Australia. In addition, review of the present collections in the British Museum (Natural History) and the Muséum National d'Histoire Naturelle in Paris shows that no relevant material has been acquired since the classic papers of Pocock (1902) and Gravier (1929) which are mainstays of our present knowledge of horseshoe crab taxonomy and distribution. The author is much indebted to the Directors and staffs of these institutions, as well as

these; the museums at Amsterdam, Copenhagen and Leiden.

Of greatest interest was finding that the Leiden museum has what is undoubtedly the original specimen of a male operculum from which van der Hoeven's Plate II, fig. 14 was drawn (reproduced fig. 1). Because this particular figure was a crucial one cited by Pocock in establishing *Tachypleus hoeveni*, the specimen in question is presumptive type material for that species. It is hereby designated the lectotype (figs. 3,4). This operculum, which is in alcohol, had been Number 1038 in the Collection of the Zoological Laboratory, University of Leiden. It was transferred to the museum when that collection was dispersed. Other records show that van der Hoeven's anatomical collections were given by him to the Zoological Laboratory at Leiden so that this evidence fits well with the identification of the specimen.

When examined by the author in August 1953, the jar containing this interesting operculum held among several other labels, a note in the handwriting of Dr. H. D. Blöte, Assistant Director of the Leiden Museum. Translated from the Dutch this reads, "This preparation most probably is the original of Plate II, fig. 14 in J. van der Hoeven's Recherches sur l'Histoire Naturelle, etc. des Lumules, Leiden 1838. See Pocock, Ann. Mag. Nat. Hist. VII, Ser. IX, 1902, p. 264."

Careful comparison of this specimen with the figure in question leaves little doubt of the correctness of Dr. Blöte's attribution (figs. 1,3). Note particularly that even the edges where the appendage was cut from the rest of the body and the slight scar on the lateral margin at the right agree almost perfectly. Only in the exact proportions of the appendage and degree of overlap between the terminal medial elements does the specimen differ from the figure. But as the specimen itself had been stapled to a slab of soapstone, some changes in its shape and in the position of its parts would not be surprising in the course of the 115 years since it was drawn. The maximum

all those mentioned in the text, for their generous cooperation and assistance in examining available material. Thanks are also due to Dr. Fenner A. Chace, Jr. of the U.S. National Museum and Dr. Charles L. Remington of the Yale University Zoology Department for their helpful suggestions concerning the manuscript.

width of this Leiden specimen was 70.5 millimeters while that of the drawing, stated to be natural size, is about 70 millimeters which provides another important point of agreement.

It should be pointed out that Pocock's interpretation of van der Hoeven's figures does not agree with the original specimen in certain respects not visible in the plates. The British zoologist believed that the opercular elements which overlap in *T. hoeveni* were separated medially, unlike those of *T. gigas* which are normally united (fig. 8). However, in the Leiden Museum operculum they are, in fact, not separate in the midline. The edges appear to overlap, not because they are free medially, but merely because the appendage is pleated with a double fold in that region. Whether this fold was present in the living animal is not obvious from its appearance.

Unfortunately, this single xiphosuran fragment is all that is known to remain of van der Hoeven's original material. Consequently, it is not possible to settle the point directly whether this unique opercular detail is really a valid species character or merely an individual idiosyncrasy. As Pocock correctly pointed out, however, three of the four drawings of the operculum labelled *Limulus moluccanus* Latreille (= *Tachypleus gigas*) in van der Hoeven's monograph show identical overlapping elements in both adult male and adult female specimens (reproduced figs. 1,2,5,6). At its face value this does make the peculiarity seem taxonomically significant. Van der Hoeven's failure to comment in any way on this anomaly is accordingly the more exasperating.

On the other hand, close reading of van der Hoeven's text reveals (1838, p. 2) that only two spirit specimens of *T. gigas* were available to him for the anatomical work reported. Yet measurements of three specimens are given (1838, p. 10). It is not explicit whether two of these are the anatomical subjects, which of them may be merely dried examples, or what the total number of individuals studied may have been. If two complete specimens only were available for the four drawings concerned, it is possible that the same operculum may have been used as a model for the figures of more than one animal. The fact that the operculum, still extant, was already detached from the whole specimen, when drawn for van der Hoeven's Plate II, fig. 14, adds some likelihood to this possibility.

Further circumstantial evidence is provided by the mirror image similarity of the opercula in figs. 2 and 10, Plate I. This is carried even to the peculiar extra plates present in the proximal lateral margins of the overlapping sections in both drawings (reproduced figs. 5,6). The collaboration of another artist in drafting Plate I in contrast to the anatomical Plates II and III drawn entirely by van der Hoeven himself may also lend credibility to this notion. The extra opercular plates mentioned above, which are not symmetrical, could also be taken as evidence that this operculum is abnormal; in general all normal xiphosuran external anatomical features are bilaterally symmetrical.

One must, therefore, entertain the possibility of *Tachypleus hoeveni* being merely an abnormal *T. gigas.* Some independent but congruent evidence has been found that abnormalities of the median distal plates of the genital operculum are not rare in this animal. In the Amsterdam Museum there is a *Tachypleus gigas* (No. Xi 1001), collected in East Sumatra by J. C. van der Meer Mohr, which also has overlapping elements at the margin of the operculum (fig. 7), although the specimen is otherwise normal. The overlapping plates are not, however, the median distal elements as in the Leiden specimen but are the lateral distal elements. These are so lobed along their medial margins that the edges lie over one another for a short distance. None of the 8 other specimens of *T. gigas* in the Amsterdam collection show any similar opercular anomalies.

Another *T. gigas* with a deformed operculum is present among the 11 specimens of this species in the Copenhagen Museum, a male from Penang Island on the west coast of Malaya (collected by the research ship "Galathea"). As in the Amsterdam specimen, there is a small medial overlap in the lateral distal opercular plates in this animal. In this case, though, the reason for the anomaly is more obvious, since there is a considerable healed wound in the edge of the operculum on the left side, and both prosoma and opisthosoma show distorted or missing parts. Further evidence for a widespread occurrence of structural abnormalities in *Tachypleus gigas* is given by van der Meer Mohr (1934), but no opercular deviations are mentioned specifically. In *T. tridentatus*, however, Smedley (1931) reported that various specimens differ considerably in the degree of separation of the internal opercular branches at their tips.

From the specimens examined and here discussed one would conclude that the peculiar fold and other unique details of the van der Hoeven *Tachypleus* operculum in Leiden are but minor teratological variants of *Tachypleus gigas*.

On the other hand the geographical origin of van der Hoeven's material in the Moluccas is an element that in all fairness should weigh on the side of the validity of *T. hoeveni*. Few, if any, specimens of Xiphosura from these islands are known in museum collections. Consequently, study of *Tachypleus* from Ceram, Halmahera, and adjacent islands might indeed show that *T. hoeveni* exists as a taxonomically distinct form in these regions.

Yet such a circumscript distribution would be unique for a xiphosuran species, since the four definitely known recent forms have wide ranges. *Limulus polyphemus* (L.) occurs from Nova Scotia to Yucatan on the east coast of North America, a large spread in latitude, covering a shore line several thousand miles long. *Tachypleus tridentatus* Leach occurs south from the Inland Sea of Japan, along the China coast, in the western islands of the Philippine Republic, in Hainan and at least as far south as Nhatrang in south central Vietnam (Flower, 1901; Smedley, 1929, 1931; Shoji, 1932; Asano, 1942; Waterman, 1953a)[4]. *Tachypleus gigas* (Müller) overlaps the latter species by occurring in northern Vietnam (Prof. C. Boisson, University of Hanoi, personal communication) and North Borneo, extends west to the Orissa coast on the Bay of Bengal and east as far as Torres Strait (Pocock, 1902; Annandale, 1909). *Carcinoscorpius rotundicauda* (Latreille) has been reported in the southern Philippines, Indonesia, Malaya, the Gulf of Siam, and the Bay of Bengal.

[4] If the specimens of *Limulus longispinus* (sic) (= *Tachypleus tridentatus*) reported (in lit.) in the Australian Museum, Sydney, are correctly identified, this species occasionally reaches as far as the west coast of Malaya.

On the basis of the evidence at hand one must conclude that *Tachypleus hoeveni* is a dubious species at best and most likely was named for an abnormal operculum of *Tachypleus gigas*. But since the original material does not permit a definitive solution of the problem, it is to be hoped that the interest and opportunity of studying the xiphosurans of the Moluccas will develop in the near future to resolve the dilemma more decisively. However, a recent attempt to do this failed. At the author's request, Dr. Dillon Ripley of the Peabody Museum at Yale University, who spent three months of 1954 in the Moluccas collecting specimens of various animals, particularly birds, tried to obtain horseshoe crabs from these islands.

According to information he most kindly gathered, *ikan mimi* or *imi imi*, as these animals are called in Indonesia, were known to fishermen in the Moluccas but were said not to occur there. According to these sources the nearest place where such crabs were ordinarily caught was Menado. This is a town on the northern arm of Celebes more than 200 miles westward across the Molucca Passage from Ternate, Tidore, Halmahera and other islands in the group. Not only were no specimens of *T. hoeveni* to be obtained even in Menado, but no evidence for the occurrence of any species of Xiphosura in the Moluccas themselves was found despite the fact that *T. gigas* and *Carcinoscorpius* are well known from other parts of Indonesia.

The reported complete absence of these forms in the area concerned is the more baffling since the Moluccas are the first place of occurrence cited for the xiphosurans in the East Indies. L'Écluse in 1605 figured specimens of *Cancer moluccanus*, a horseshoe crab sent to Holland reputedly from the Moluccas. Rumphius (1705) in his famous book about the natural history of these islands illustrates a horseshoe crab under the name of *Cancer perversus*. This animal, he states, was well known by him to occur in the Moluccas (he was working in Amboina in the southern part of the archipelago) and he also had received a specimen of it from Menado.

Summary

1. In reviewing material suitable for determining the validity of *Tachypleus hoeveni* Pocock, an original fragmentary

specimen apparently used by van der Hoeven for one of the figures cited as the type by Pocock was re-examined in the Rijksmuseum van Natuurlijke Historie in Leiden. This specimen itself, here designated the lectotype, and Pocock's monograph do not alone permit a decisive conclusion whether the material represents an anomalous *Tachypleus gigas* or another valid species.

2. Evidence has been obtained from single specimens in the Amsterdam and Copenhagen zoological museums that opercular anomalies, comparable to but distinct from the one for which *Tachypleus hoeveni* was erected, are not rare in *Tachypleus gigas.*

3. The fact that van der Hoeven's material came from the Moluccas, a region from which few, if any, xiphosuran specimens have since been studied, leaves open the possibility of a taxonomically significant geographic variation in this area. However, a recent search failed to find any Xiphosura in the Moluccas.

4. It is concluded that *Tachypleus hoeveni* is probably a synonym of *T. gigas*, but this synonymy can only receive its decisive test when substantial series of Indonesian xiphosurans have been studied.

5. A key to recent species of Xiphosura is presented as an Appendix.

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Appendix

KEY TO RECENT XIPHOSURA

1. Tail spine oval or circular in cross section with no marked dorsal ridge. Adult sexual characteristics: Male, first two pairs of walking legs modified as chelate claspers (fig. 11A) .... *Carcinoscorpius rotundicauda* (Latreille)
Tail spine triangular in cross section with marked dorsal ridge along most of its length .... 2.

2. Genital operculum (first opisthosomal appendage) with three endopodite segments on each side (including tab-like terminal element) (fig. 10A). Adult sexual characteristics: Male, first pair of walking legs modified as hemichelate claspers (fig. 11B) .... *Limulus polyphemus* Linnaeus
Genital operculum with two endopodite segments on each side (fig. 10C) .... 3.

3. Distal endopodite segments of genital operculum overlapping in midline (according to Pocock not united in midline but are so in lectotype; see text) (fig. 10B). Adult sexual characteristics: Male, presumably first two pairs of walking legs modified as hemichelate claspers. Female, presumably first three movable lateral opisthosomal spines long, other three short stubs (fig. 9B) .... *Tachypleus hoeveni* Pocock
Distal endopodite segments of genital operculum united and not overlapping along midline (fig. 10C). Adult sexual characteristics: Male, first two pairs of walking legs modified as hemichelate claspers; anterior margin of prosoma scalloped (fig. 9A). Female, first three movable lateral opisthosomal spines long, other three short stubs (fig. 9B) .... 4.

4. Usually three spines on posterior dorsal surface of opisthosoma over base of tail spine (fig. 9B); lateral eyes black, no pseudopupil visible; lateral eye length not more than 5-6 per cent of prosoma length along the midline ....
.... *Tachypleus tridentatus* Leach
One spine only on posterior dorsal surface of opisthosoma over base of tail spine; lateral eye brownish, pseudopupil visible; lateral eye length more than 6.5 per cent of opisthosoma length along the midline .... *Tachypleus gigas* (Müller)

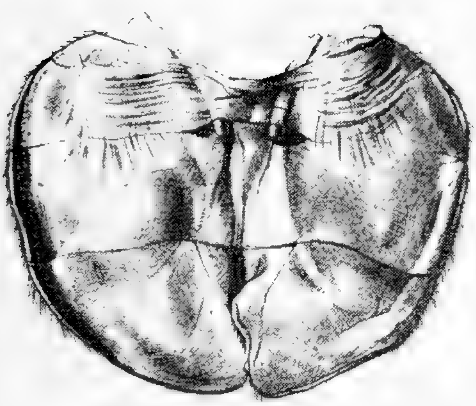
Plate I

Fig. 1. Posterior surface of the genital operculum of a male Moluccan xiphosuran as figured by van der Hoeven (1838, Plate II, fig. 14). The original author does not mention the anomalous double fold in the midline of the central terminal segments and referred this drawing to *Limulus moluccanus* (= *Tachypleus gigas*). Pocock (1902) considered this opercular fold, which may also be seen in figs. 3, 4, 5 and 6, grounds for establishing a third species of *Tachypleus, T. hoeveni*. Maximum lateral extent (width) of this operculum 70 mm.

Fig. 2. Posterior surface of the genital operculum of a female Moluccan xiphosuran as figured by van der Hoeven (1838, Plate II, fig. 15). This also was assigned by the original author to *Limulus moluccanus* (= *Tachypleus gigas*). Note that the median margins of the inner and outer terminal segments are neither folded nor overlapping and are normal for the species like those shown in fig. 8. Maximum lateral extent of this operculum 85 mm.

Fig. 3. Posterior surface of the genital operculum of a male xiphosuran which is most likely the original specimen from which van der Hoeven's (1838) Plate II, fig. 14 (fig. 1, above) was drawn. Except for the length width ratio, the two agree closely. Photograph courtesy of the Rijksmuseum van Natuurlijke Historie, Leiden. Maximum lateral extent of this specimen 70.5 mm.

Fig. 4. Anterior surface of the same specimen as shown in Fig. 3. Since this peculiar operculum apparently was the basis for Pocock's species *Tachypleus hoeveni*, it is designated as the lectotype pending final clarification of its validity. The specimen is in the Rijksmuseum van Natuurlijke Historie, Leiden, through whose courtesy the photograph is reproduced.



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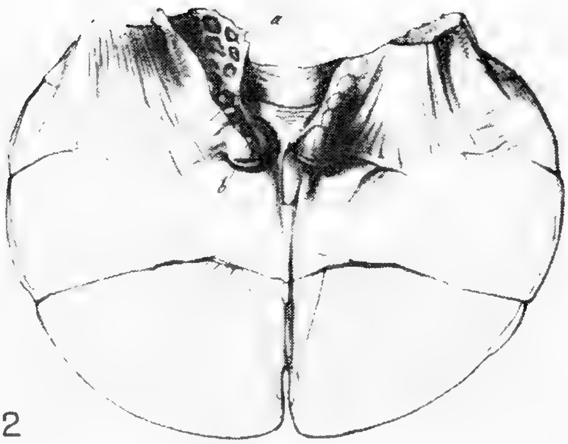

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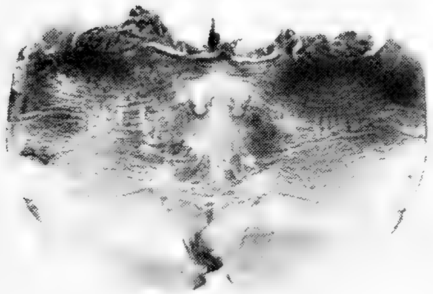

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4

Plate I

Plate II

Fig. 5. Part of van der Hoeven's (1838) Plate I, fig. 2 showing the ventral surface of a mature female *Tachypleus* (prosoma length 100 mm.). This drawing was identified by the original author as *Limulus moluccanus* (= *T. gigas*) but on the basis of the genital operculum with the overlapping median elements was considered by Pocock to be *T. hoeveni.*

Fig. 6. Plate I, fig. 10 of van der Hoeven (1838) showing the ventral surface of a male *Tachypleus* opisthosoma (prosoma length 82 mm.). As in fig. 5 above the overlapping distal moiety of the operculum induced Pocock to include this in *T. hoeveni* although van der Hoeven had referred it to *Limulus moluccanus* (= *T. gigas*). Pocock used this figure and that shown in fig. 5 above as evidence that the peculiar folds in the operculum shown here in figs. 1, 3, and 5 were not just an individual idiosyncrasy since the same thing is shown in drawings of both sexes. Note however, that the opercula in the drawings reproduced in figs. 5 and 6 are mirror images of each other and nearly identical which suggests that one operculum was used as a model in drawing two individuals.

Fig. 7. Ventral view of part of the opisthosoma of a mature male *Tachypleus gigas* (prosoma length 98 mm.) with an anomalous genital operculum showing some overlap of median elements. Note, however, that here the outer terminal segments rather than the central ones as in the Leiden specimen (fig. 3) form the overlapping pair. Also observe that the median edges of these segments are free, not fused, and just folded over as in the other case. Specimen Xi 1001 in the Zoologisch Museum, Amsterdam, through whose courtesy the photograph is reproduced.

Fig. 8. Ventral view of part of the opisthosoma of a mature *Tachypleus gigas* (prosoma length 95 mm.) with a normal genital operculum showing the smooth median fusion of the central distal segments with no folding and the free edges and absence of overlap in the lateral distal segments. Photograph courtesy of the Zoologisch Museum, Amsterdam.

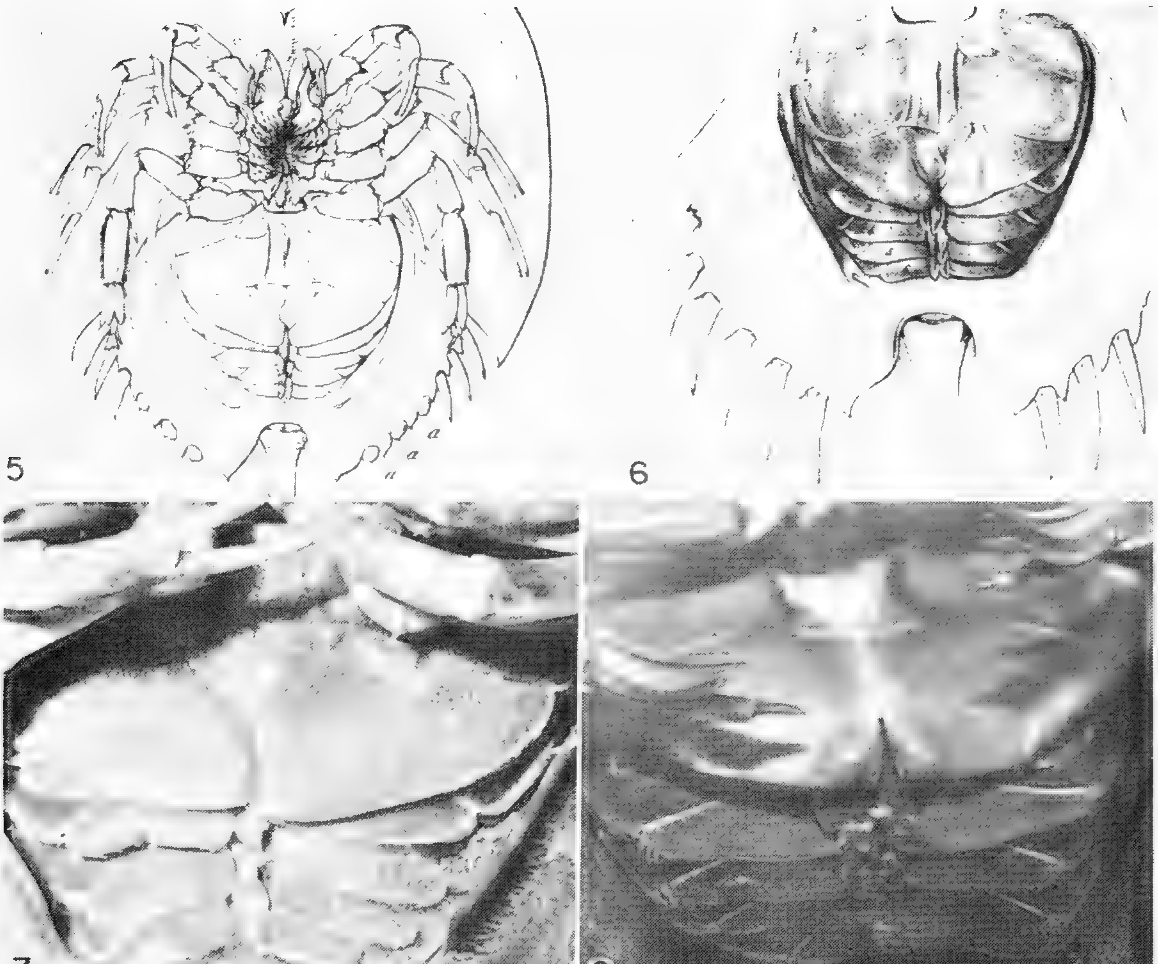


PLATE II

Plate III

Fig. 9. Adult sexual characteristics in *Tachypleus tridentatus.* A. Male prosoma showing scalloped anterior margin, dorsal view. X 0.3. B. Female opisthosoma showing lateral movable spines (*a* - *f*) and species characteristic posterior median ones (*g, h, i*), dorsal view. X 0.3.

Fig. 10. Genital opercula showing species characteristic endopodite segments (*a*, *b*, *c*), anterior view. A. *Limulus polyphemus* with three of these segments. X 0.5. B. *T. hoeveni* with overlapping segment (*b*) (after van der Hoeven, 1838). X 0.5. C. *T. gigas* with two endopodite segments. X 0.4.

Fig. 11. First claspers of adult male, anterior view of left appendage. A. *Carcinoscorpius rotundicauda*, chelate. X 1.5. B. *L. polyphemus*, hemichelate, X 0.7. C. *T. tridentatus,* hemichelate. X 0.7.

(Figs. 9-11 drawn by Shirley P. Glaser)

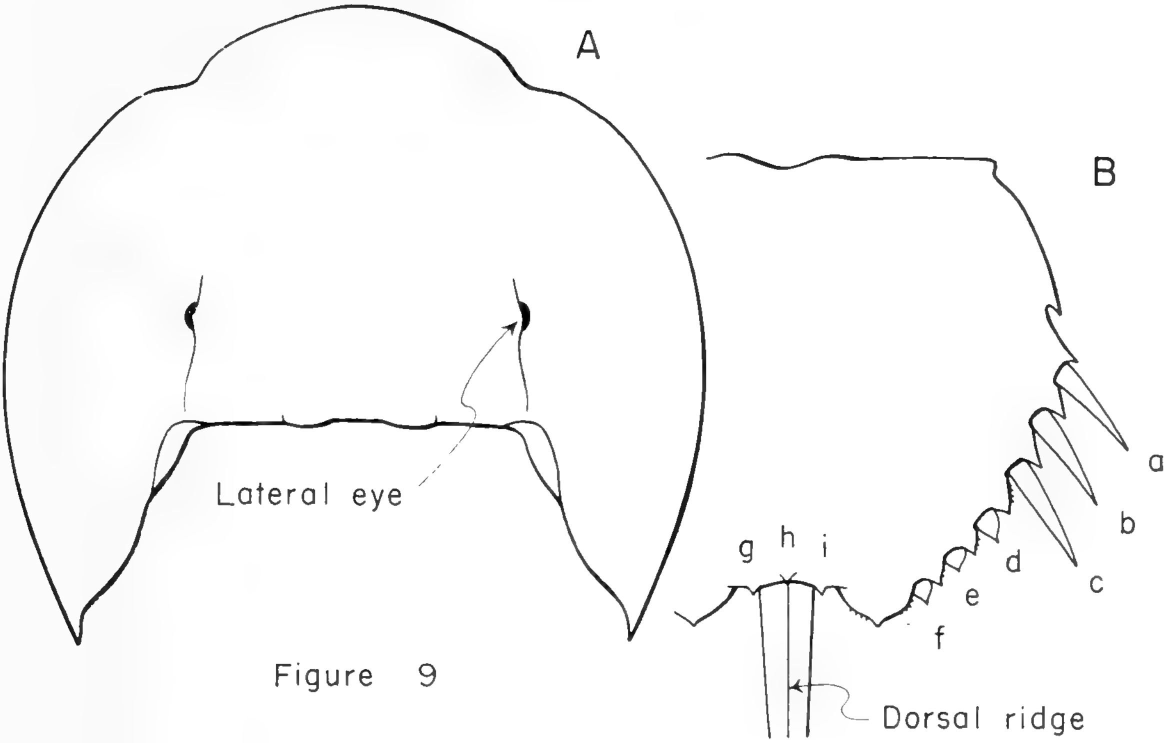


Figure 9

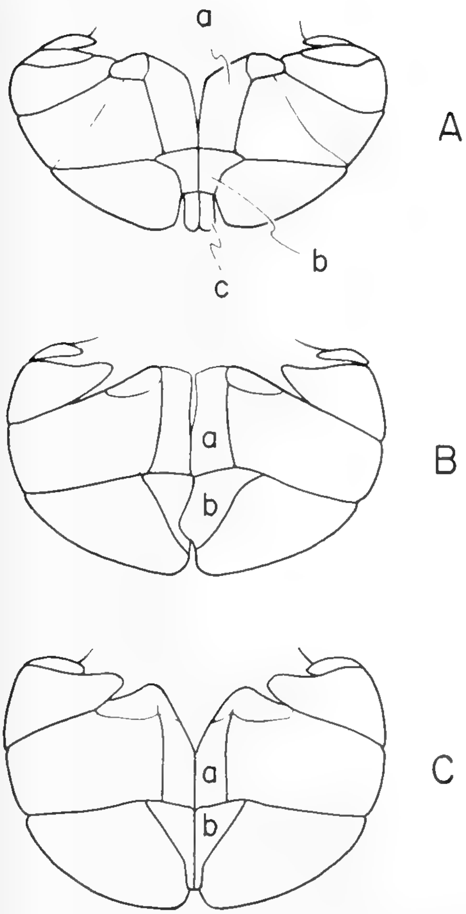


Figure 10

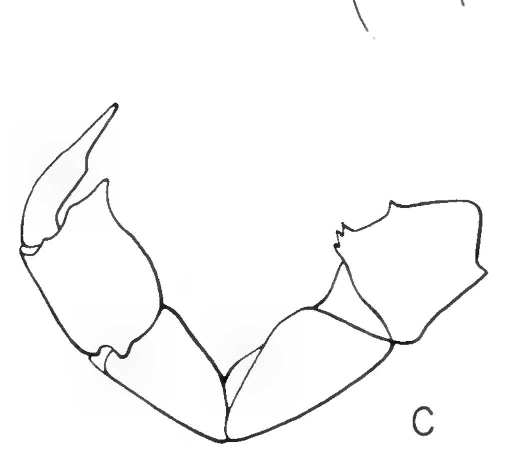


Figure 11

PLATE III

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number [redacted] 37 September 15, 1958 New Haven, Conn.

A NOTE ON THE FIRETHROAT AND THE BLACKTHROATED ROBIN

S. Dillon Ripley

While on a visit to the U.S.S.R. recently, I had the opportunity of examining two specimens of the small chat, the Blackthroated Robin, collected by Berezowsky and Bianchi and described by them in 1891 as "*Larvivora*" *obscura.* Both are adult males in fully adult plumage and are in the Zoological Museum in Leningrad.

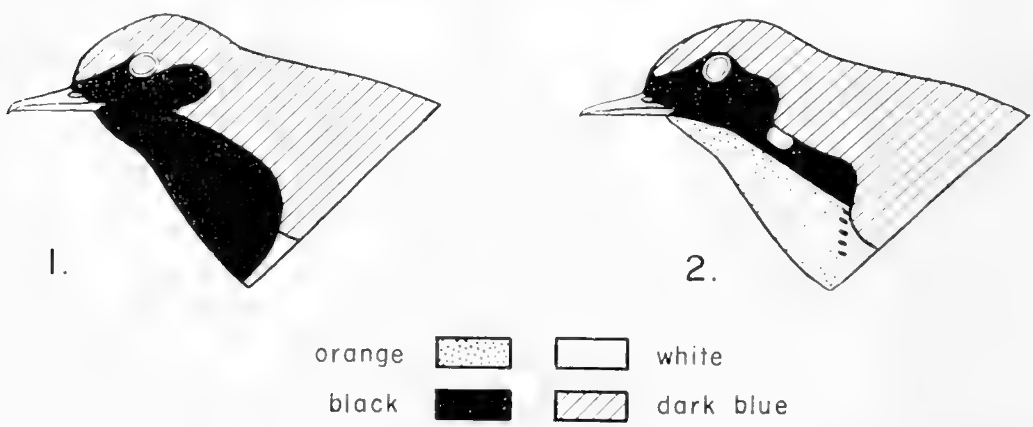
Also in the Leningrad collection is an adult male specimen of "*Calliope*" *pectardens* David. Due to the kindness of Dr. A. Ivanov, I was able to examine these specimens closely. Later in London I examined the series of *pectardens* and the single male *obscura* which have already been reported on by Goodwin (1956, Bull. Brit. Orn. Cl. *76*: 74-75). Mr. H. G. Deignan has also kindly supplied me with information on the fine series of *pectardens* in the U. S. National Museum.

Goodwin and Vaurie (1956, Bull. Brit. Orn. Cl. *76*: 141-143), have published their comments on these two species, bringing forward the opinion that both were color phases of a single species. In connection with studies on the subfamily of the thrushes for the Peters' "Checklist," I was anxious to determine this matter to my own satisfaction.

The principal problem as to the identity or discreteness of these two populations is lack of specimens showing stages of plumage. In the British Museum and the U. S. National Museum collections there are fine series of *pectardens* from Yunnan, southeast Sikang and southeast Tibet. A single male adult *pectardens*, perhaps a post-breeding season bird has been taken in southwest Shensi. There are many immature males, two presumed females (so identified), and a young male in the spotted plumage of the nestling. The specimens of *obscura*, however, are confined to adult males, so that the differences or resemblances between the two populations must be considered only as between the adult male plumages. These males of *obscura* come from southeast Kansu, and southwest Shensi in west China.

The obvious difference between the adult males is that the throat and breast are black in *obscura*, while in *pectardens* an approximately similar area is orange, and in addition whereas both species have the sides of the neck black, there is a white patch on the side of the neck in *pectardens*. Goodwin and Vaurie's thesis (1956, *tom. cit.*) is that this color difference is not a difference in pattern, that, therefore, it is a simple genetic replacement, and that the species has a dimorphic breeding plumage, as has been noted in some species of wheatears (*Oenanthe*).

Examination of the specimens in Leningrad and other museums has inclined me to disagree. While extremely close the patterns are different as the following sketch shows.



1. *obscura*, adult ♂ 2. *pectardens*, adult ♂

When examined closely it can be seen that the black edging to the upper parts is more extensive in *pectardens*, extending onto the bristle-like forehead feathers, over the eye, and more broadly and in a different pattern along the sides of the neck.

The physical measurements of these birds do not appear to differ significantly. My measurements, while not agreeing exactly with those of the authors cited, are roughly similar;

	wing	tail	culmen (in mm.)
obscura 3♂♂	65-71.5	50,50,54	15-17
pectardens 10♂♂	64-71	52.5-58 (mean 55.7)	14.5-17

There appears to be a slight tendency towards a longer tail in *pectardens* which may be a function of its habits. However, comparing the wings of the specimens, there is a difference. In *obscura* the primaries in freshly moulted birds are of a broader, more rounded appearance, the 4th and 5th tending to be equally long, the third tending to be shorter. In *pectardens* on the other hand the primaries in freshly moulted birds are individually more pointed in shape. In these birds the 4th primary tends to be longest, the 3rd and 5th more equal, with a slight tendency for the 5th to be the longer of the two.

In juvenal *pectardens* the 4th and 5th primaries are equally long, as in the adult of *obscura*. But a young ♂ *pectardens* taken in January in northern Burma (B.M.coll.) on winter grounds, already has the more pointed wing of the adult. This would indicate that in this species there is a complete post-juvenal moult, involving the wing feathers, even though the assumption of full adult plumage only comes gradually in successive later moults.

From the above it appears to me that these populations represent two distinct species, whose ranges may or may not be partly overlapping in northwest China. The northernmost species, *obscura*, is apparently more sedentary as indicated by the shape of the wing and indeed the paucity of specimens in collections. The more southern species, *pectardens*, indicates by the appearance of the wing and the occasional records of winter birds in Sikkim, Assam and northern Burma to the south of its usual range, that it is a more migratory species. In addition the minor differences of distribution of black on head, neck and sides of upper breast, serve to reinforce the more obvious, but more questionable from a genetic point of view, differences between orange and black throat patch and presence or absence of white neck spot. I believe that eventual examination of females and young of *obscura* will substantiate the distinctness of these two species.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 38 April 20, 1959 New Haven, Conn.

COMMENTS ON BIRDS FROM THE WESTERN PAPUAN ISLANDS

S. DILLON RIPLEY

1. *Birds from Kofiau Island*

Opportunities for visiting Kofiau Island (often called Koffiao, Kavijave, Kavijaaw, or Poppa in the literature) are few and far between. The island lies nearly ninety miles west of Sorong, regional capital of western Netherlands New Guinea, exposed to strong swells in the monsoon seasons. No boat anchorage exists and the small population of Besarese fishermen lives primarily on a few offshore rocky islets.

Odoardo Beccari visited Kofiau in July, 1875, on a schooner from Ternate, intending to spend several days (1875). His visit was cut short, however, by illness, and he spent only thirty hours there. Fortunately he was able to collect a total of 40 specimens during that time including topotypes of *Tanysiptera ellioti* and *Rhipidura vidua.* These forms had been taken in 1867 by David Hokum, an assistant of Mr. Hoedt a professional supplier of birds in Ambon. In 1875 also Bruijn's collectors from Ternate visited Kofiau, and except for an undated visit by Bernstein, this seems to have been the last ornithological visit to the Island.

During 1954 while studying birds in the Moluccas and Western Papuan Islands on a field trip,[1] my wife and I attempted

[1] This field work was supported by research fellowship grants from the Guggenheim Foundation and the National Science Foundation as well as funds from Yale and the Vose Fund of the Explorer's Club of New York.

to visit Kofiau. Neither patrol vessels nor commercial schooners were available, however, during our stay in New Guinea and an attempt to secure the services of an oil company flying boat also failed. Somewhat later my assistant, Jusup Khakiaj, managed to visit Kofiau in 1955 in a seagoing canoe accompanied by an Arafura bird hunter from Misool. He spent fifteen days from the 25 April to 9 May on the Island and was able to clamber about the rocky foreshore and climb a short way into the heavily forested interior.

Kofiau Island is about fifteen miles long, running in an east-west direction. It is heavily wooded, and the present settlements are essentially on the offlying islands such as Djailolo and Deer which lie just north of the mainland of Kofiau separated from it by a narrow sheltered channel. Kofiau lies outside of the 200 meter bank which marks the Sahul Shelf and includes such islands as Salawati, just off the New Guinea mainland, and Misool, some thirty miles south south-east of Kofiau. The island has several hills, one nearly a thousand feet tall, named Mata or Boemfoar.

The Boo Islets which lie about ten miles west of Kofiau include one islet Boo Ketjil an alternative name of which is Popa. This name has been applied to Kofiau in the literature. Beccari in his letter to Salvadori (1875, tom. cit.:707) speaks of "Poppa" as being a misnomer for Kofiau, which he spelt Koffiao. David Hokum in 1867 called the island Kavijaaw.

Jusup Khakiaj's collection while small, is of interest, as it appears to be the first made in perhaps eighty years. I am very grateful to the authorities of the American Museum of Natural History for permission to examine specimens in their care.

Of the thirty-one known species and subspecies from Kofiau, listed in the following pages it is interesting to note that they fall into these several categories.

Species of unknown affinities: one, *Ducula* species (seen but not collected).

Migrants: three, *Pluvialis dominica fulvus*, *Merops ornatus*, *Halcyon sancta sancta*.

This leaves twenty-seven forms which may be characterized as follows:

1) Forms common to Moluccas and New Guinea; seven (= 27%).

Butorides striatus papuensis
Pandion haliaetus melvillensis
Megapodius freycinet freycinet
Chalcophaps indica indica
Caloenas nicobarica nicobarica
Pachycephala phaionotum
Nectarinia jugularis frenata

2) Forms representing New Guinea subspecies (includes Kai and Aru Islands); fourteen (= 51%).

Ptilinopus rivoli prasinorrhous
Ptilinopus viridis pectoralis
Macropygia amboinensis doreya
Opopsitta diopthalma diopthalma
Micropsitta keiensis chloroxantha
Geoffroyus geoffroyi pucherani
Cacomantis variolosus infaustus
Alcyone pusilla pusilla
Pitta sordida nova-guineae
Coracina tenuirostre müllerii
Gerygone magnirostris occasa
Monarcha alecto chalybeocephalus
Monarcha guttula
Philemon novaeguineae novaeguineae

3) Forms representing Moluccan subspecies; two (= 7%).

Coracina papuensis melanolora
Dicrurus hottentottus atrocaeruleus

4) Forms intermediate between species of the Moluccas and New Guinea; four (= 15%).

Tanysiptera (galatea) ellioti
Rhipidura rufiventris vidua
Monarcha julianae
Nectarinia sericea mariae

From the above it will be seen that while 51% of the Kofiau residents are overwhelmingly of close New Guinea affinity, almost one quarter or 22% represent forms either intermediate or more nearly Moluccan in their affinity, thus corresponding closely with the geographical position of the Island. That 15% of these represent endemisms is a remarkable example of the inherent speciation potential of such an island in such a geographic location.

Annotated List of Birds from Kofiau

In the following list, I have given the names of the collectors in brackets at the end of the discussion.

1) *Butorides striatus papuensis* Mayr

♀, May 8, 1955, wing 178 mm., culmen 65 mm. This specimen is small compared to Mayr's measurements (1940), but agrees with at least one specimen, although it was listed as possibly subadult, recorded by Van Bemmel (1948:397). (Khakiaj)

2) *Pandion haliaetus melvillensis* Mathews

♀ April 30. (Khakiaj)

3) *Megapodius freycinet freycinet* Gaimard

♀ May 2 (Bruijn, Beccari, Khakiaj)

4) *Pluvialis dominica fulva* (Gmelin)

An adult, unsexed, in breeding dress was taken in May. (Khakiaj).

5) *Ptilinopus rivoli prasinorrhous* Gray

(Beccari)

6) *Ptilinopus viridis pectoralis* (Wagler)

(Beccari)

7) *Ducula* sp.?

Jusup Khakiaj reported the presence of a large fruit pigeon on Kofiau. The birds were high up in forest trees, difficult to see, as always, and resisted his collecting efforts. He believes that the species represented is *Ducula rufigaster*.

8) *Macropygia amboinensis doreya* Bonaparte
♂ subadult, April 30 (Beccari, Khakiaj).

9) *Chalcophaps indica indica* (Linnaeus)
(Beccari)

10) *Caloenas nicobarica nicobarica* (Linnaeus)
(Hoedt)

11) *Opopsitta diophthalma diophthalma* (Hombron and Jacquinot) (Beccari)

12) *Micropsitta keiensis chloroxantha* Oberholser
(Beccari)

13) *Geoffroyus geoffroyi pucherani* Souancé
♀, April 30. Wing 164. (Hoedt, Khakiaj)

14) *Cacomantis variolosus infaustus* Cabanis and Heine
♀, April 25. Wing 117, culmen 20. Iris grayish, bill dark brown, feet yellowish. (Bernstein, Khakiaj)

15) *Alcyone pusilla pusilla* (Temminck)
(Beccari)

16) *Halcyon sancta sancta* Vigors and Horsfield
♀, May 8. (Beccari, Khakiaj)

17) *Tanysiptera (galatea) ellioti* Sharpe

This beautiful kingfisher had a decidedly international introduction to the world of natural history. Collected by Hoedt's collector, presumably David Hokum in 1867, the type specimen was acquired by Count Turati of Milan who sent it to Jules Verreaux in Paris for identification. There it was seen by Mr. Daniel Giraud Elliot of New York who advised that the specimen be sent to Dr. Sharpe in London who described it in 1869. Other specimens from Hoedt reached Leyden. Beccari collected the species for the Genoa Museum, one of the specimens of which came into the Rothschild collection and is now in New York.

The series collected by Jusup Khakiaj includes six adults, all labelled females, taken May 1-5, and two young birds labelled males, taken May 1 and 2, in first winter or first basic plumage. The adults are alike in possessing a uniformly white rump and upper tail coverts, in this and the largely white tail bearing a certain resemblance to *sabrina* of the Moluccas.

This population has been kept separate from that complex of populations of the Moluccas, Papuan Islands and parts of the New Guinea mainland, all now included in the species *galatea*, on the basis of having tail feathers which are not sharply spatulate at the tip. This is essentially true as demonstrated by this series. All the adults except one possess broad central tail feathers, narrowing somewhat near their

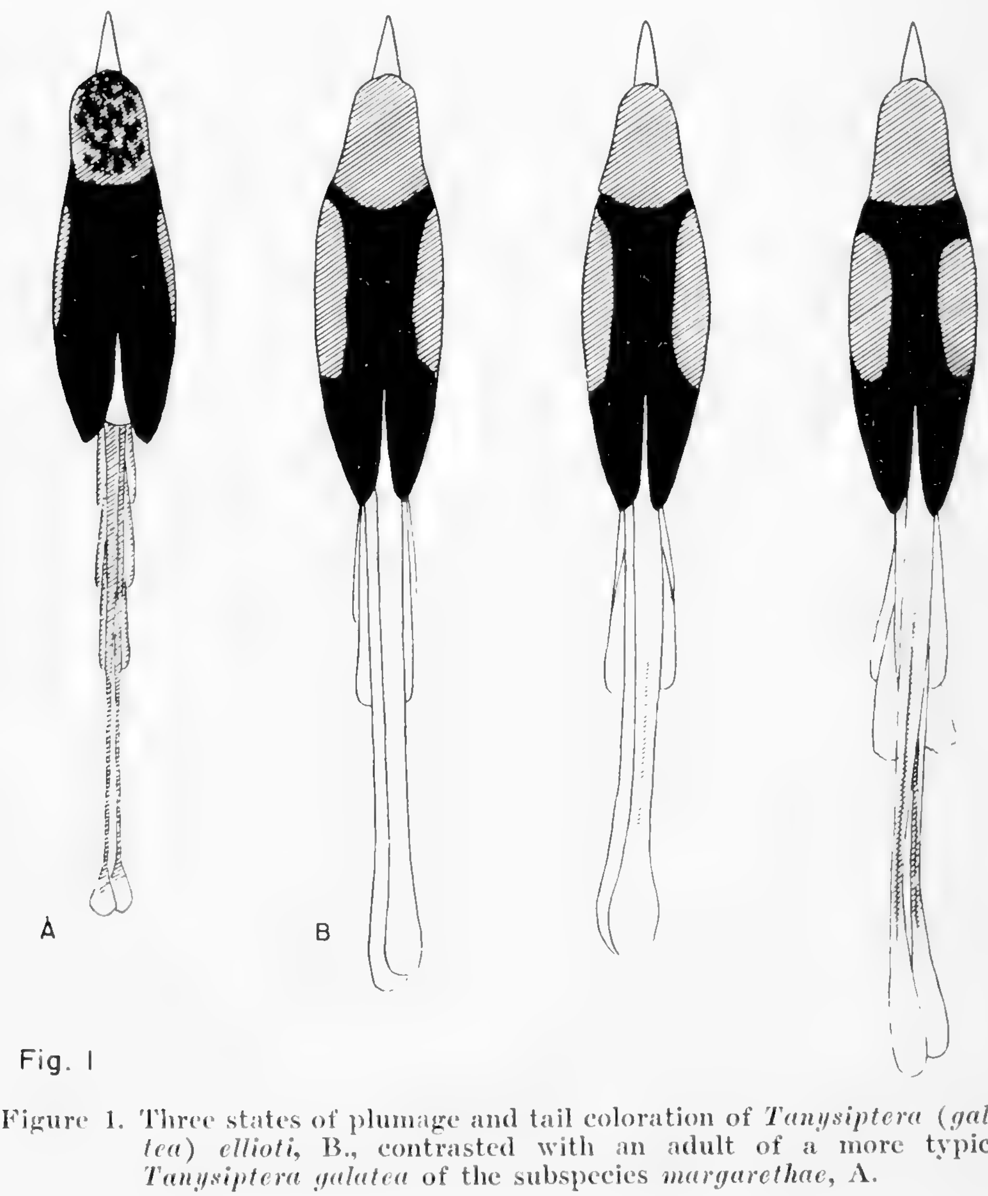


Figure 1. Three states of plumage and tail coloration of *Tanysiptera* (*galatea*) *ellioti*, B., contrasted with an adult of a more typical *Tanysiptera galatea* of the subspecies *margarethae*, A.

terminal ends and tapering slightly to a bluntly rounded and broad tip. In four cases the sub-terminal segment of the tail shaft where the feather shows signs of tapering is dull bluish black or blackish. In one of these birds a very narrow area of the vanes adjacent to the shaft is edged with blue. One adult has almost completely white tail feathers, only a trace of blackish shading appearing on the edge of the subterminal part of the shaft. (Fig. 1).

A single adult shows marked polymorphism. While the rump and upper tail coverts are white, and while the tips of the tail feathers are broadly and bluntly rounded, the subterminal area of the tail, representing a third of the total length of the central feathers is distinctly narrowed and the vanes strongly washed with blue. The effect is close to that of *T. g. sabrina.* This specimen is important in demonstrating the persistence of an old ancestral allele in what is not a completely homogeneous population. One is impressed that this is a species *in statu nascendi* or as Mayr has called it a form of "almost specific rank," (1942).

The young birds are interesting as Sharpe has noted (1892) in that the under parts are washed with "ochre" or rich brownish buff, with almost completely reduced marginal edgings of blackish so noticeable in other forms. These young birds have bright blue caps, scapulars and lesser and median wing coverts, and ultramarine upper back and primary coverts, the latter with reduced brownish edging. The feathers of the lower back and rump are largely pale brown with white centers and blackish margins, rather strikingly different from the rump of related forms. The tail feathers are blue above, very pale at the centers, and noticeably broader than young of other forms.

In these two birds the breast feathers are very badly frayed, indicating the wear of grubbing for insects in muddy jungle undergrowth.

Measurements: Wing 6 ♀ ad. 101.5-108 (105.5) mm.
Tail 6 ♀ ad. 153 (moult?)-215 (190.4).
Culmen 6 ♀ ad. 37-40
wing-tail ratio 5 ♀ ad. 49, 53, 54, 57, 64%

(Hokum, Beccari, Bruijn, Khakiaj).

18) *Merops ornatus* Latham
♂ ad. May 6. (Khakiaj)

19) *Pitta sordida novae-guineae* Müller and Schlegel
♂ ad. May 5. Wing 104. (Beccari, Khakiaj)

20) *Coracina tenuirostre müllerii* Salvadori
(Beccari)

21) *Coracina papuensis melanolora* (Gray)
♂, ♀ ad. May 9, Wing ♂ 150.5, ♀ 149; culmen (from skull) ♂ 31, ♀ 32. (Beccari, Khakiaj)

22) *Gerygone magnirostris occasa* Ripley
♂ ad. May 2. Type.

As pointed out in the original description (1957) this form differs from its geographical neighboring forms, *cobana*, *brunneipectus* and *conspicillata* from the neighboring islands of Waigeu, Batanta and Salawati; western New Guinea, and the Aru Islands by being much more richly yellow on the underparts. In the color of the underparts it approaches *rosseliana* from the Louisiade Archipelago and in color of the upperparts it is close to *affinis* from north New Guinea, an interesting example of pattern replacement in geographically related forms. (Khakiaj)

23) *Rhipidura rufiventris vidua* Salvadori and Turati
♂ ad. May 5.

A topotype of this subspecies, not collected for presumably eighty years. As Beccari points out (1875:707), David Hokum collected the original specimen for Hoedt who sent it to Turati. Wing 74.5, tail 75.5, culmen 16.

This form differs markedly from *gularis* the adjacent population of the Western Papuan Island by being much smaller (wing ♂♂ 83-92), the gray breast band marked with white spots, lacking in *gularis*, but present in *obiensis* and *kordensis*, and by having the abdomen and belly plain white, not washed with pinkish buff as in *gularis*. (Hokum, Beccari, Khakiaj)

24) *Monarcha alecto chalybeocephalus* (Garnot)
♂ ad. May 8. (Beccari, Khakiaj).

25) *Monarcha guttula* (Garnot)
(Beccari)

26) *Monarcha julianae* new species.*

Type: ♂ ad. (Y.P.M. no. 39235) collected April 26, 1955, by Jusup Khakiaj on Kofiau Island, Netherlands New Guinea.

Diagnosis: from *guttula* this species which is known from a single adult male differs by being slightly larger, wing 81, tail 73.5, culmen 17; compared to a small series of *guttula* from Misool and Waigeu, ♂ ♂, wing 76.5-79, tail 67.5-71, culmen 14-16, [Gyldenstolpe's measurements (1955) are equivalent] and by the following differences in pattern and color: back bluish black rather than gray; wing coverts are bluish-black throughout, in *guttula* the inner wing coverts are grayish, the greater wing coverts are bluish black with pronounced white terminal spots; below the prominent black bib reduced to a narrow diamond-shaped throat patch, extending in a median point towards the upper breast, the white of the breast extending on the sides to the area below the eyes. Like *guttula* the tail of this species is black above, and below the outer four pairs of tail feathers are tipped with white, the outermost broadly so, the white area representing about 40% of the length of the feather.

This species is much more closely related to what I would prefer to call the *leucurus* superspecies and should be included in it, I believe. This superspecies consists of three additional populations as follows:

A) *Monarcha everetti* Hartert. This small Monarch flycatcher is found only on Tanahdjampea, an island of the Saleyer group south of Celebes and north of Flores, between five hundred and eight hundred miles west of the locus of its nearest relatives in the Moluccan-Papuan region. This species represents, as Rensch points out (1936) an incursion of papuan-australian origin into the lesser Sunda-Celebesian area, an area which is primarily of oriental affinity. I entirely agree with Mayr (1944) that

*This species is named, by gracious permission, in honor of Her Majesty, the Queen of the Netherlands.

this species has nothing to do with the widespread *Monarcha trivirgatus* as Meise attempted to demonstrate (1929). As Mayr notes, this is an "instance of ill-advised application of the principle of geographical representation." Simply because the widely distributed gray-backed scrub-inhabiting Spectacled Monarch happens to be absent from certain islands is no reason for including highly distinctively-plumaged arboreal-type Monarchs in the same species.

This species is smaller than its relatives, and differs from them in having a white rump, and by having a pronounced white patch on the inner margins of all but the outermost primary, and on all the secondaries making a poorly concealed white wing patch which must be extremely noticeable in flight. In addition, the black throat patch is like a large bib in shape, extending down onto the upper breast. The tail, which is rounded, has the four outer tail feathers tipped with white, the outermost white for half its length.

The female is gray above with whitish lores, the upper tail coverts buffy white and the tail black with whitish tips to the outermost feathers. Below the breast is light ochraceous-buff paling into grayish on the throat and sides of flanks and into dull creamy white on the abdomen. This female plumage is markedly different from the forms described hereafter.

In proportions of tail length to wing length and bill size, this species seems similar to its relatives to the east. In shape, however, the tail is much more rounded, the outer tail feathers being only 76% as long as the central tail feathers. It is also notably smaller; wing 3 ♂♂ 67.5-69; tail 67-70.5; culmen 15-16; ♀ wing 58.5, tail 60, culmen 14.5. This form is represented as "A" in Figure 2.

B) *Monarcha leucurus leucurus* Gray. This population occurs on the Kai Islands (also spelled Kei or Key) of extreme eastern Indonesia, south of the western end of New Guinea. With *loricatus* I believe it forms a species. Both are rather large Monarchs, blue black above with a varying shape of throat patch below which extends narrowly onto the upper breast. The outer three pairs of tail feathers are white, some brownish margins occurring on the penultimate and third inner feathers. The fourth pair of tail feathers has a black inner web for the basal one-third of its length.

The female is dark bluish-gray on head and upper back, brownish gray on the lower back, upper tail coverts blackish gray, central tail feathers black; below center of throat gray, sides of throat and breast dark orange rufous, paling to warm brown on the flanks; center of abdomen white.

Size medium; wing 4 ♂♂ 75-80; tail 74-77; culmen 17-18; ♀ wing 71, tail 74, culmen 17.

This form is represented as "B" in Figure 2.

C) *Monarcha leucurus loricatus* Wallace. This population is found on the large island of Buru just west of Ceram. Although Stresemann (1914) mentions this form as occurring from the coast to the higher tableland and not higher than 800 meters in altitude, Toxopeus in Siebers (1921-22) found it only in the mountains at 1200 meters. This is the largest of the forms, the male blue-black above; below with a black throat patch just reaching the upper breast, and with a small patch of bluish black on the sides of the breast just before the bend of

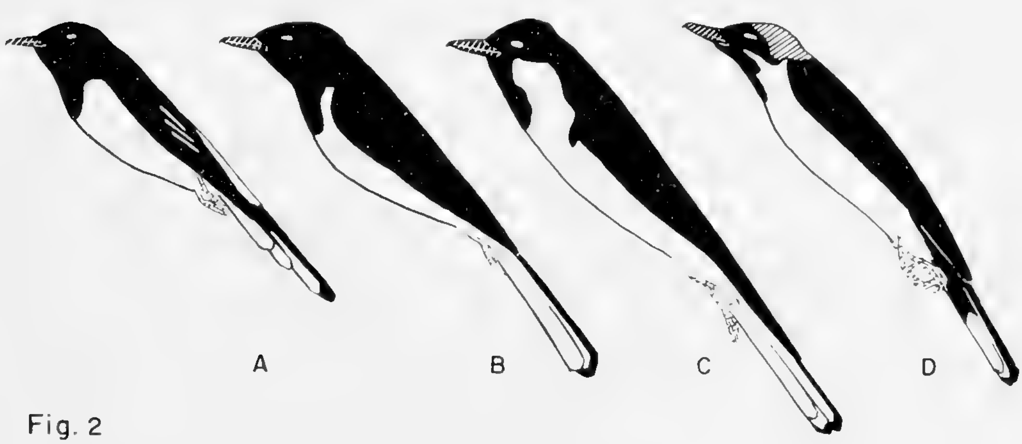


Fig. 2

Figure 2. *Monarcha everetti*, A; *Monarcha leucurus leucurus*, B; *Monarcha leucurus loricatus*, C; *Monarcha julianae*, D.

the wing. The tail is only slightly rounded, the outermost feathers being 83-86% of the length of the central tail feathers. The two pairs of outer tail feathers are white with some blackish along the base of the shaft, the third pair with a very narrow (2 mm.) black tip, and the fourth pair with a black tip some 10 mm. in width.

The female is brown on the forehead, more grayish, "hair-brown" on the crown and nape, and russet on the back, wing coverts and rump. The tail feathers are brownish black above. Below except for some grayish on the chin and center of the upper throat, the female is warm vinaceous brown. The outer tail feathers are rich buffy brown instead of white as in the female of *leucurus*.

Size largest; wing 4 ♂ ♂ 86-91; tail 72.5-85.5; culmen 17-20; female wing 77.5, tail 75.

This form is represented as "C" in Figure 2.

D) *Monarcha julianae.* The single male differs from *everetti* and *leucurus* by having a gray rather than bluish-black crown and nape, shading into the white of the neck behind the black auricular patch. Unlike *everetti* but like *leucurus*, the rump is concolorous with the back and there are no white patches on the inner margins of the wing feathers. Below *julianae* has a small roughly diamond-shaped throat patch, the white of the throat extending laterally forward to below the eyes. The outer tail feathers are tipped with white rather than largely white as in *everetti* or all white as in *leucurus*. The tail is somewhat rounded, the outermost feathers approximating 85% of the length of the central tail feathers.

This new species is represented as "D" in Figure 2. Unfortunately, the female of this new form is unknown. It would be interesting to know if the female is dimorphic as in the *leucurus* superspecies, and if so if it is predominantly russet in tone as in *leucurus* or grayish and isabelline as in *everetti*.

The fact that *julianae* can coexist on a small island the size of Kofiau along with the widespread *Monarcha guttula* (collected formerly by Beccari) is an example of how little is understood of the ecology and niche relationships of the *Monarcha* species. *Monarcha guttula* is stated by Mayr (1944, *t.c.*) to belong to the *trivirgatus* group, although it cannot be considered a member of a superspecies as it overlaps with *trivirgatus* in the Louisiade Islands. Undoubtedly a close analysis of the feeding habits and spatial relations of these species will reveal a great deal about the problem of coexistence and competition. *Monarcha trivirgatus* in my experience is a bird of scrub, low bushes and substage vegetation, found from the coast up to 2500 feet altitude. *Monarcha guttula*, at least on Misool Island, was found in the substage and also high up in the lower storey of the canopy forest. Unfortunately, Jusup Khakiaj has not noted the position in the forest of the single male of *julianae* which he secured.

27) *Pachycephala phaionotum* (Bonaparte)
2 ♀ ad. May 3, 5. (Khakiaj)

28) *Dicrurus hottentotus atrocaerulus* Gray
2 ♀ ad. April 25.

Wing ♀, 150, 163; bill (using Vaurie's scale, 1949:284) 25, 25 mm.

These two specimens place the Kofiau birds with the large-billed population of Halmahera and Batjan Islands, rather than with the west New Guinea *carbonarius* where they had been assigned by previous authors including Vaurie (1949) who had not examined specimens. Thus the spangled drongo of Kofiau belongs to the Moluccan rather than the Papuan form. (Beccari, Khakiaj).

29) *Nectarinia sericea mariae*, new subspecies

Type: ♂ ad. (Y.P.M. No. 39234), collected April 25, 1955, on Kofiau I., Netherlands New Guinea, by Jusup Khakiaj.

Diagnosis: compared to *cochrani* (Stresemann and Paludan) of Waigeu and Misool Islands, this form has a pansy-violet rather than steel-blue with a purplish gloss, throat patch. This color is nearer that of typical *sericea* which, however, is more bluish, merely shaded with aster purple (Ridgway, 1912). The cap color is far more greenish than in *sericea* or *cochrani*, approaching in this respect *auriceps* of the Moluccas although it is less yellow-green than in that form. In the same way the iridescent color of the wing coverts, rump, and upper tail coverts is more greenish-blue rather than steel blue with a purplish-greenish gloss. This is especially noticeable in the area of the lower back. The single female appears somewhat brighter in color on the yellow underparts, nearer typical *sericea* than either *cochrani* or *auriceps*.

In size these birds also approach typical *sericea*:

	Wing	*Tail*	*Culmen*
2 ♂	59, 61	35, 37	18, 19
♀	54	32.5	18

A series of *cochrani* measured by Stresemann and Paludan (1932) showed wing measurements of 54-58, ♀ 51, and in *sericea* ♂ ♂ 60-64, ♀ 51.5-53 mm.

This Kofiau Island population represents an interesting example of discontinuous geographic variation of the type referred to so exhaustively by Mayr (tom. cit. 1942:77-84). If the distinguishing characters of the iridescent colors of the male *mariae* are contrasted with adjacent populations running from left to right as one travels from west to east the following discontinuous clinal pattern emerges:

	auriceps, Moluccas	*mariae*, Kofiau	*cochrani* W. Papuan Is.	*sericea*, New Guinea
throat color	bluish	pansy-violet	steel-blue	bluish shaded with aster purple; described as "reddish lilac" by Gyldenstople (1955:376)
cap color	golden-green	"chrysoprase-green" (Ridgway)	bluish-green, "tyrolite green (Ridgway)	bluish-green, "tyrolite-green"
rump and wing coverts	steel blue	yellowish blue green	bluish-green with a faint yellowish suffusion	bluish green with a faint yellowish suffusion

Named in honor of my wife, Mary Livingston Ripley.
Range: Kofiau Island (Beccari, Khakiaj).

29) *Nectarinia jugularis frenata* (Müller)
2 ♂ Apr. 24, 27. Wing, 54.5, 57.5. (Khakiaj)

30) *Philemon novaeguineae novaeguineae* (Müller)
Jusup Khakiaj failed to collect this noticeable bird for the same reasons that he missed securing the fruit pigeon. Both species tend to dwell in the upper heights of the trees. (Beccari).

2. New or noteworthy records from the Western Papuan Islands

1) *Procellaria pacifica chlororhyncha* Lesson
A male of this form from Kabaré, Waigeu Island taken by my assistant, Jusup Khakiaj, on October 8, 1955, appears to be the second record for New Guinea *vide* Mayr (1941:5).
Wing 267, tail 131, culmen (from external nares) 31.

2) *Goura cristata minor* Schlegel
A pair of Crowned Pigeons from Misool, the female in the melanic plumage sometimes encountered in this form, the throat and belly blackish, divided by a narrow smokey-blue chest band, the upper surface of the tail largely black, are considerably smaller than birds from Waigeu. In addition, a male from Misool recorded by Mayr and de Schauensee (1939) and a pair of birds in the American Museum collection are similarly small, wing ♂ ♂ 327-335, ♀ ♀ 320, 324. Waigeu birds measure: wing ♂ ♂ 350-365, ♀ ♀ 318 (1), 333-353. It is possible that additional material might reveal the existence of a distinct subspecies on Misool, which in several other instances seems to have evoked the emergence of populations with smaller dimensions than on the mainland of New Guinea or neighboring islands.

3) *Cuculus saturatus saturatus* Blyth
A male from Waigeu I. taken Sept. 24, 1955 with a wing measurement of 187.5 appears to belong to this small subspecies. Presumably the immature recorded by de Schauensee (1940) with a wing measurement of only 172 represents *saturatus* rather than *horsfieldi*.

4) *Collocalia vanikorensis granti* Mayr

Three males of this form were taken on Misool, a new record for that island. Wing measurements 114 (2), 116. In size they seem slightly smaller than typical *granti*, but are similar in color to that form.

5) *Coracina morio incertum* (Meyer)

A male of this form taken by me at Fafanlap, Misool I. on 27 November, 1954, is an extension of range of this species to that island.

6) *Eupetes caerulescens caerulescens* Temminck.

A male taken at Wasa, Misool I. by Jusup Khakiaj on February 6, 1955, substantiates the old record of Neumann's type of "*occidentalis*" as having come from "Waigama" on Misool. Wasa is not far from Waigama, but in any case the form ranges all over the island as we saw it in dense forest at Tamulol nearer the south coast.

7) *Pomatostomus isidori isidori* (Lesson and Garnot)

An unsexed adult taken in September, 1955, by Jusup Khakiaj appears to be a first record for Waigeu Island. This seems surprising in view of the work of Stein and Bergman.

8) *Rhipidura threnothorax threnothorax* Müller

At Tamulol on Misool, I collected a male specimen of this Fantail on November 14, 1954, which is a new record for the island. It does not differ from mainland New Guinea specimens and weighed 19 grams.

3. Birds from Ajoe Island

Ajoe is the largest of a group of coral islets about twenty-five miles north of Waigeu Island. It is a sandy island, about three miles by a mile and a half in area, rising to a height of nearly three hundred feet. It is covered with scrub and coconut palms and there are several villages of Besarese fishermen. These Besarese people, a mixture of Malay and Biak Island Papuan origin, are noted sailors in the region, and in former days practiced a certain amount of local piracy and free lance smuggling.

Jusup Khakiaj collected a few birds on September 1, 1955, on Ajoe, and as the island has not been visited by a collector before, it is worth noting that he obtained the following species: *Eos squamata squamata, Merops ornatus, Halcyon sancta sancta, Aplonis mysolensis mysolensis.*

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ON *MAKAIRA NIGRICANS* OF LACÉPÈDE

By

JAMES E. MORROW, JR.

INTRODUCTION

The identity of *Makaira nigricans* has long been a puzzle to ichthyologists engaged in studies of the istiophorids. While undoubtedly a marlin of some sort, the published description and figure (Lacépède, 1803: 688—691, Pl. 13, fig. 3) are such that it has been impossible to identify the fish with any known species. Lacépède himself never saw the actual specimen, but made his description from the notes and a sketch sent to him by MM. Traversay, Fleuriau-Bellevue, and Lamathe. The first named was the sub-prefect of La Rochelle, the second was said to have been a well-known naturalist of the district, and the third appears to have been a gentleman resident at Ars, on the western side of the Île du Ré, where the fish was found washed up on a beach after a storm.

Recently, through the efforts of Dr. Willard Hartman, Peabody Museum of Natural History, Yale University, we received photographs of the original sketch (reproduced here as fig. 1) and notes from the librarian of the Muséum National d'Histoire Naturelle in Paris. On this drawing, several notes give the dimensions of various parts of the fish. These notes are in two handwritings. One is rather coarse and heavy and contains several misspellings. Presumably this is the hand of the person who drew the sketch. The other hand is much finer, apparently that of a well-educated person, and is presumably the writing of either M. Fleuriau-Bellevue or M. Lamathe. The impression gained by examining the notes in the two hands is that those in the coarser hand were made first, and that those in the finer hand represent additions and corrections. Prof. Georges May, Department of French, Yale University, kindly puzzled out the sometimes rather illegible notations and archaic usages.

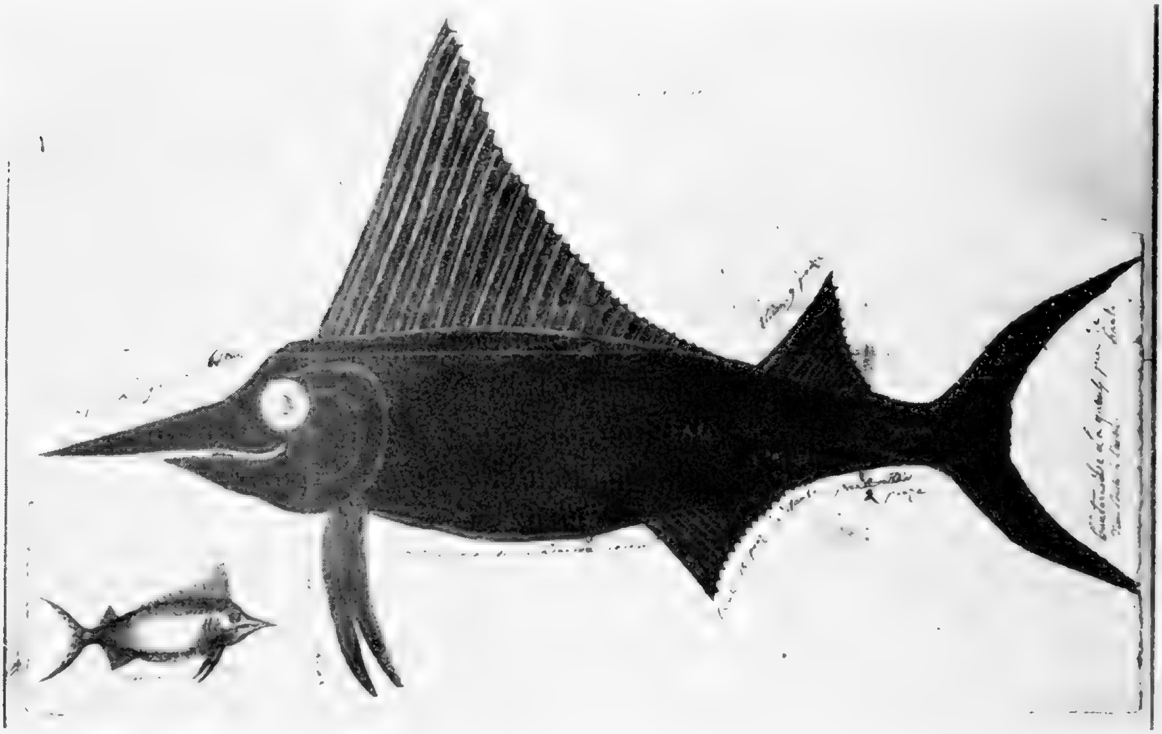

Figure 1. The Traversay drawing, on which Lacépède based his description of *Makaira nigricans*. See text for notations. The small picture at the lower left is the illustration published by Lacépède.

Over the snout of the fish is written "2 pieds de Longure De la Picque ou defense"; along the anterior edge of the dorsal fin, "hautur 23 pouze"; above the middle of the back, in the better handwriting, "Cette partie se replojoit sur elle même dans le corps de l'animal et saillois de 4 ou 5 pouces á l'extérieur"; along the anterior edge of the second dorsal "Éleron 9 pouze"; across the spread of the tail, "hauture de la queue 4 pieds de haut," and in the better hand, "d'une pointe à l'autre"; below the caudal peduncle, "pointe D'os 2 pouze";

along the posterior edge of the anal fin, "Élerons 15 pouze de deboute" (the last two words quite illegible, but Prof. Mayr suggests that a poorly educated person might have made such usage of the adverb "debout"): below the belly, "Du corps entier De Longueur 10 pieds," and below this, in the better hand "trois pieds de profil"; along the anterior edge of the pectoral fin, "Longuer 23 pouze." Notes on the back of the drawing, apparently written by Lacépède and copied for us by Dr. Hartman, read: "Il pesait 365 kylogr. 730 lbs." (the latter in pencil in another hand) "Les habitants de l'Île de Rhé en ont mangé avec plaisir. La chair était un peu sèche, non huileuse. Makaira. Makaira noirâtre. L'individu dessiné a été pris auprès de la rochelle. La tempête l'avait jeté sur le rivage. Le sous-préfet Traversay m'a donné le dessin sur lequel j'écris cette note."

The notes on the separate page, in a hand similar to the finer one on the sketch, read: "Notes à ajouter à la description du poisson échoué sur les côtes de l'Isle de Ré en Vend^{re} an 10.– dont le dessin a été remis a M. de Lacépède par M. de Traversay. Ce poisson n'a point d'event sur la tête comme les Marsouins. L'os de la déffense ressemble assés à l'yvoire. La deffense est ronde, et sans tranchans d'aucun coté. elle est droite, unie et sans sillons. Il n'a point de dents, son palais etoit extrement ápre à la main. La chair très blanche, courte, seche et d'un gout fade.

"Ces renseignmens ainsi que le dessein, ont été donnés a M. Fleuriau-Bellevue par *M. Lamathe fils, demeurant à Ars, Isle de Ré* M. Lamathe lui a mandé qu'il répondrois tres volontiers à toutes les questions que M. de Lacépède jugerois à propos de lui faire à ce sujet."

DISCUSSION

Much of the difficulty that has been encountered in attempting to identify any currently known species of marlin with *Makaira nigricans* is the direct result of two errors made by Lacépède in writing his description. First, he stated "Longueure totale, 330 centimetres," but the notes on the original drawing clearly say that the length of the body—not the whole fish—was ten pieds (about 3250 mm). On this point, Cuvier (1831:

290), referring to the figure published by Lacépède, remarked, "M. de Lacépède a fait refaire le dessin d'après ces dimensions écrites; mais je crois qu'il a trôp raccourci le corps, et que l'auteur du dessin n'entendait pas comprendre dans les vingt [sic] pieds l'épée ni la Caudale." Following Cuvier's hint, it would seem that the posterior reference point in measuring the length of the body was somewhere near the base of the tail.

But from what anterior point was the body measured? Comparing the length of the spear given by Lacépède (2 pieds, or about 650 mm), with various measurements of snout length in other large marlins indicates that the spear of *M. nigricans* must have been measured from its tip to the tip of the lower jaw. Both the angle of the mouth and the anterior border of the eye are too far back. Measurements to either of these points from the tip of the snout would, in such a large fish, be on the order of 900 to 1,000 mm or more, rather than 650 mm. The nostril, another possible reference point, is so close to the eye that measurements to this would still be far larger than 650 mm. The most probable reference points for the snout measurements are thus the tip of the snout and the tip of the lower jaw. At 650 mm, this length of snout is quite reasonable for a large fish. Lacking evidence to the contrary, it is logical to assume that the anterior reference point in measuring the body length was also the tip of the lower jaw. This results in a standard length of the fish, from the tip of the snout to the tail base, of about 3900 mm. This is indeed a very large fish, but it is not beyond the recorded or reported size for several species of marlins.

The second error of transcription in Lacépède's article is his statement "une hauteur d'une meter" (1,000 mm), whereas the note on the sketch reads "trois pieds de profil" (974 mm). To the ichthyologist, "profil" is not the same as body depth (hauteur). The latter is the straight-line distance from the mid-dorsal to the mid-ventral line, while the former is the distance between these two lines measured around the curvature of the body. For white marlin, our data indicate that the depth varies between 79% and 89% of the profile, averaging 82%. Data supplied by Dr. C. R. Robins, Marine Laboratory, University of Miami, produce an average relationship of a fraction over

82% for 26 specimens of Atlantic blue marlin. Nakamura (1938: 5) reported that the depth averaged between 83% and 86% of the profile in the three Pacific species examined by him. Since *M. nigricans* was an Atlantic fish, it seems justifiable to take 82.5% of the profile for an approximation to the body depth, or 804 mm.

Two other points require comment. It has been suggested that the awkard positioning of the pectoral fins in the sketch was intended to portray the rigid pectoral fins of the black marlin of the Indo-Pacific. Indeed, we ourselves (Morrow, 1959) advanced somewhat the same line of reasoning in seeking to establish the identity of *Tetrapturus indicus* Cuvier. But there we were dealing with a drawing made by an experienced zoological illustrator. In the present situation, the drawing apparently was made by someone with little education, zoological knowledge, or artistic ability. Particularly since the black marlin has never been recorded from the Atlantic ocean, it seems to us far more probable that Cuvier's (1831: 289) interpretation was correct—that, consciously or no, the artist was influenced by experience with a fish that must have been well-known to him, the broadbill swordfish, and drew the fins as he thought they ought to be rather than as they were.

The statement that the meat of *M. nigricans* was "très blanche" has also been taken to indicate the black marlin, whose flesh is very white in contrast to the red meat of the Atlantic species. However, we have eaten nearly all the istiophorids*, and can testify from personal experience that the flesh of all these turns white when cooked. Since the rest of the description of the meat obviously refers to its condition on the table, the statement regarding color can only mean that it was well done.

The remaining measurements, etc., seem clear enough, and as Lacépède and the notes agree, there seems to be no need for further comment. We now have a set of dimensions for *M. nigricans* as shown in Table I, and by exercising only the minimum of imagination, it should be possible to reconstruct the beast. The result is shown in fig. 2.

* Atlantic and Indo-Pacific blue marlins, black, white and striped marlins, Atlantic and Indian ocean sailfish, Indo-Pacific spearfish.

TABLE I

Revised dimensions of *Makaira nigricans* Lacépède*

Height of dorsal fin	23 pouces	622 mm
Length of pectoral fin	23 pouces	622 mm
Depth of body	2.49 pieds	804 mm
Length of snout, to tip of lower jaw	2 pieds	650 mm
Length of body, tip of lower jaw to tail base	10 pieds	3250 mm
Standard length	12 pieds	3900 mm
Tail spread, tip to tip	4 pieds	1300 mm
Height second dorsal fin	9 pouces	244 mm
Length posterior edge of first anal fin	15 pouces	460 mm

* At the time when Lacépède wrote, the pouce and pied had not been standardized. In converting to the metric system, we have used 1 pouce = 2.707 cm and 1 pied = 0.3248 m. While this may result in some small error in absolute size, it will not affect the proportional relationships.

The general facies of the reconstruction resemble those of the blue marlin more closely than those of any other species. Particularly, the robust body and moderately low dorsal fin place *M. nigricans* with the blue rather than white among the Atlantic species. The pectoral fin is very short, but its length falls at the lower limit of the range for blue marlin (Conrad and LaMonte, 1937: 218), and found also in black and Indo-Pacific blues (see Table II). The shape of the first anal fin is

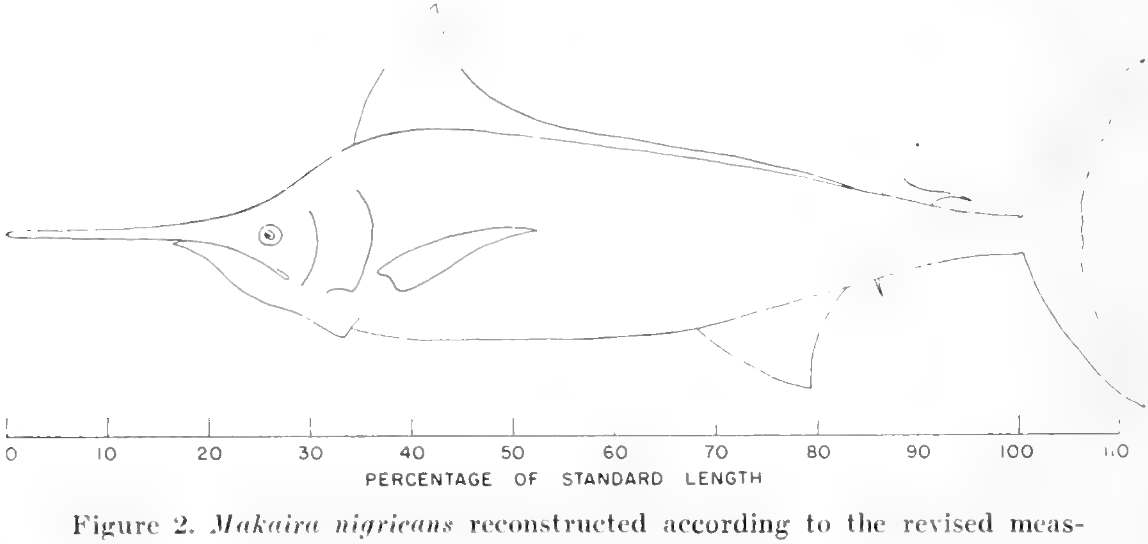

Figure 2. *Makaira nigricans* reconstructed according to the revised measurements of Table I. See text for discussion.

TABLE II

Comparison of characteristics of *Makaira nigricans* with those of other species of marlins.

	Makaira nigricans	*Makaira ampla*	*Makaira albida*	*Istiompax indicus*	*Makaira mazara*	*Makaira audax*	*Makaira bermudae*
Depth as % S. L.[1] ..	20.6	19.6 (18.2-22.0)	14.6 (13.5-16.5)	20.6 (17.5-23.1)	19.0 (15.0-21.1)	15.9 (14.5-17.4)	24.4
Height dorsal as % of depth[1]	78.3	78.6 (67.3-86.5)	116.5 (98.4-136.3)	60.4 (46.3-70.8)[2]	77.0 (54.9-94.3)	127.3 (102.3-156.1)	133.3
Height dorsal as % of S. L.	16.0	15.2 (12.8-17.4)	16.8 (13.7-20.2)	13. 2 (10.2-14.9)[3]	14.0 (11.9-16.0)	19.3 (16.1-22.1)	32.5
Length pectoral as % of S. L.	16.0	19.7 (17.2-21.5)	20.5 (18.9-23.5)	19.6 (16.2-22.5)	19.6 (16.3-21.9)	21.2 (18.0-23.9)	...
Tip snout to tip lower jaw as % S. L. .	16.7	17.5 (14.8-20.4)	15.4 (11.8-17.6)	14.8 (11.0-18.0)	15.5 (14.3-16.6)	13.6 (11.9-15.4)	...
Habitat	Atl. coast of France.	Atl. coasts N & S Amer., Africa, Portugal, France. Madeira; Azores; St. Helena. Caribbean Sea.	Atl. coasts N & S Amer.; off Portugal, Azores, Madeira; Mediterranean.	Pac. & Indian Oceans, S. Cal. & S. Amer. to Australia, Japan, E. Africa. Never recorded from Atlantic.	Same as *I. indicus*.	Same as *I. indicus*.	Bermuda.
Size	804 lbs. at est. S. L. 3900 mm. Est. T. L. 15′.	Largest record 756 lbs, 14′ TL. Unverified repts to over 1000 lbs.	Largest record 161 lbs, 8′ 8″. TL. No repts of larger fish.	Largest record 1560 lbs., 14′ 6″ TL. Repts to over 2000 lbs.	Recorded over 1000 lbs, rept over 2000 lbs.	Largest record 692 lbs., 13′ 5″; others to 430 lbs., 10′ 8″ TL.	10′ 1″ (TL?)

[1] Because of allometric growth, these proportions based only on specimens over 2500 mm in species attaining that size.
[2] One additional specimen 78.3, not included in average [3] Two additional specimens 17.5 and 18.2, not included in average.

a bit odd for any marlin species, but may be accounted for by the assumption that either the fin was damaged or was not fully erect when measured. Some support for the former may be found in the presence of a stub of bone (point d'os) just behind the first anal, indicating that the second anal had been damaged and lost. The second dorsal fin seems rather high, but we can offer no explanation.

The weight of *M. nigricans*, 804 pounds, is rather light for a fish of its assumed length. Either we have made a gross error in assuming this length (which does not seem likely, as the various proportions fit quite well), or it really was a thin fish. According to length-weight relationships derived from various sources (our own data, as well as that published by Gregory and Conrad, 1939, Tables I and III; Conrad and LaMonte, 1937, Table I; Royce, 1957, Appendix Tables 1 and 2), a fish this size should have weighed well over 1,000 pounds. However, the same data also show that individual weights may differ from the computed regression by as much as 40% of the expected value. There are also a number of possibilities which would result in a lighter weight than expected. First, the fish was washed ashore. This fact, coupled with its large size, at once suggests that it was an old, sick, dying animal, quite possibly emaciated. Second, it may well have lain on the beach for a day or two before being weighed. The rapid loss of weight by fishes out of water is so well known as to warrant no further comment. Third, it is quite possible, even probable, that the fish was cut up in order to be weighed more easily, with concomitant loss of body fluids. It may even have been eviscerated. And finally, it is not improbable that the weight was estimated, without ever putting the fish on a scale at all.

We can now compare the reconstructed *M. nigricans* with each of the currently recognized (or recently described) species of marlin (see Table II).

The depth of the body, at 20.6% of the standard length, agrees with the Atlantic blue marlin (*M. ampla*), the Indo-Pacific blue (*M. mazara*), and the black marlin (*Istiompax indicus*). The body is much too deep for either the white (*M. albida*) or the striped (*M. audax*), and not deep enough for the Bermuda marlin (*M. bermudae*).

The height of the dorsal fin, expressed as a percentage of the depth of the body, also appears to eliminate identification with the white, striped, and Bermuda marlins. In all three of these species, the height of the dorsal fin is greater than the body depth, but in *M. nigricans* the dorsal height was less than 80% of the body depth. This value agrees well with the figures for the two blue marlins, but is somewhat too high for the black marlin, except for a single specimen.

The height of the dorsal as a percentage of the standard length agrees with the two blue marlins and the white marlin. It is far too low for the Bermuda marlin, slightly low for the striped, and a little too high for the black, although two specimens of this last species had dorsal heights that overlapped with *M. nigricans.* The weight of the evidence here, however, favors the blue marlins over the others.

The pectoral fin of *M. nigricans*, at 16% of the standard length, is too short for any known species. Both the black and the Indo-Pacific blue, however, come close to this value at the low end of their ranges, and the Atlantic blue is not far off. Conrad and LaMonte (1937: 218) give a lower limit of 1/6 of the standard length for this last species. The relative length of the pectoral fin seems to rule against identity with either the striped or the white marlins, which have rather long pectoral fins.

The length of the snout, from its tip to the tip of the lower jaw, is 16.7% of the standard length in *M. nigricans.* This value is only just beyond the upper limit observed in the Indo-Pacific blue, and is within the range of all the others except the striped marlin.

M. nigricans, at a weight of 804 pounds and an estimated total length of about 15 feet, was much too large to have been either a white or a striped marlin. Although the rod and reel record for the latter is listed at 692 pounds, the fact that this individual, caught nearly thirty years ago, was so much bigger (see Table II) than any individual taken since, despite greatly increased fishing intensity, suggests that it may have been misidentified. It is quite possible that the fish was really an Indo-Pacific blue, a species generally not recognized by American anglers and ichthyologists at the time. Be that as it may, the size of *M. nigricans* falls well within the recorded or reported range of the two blue marlins and the black marlin.

The locality of capture at once rules out identification of *M. nigricans* with any of the three Pacific species. In the more than 150 years since the discovery of *M. nigricans*, with thousands of marlin taken each year in recent times, not a single individual of any Pacific species has ever been reported from a location in the Atlantic, nor has any individual of an Atlantic species ever been found in the Pacific. (A possible exception is found in the Atlantic and Pacific blue marlins, which may or may not represent a single species. They are treated here as two separate species.) Neither the black nor the striped have been found in the Atlantic at any time.

Summing up, then, the pectoral fin of *M. nigricans* is slightly shorter than the shortest pectorals of the Atlantic and Pacific blues, and the black. The gap between *M. nigricans* and either the striped or the white is rather wider, and there is no comparative data for the Bermuda marlin. Of the remaining six characteristics considered, three rule out identification with the white marlin, viz: (1) depth of body as percentage of standard length; (2) height of dorsal as percentage of depth; (3) overall size. Five factors militate against identity with the striped marlin: (1) depth of body as percentage of standard length; (2) height of dorsal as percentage of depth; (3) snout length; (4) habitat; (5) overall size. Comparing with the black marlin, three factors indicate non-identity: (1) height of dorsal as percentage of depth; (2) height of dorsal as percentage of standard length; (with possible exception as noted); (3) habitat. With respect to the two blue marlins, only one factor, habitat, rules out the Pacific form. All characteristics of *M. nigricans* are in agreement with those of the Atlantic blue marlin. The few measurements available for the Bermuda marlin absolutely prohibit any possibility of indentifying this form with *M. nigricans*.

Makaira nigricans is thus established as the form currently known as *M. ampla*, the Atlantic blue marlin. The specific name, *nigricans*, has priority over *ampla* by 58 years. *Makaira nigricans* is the type species of the genus. The type specimen itself was eaten. The type material of the species is a sketch, accompanied by notes and measurements, now with the original manuscript of Histoire Naturelle des Poissons, volume 8, by Cuvier and Valenciennes, in the library of the Muséum National d'Histoire Naturelle, Paris.

SYNONYMY

Makaira nigricans Laépède. 1803, Histoire naturelle des Poissons, Paris, vol. 4, pp. 688-691, Pl. 13, fig. 3.

Tetrapturus herschelii Gray, 1838, Ann. Mag. nat. Hist., *1*, 313, Pl. 10.

Tetrapturus amplus Poey, 1860, Memorias sobre la historia natural de la Isla de Cuba, vol. 2, pp. 237, 243-244; ibid., 1861, Pl. 15, fig. 2.

Makaira perezi de Buen, 1950, Publ. Cient. Serv. oceanogr. Pesca, Montevideo, *5*: 171-175.

ACKNOWLEDGEMENTS

The field work involved in accumulating much of the comparative data used here has been assisted and supported by Messrs. Wendell W. Anderson, Thomas Shevlin, John K. Howard, Alfred C. Glassell Jr., Al Pflueger, the American Academy of Arts and Sciences, and the Society of the Sigma Xi. Assistance in other directions has been received from Dr. Willard D. Hartman, Prof. Georges May, and Dr. C. Richard Robins. Messrs. Howard and Robins and Miss Francesca R. LaMonte have criticised the manuscript. To all these good friends and institutions, grateful thanks are tendered.

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Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 40 May 28, 1959 New Haven, Conn.

A NEW SPECIES OF *GRAMMATOSTOMIAS* (FAMILY MELANOSTOMIATIDAE) FROM THE WESTERN NORTH ATLANTIC

James E. Morrow Jr.*

The genus *Grammatostomias* is most easily distinguished from other genera of the family by the presence of a streak or loop of luminous tissue on the sides of the body above the lateral row of serial photophores. Within the genus, the form of the loop or streak, and the number of rays in the pectoral fin appear to be valid characteristics upon which the several species can be distinguished.

Grammatostomias circularis, new species

Figure 1. *Grammatostomias circularis*, new species. Drawn from the type specimen, 135.6 mm from snout tip to tail base. The skin of the caudal region has been slightly restored in the illustration. Drawn by Miss Shirley Glaser.

Study Material. Type Specimen. One specimen, 135.6 mm in standard length, from the western north Atlantic, north of San Juan, Puerto Rico; Yale Peabody Museum of Natural History, Bingham Oceanographic Collection, No. 3773.

* Bingham Oceanographic Laboratory, Yale University.

Distinctive Characters. G. circularis is separated from the other two species of the genus by the presence of 9 pectoral rays and by the nearly circular form of the lateral loop of luminous tissue.

Description. Proportional measurements of the type specimen are expressed as percentages of the standard length unless otherwise indicated.

Body: depth 10.5.

Head: 15.6

Eye: 2.6; 16.5% of head.

Snout: 3.4; 21.7% of head.

Interorbital: 4.1; 26.0% of head; ca. 150% of eye diameter.

Distance from snout: to origin of dorsal fin 78.3; to origin of anal fin 78.3; to origin of ventral fins 45.8.

Dorsal fin: rays 21; length of base 14.6.

Anal fin: rays 23; length of base 17.0.

Pectoral fin: rays 9.

Ventral fin: rays 8.

Branchiostegal rays: 10.

Serial photophores: Ventral row: I-P 7, P-V 18, V-A 21 (the last two above anal base), A-C 13. Lateral row: O-V 18, V-A 19, 20.

Body slender, compressed, depth about 1/10 of standard length. Caudal peduncle about 5% of standard length, strongly compressed. Barbel pigmented basally, broken off, the part remaining not quite as long as head.

Head about 1/6 of standard length, its dorsal profile gently rounded, premaxilla projecting into dorsal line. Snout longer than eye. Interorbital width greater than snout, about 1 1/2 times eye, slightly convex, with a low, inconspicuous ridge above each eye. Eye round, about 1/6 of head. A small light organ present on ventral edge of fleshy orbit below center of eye. Postocular organ elongate, its length about 5 times its width, length less than 1/2 eye, long axis parallel to upper jaw. A small, vertically elongate luminous spot present before eye; three small spots on upper jaw, one just before postocular organ, a second elongate spot behind postocular, and a third round one behind. Branchiostegals 10, a photophore on membrane near base of each ray.

Mouth extending nearly full length of head, gape straight. Premaxilla with a large fixed tooth anteriorly, followed by a larger depressible one which is largest tooth in upper jaw. These followed by two rigid, outer teeth, a depressible inner tooth, a rigid outer, a depressible inner, and five rigid teeth to posterior end of premaxilla. Maxillary with about 28 small oblique denticles on posterior part of its ventral margin. Mandible with a large, rigid fang anteriorly, followed by a minute rigid tooth, a depressible tooth and a rigid outer tooth. Behind these, three inner depressible teeth and three rigid outer teeth, approximately in pairs, inner teeth longer than outer ones. Behind these, 11 small rigid teeth in single row, irregular in size, 1st and 4th longest. Vomer without teeth. Palatines with 3 or 4 teeth in single row on each side, 2nd and 4th teeth minute. Two pairs of backwardly-directed teeth on tongue. Twelve small single teeth on first gill arch.

Pectoral fins close to mid-ventral line, their origins just below posterior edge of gill openings, fins of 9 long, slender, dark-colored rays, several with slim luminous bodies, one with a large thick mass of luminous tissue basally. Pectoral rays about as long as a head. Ventral fins of 8 rays, well developed, originating before middle of standard length. Dorsal and anal origins on same vertical, anal base longer than that of dorsal, both fins with thick sheaths of body skin extending well up on the rays. Caudal forked.

Sides of body with a nearly circular line of luminous tissue, its antero-posterior diameter slightly greater than length of post-ocular part of head, extending backwards from gill openings (see fig. 1). Vertical extent from near dorsum almost to lateral row of serial photophores. Luminous line quite even, smooth, without zigzags or noticeable thickenings.

Skin smooth, scaleless, marked with vertical rows of tiny photophores, and with numerous small organs scattered over head and body.

Color. The alcoholic specimen is dark brownish black. Serial photophores bluish, luminous loop pale violet.

Type Locality. North of San Juan, Puerto Rico, 18° 55′ N, 66° 10′ W to 19° 05′ N, 65° 59′ W; 0 to 225 fathoms.

Name. The species is named *circularis*, with reference to the nearly circular shape of the lateral loop of luminous tissue.

Comparision With Other Species. The present species is most easily compared with others in the genus by means of the following key.

Key to Species of *Grammatostomias*

1a. Sides with a long luminous line from just behind gill cover to behind ventral bases, hooked sharply downward at its anterior end. Pectoral with 5 rays............*dentatus* Goode and Bean, 1895*

1b. Sides with a closed loop of luminous tissue. Pectoral rays 9 to 11.

2a. Luminous loop elongate, extending posteriorly about to ventral bases, its anterior ventral portion thickened and zigzag............................*flagellibarba* Holt and Byrne, 1910.**

2b. Luminous loop nearly circular, without thickenings or zigzags..*circularis* new species.

Acknowledgements. We wish to express our gratitude to Dr. Richard H. Backus, Woods Hole Oceanographic Institution, who collected the type specimen, for his gift of the same to the Peabody Museum's Bingham Oceanographic Collection. We are also grateful to Miss Shirley Glaser for her fine drawing.

**Lamprotoxus angulifer* Beebe 1932 is a synonym.

** *Lamprotoxus paucifilis* Regan and Trewavas 1930 and *Lamprotoxus phanobrochus* Regan and Trewavas 1930 are synonyms.

Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

No. 41 Sept. 15, 1959 New Haven, Conn.

BIRDS FROM DJAILOLO, HALMAHERA[1]

By

S. DILLON RIPLEY

My wife and I had the opportunity of spending a week in the vicinity of Djailolo on the island of Halmahera from September 2 through 8, 1954, during a trip in the Moluccas sponsored partly by the Guggenheim and National Science Foundations as well as Yale University.

Djailolo was visited briefly by Alfred Russel Wallace in 1858 who remarked (1869) on the lack of original forest in the area around Sahoe, and the vast extent of heavy grass and high reeds which made bird study very difficult. We had originally intended to spend several months on Halmahera, but were prevented from doing so by a local outbreak of guerilla activity and so had to content ourselves with a short visit to the Djailolo area.

In back of the village there is a low, conical, three thousand foot mountain, Mount Djailolo, which has patches of heavy forest on its steep slopes. In addition, an experimental agricultural farm at Achango, seven kilometres by road to the north gave us an opportunity to camp in the midst of a varied environment, patches of dense scrub mixed with sago swamp,

[1] Dedicated to Professor Erwin Streseman in honor of his seventieth birthday.

cleared fields, high stands of cultivated trees such as kapok and shade trees used in the plantations of cocoa and nutmeg. Five kilometres farther along this road to the north is a small auxiliary airstrip which occasionally serves the Ternate area. Altogether in 1954 this was a far more rewarding mixture of scrub and second growth forest than one would be led to believe from Wallace's description.

Is this short time we failed to see many of the birds collected by Wallace or later visitors such as Bernstein, Heinrich, or de Haan. However, we made a small collection and a few observations which may be of interest.

Several species were seen but not collected as follows:

Sterna sumatrana, Djailolo Bay

Tadorna radjah radjah. The Radjah Shelduck was flushed out of a sago swamp at Achango, the female uttering the characteristic grunting call as they flew.

Spizaetus gurneyi. A pair of this hawk-eagle was observed on the slopes of Mount Djailolo. As the birds flew they showed a prominent mirror patch at the base of the primaries. The birds first appeared about 8:30 a.m., circling high over the heavy forest about half way up the mountain approximately 1500 feet above sea level. Their circling was purposeful, taking them ever lower down to lower altitudes, finally to the area of semi-cultivation and scrub until they were lost to view in the lowland coconut plantation.

Hornbills, *Aceros plicatus ruficollis*, were coming into breeding condition at this time although still occupying a communal roost in the kapok trees. However, display flights were common. The appearance of the Hawk-eagles seemed to drive them into a frenzy of display. Six hornbills could be seen at one time in the air, circling round and round in tight circles as the hawk-eagles flew by, banking sharply with set wings making a characteristic whirring, drumming sound.

Rallus philippensis subsp. Two rails were flushed from the paddy fields at Achango on September 8. They were close enough to spot the grayish-streaked sides, brownish-grayish back and reddish streak through the eye identifying them as the Banded Rail. Presumably they were migrants into the north Moluccas from Australia and belonged to the population *yorki*. This species has not previously been recorded from Halmahera *vide* van Bemmel (1948).

Centropus bengalensis medius. Seen in long grass at the Djailolo airstrip.

Species collected.

1.) *Accipter novaehollandiae griseogularis* (Gray)

In a backyard garden at Achango.

2.) *Ptilinopus hyogastra* (Temminck)

Often perched on telephone wires. Males were coming into breeding condition ahead of females. The first female with enlarged ovaries was taken in October on Batjan. Weight; ♂♂ 159, 169; ♀♀ 105, 162 grams.

3.) *Ducula bicolor* (Scopoli)

4.) *Reinwardtoena reinwardtsi reinwardtsi* (Temminck)

5.) *Macropygia amboinensis batchianensis* (Wallace)

♀ ovaries enlarged September 7, weight 139 grams.

6.) *Geoffroyus geoffroyi cyanicollis* (S. Müller)

Not breeding. One bird very worn. Weight ♂♂ 174, 188, ♀♀ 160, 188, 190, 222 grams.

7.) *Scythrops novaehollandiae* Latham

The Channel Bill appeared for the first time on September 2, and was seen daily flying north in small groups from two up to ten. The birds appeared to be migrating. A single male had small fruits in the stomach. Unrecorded previously from Halmahera.

8.) *Centropus goliath* Bonaparte

This coucal was heard to give two calls, a curious chuckling which sounds like a rail, and a deep low moaning roar. Local name, "Sokukud."

9.) *Otus leucospilus* (Gray)

This is a large dark owlet, larger than any of the forms of *scops* (wing of our ♂ 173 mm.), dark above and with pronounced dark central streaks on the feathers of the upper surface.

In southern Asia the typical call of *scops* may be likened to "tonk tonk ta tonk." As Heinrich (1940) has noted, this species calls entirely differently. A single male perched about thirty feet above the ground in dense shade trees at Achango called a single, rasping "kwok" at regular intervals with perhaps ten seconds between each call. The resonance and growling quality of the call sounded more like a barking deer than a bird. Weight 160 grams. Local name, "Goroko."

10.) *Ninox connivens rufostrigata* (Gray)

A female collected from a shade tree at Achango had a two-syllabled call like the yapping of a small dog, "ow-wow, ow-wow." Heinrich (1956) found this owl in the mountains in contrast to our experience.

11.) *Caprimulgus macrurus schillmölleri* Stresemann

A male in breeding condition weighed 79 grams. Call, the familiar "tock tock" of the species.

12.) *Collicalia vanikorensis moluccarum* Stresemann

A female coming into breeding condition weighed 11 grams. Another female weighed 12 grams. First record of this subspecies for Halmahera *vide* Van Bemmel (1948). One of these specimens with a wing measurement of 114 mm. seems exceedingly close to the race *waigeuensis*. The other female with a wing of 107 mm. fits closer to *moluccarum*. These specimens belong to the *vanikorensis* assemblage with uniform backs and unfeathered tarsus. Local name "putih."

13.) *Collocalia esculenta nubila*, new subspecies.

Type: ♂ ad. (Y.P.M. no. 36966), collected September 6, 1954, by S. Dillon Ripley at Achango, Djailolo, Halmahera, Indonesia.

Diagnosis: The single specimen of Glossy Swiftlet taken by me on Halmahera prompted me to examine comparative material of this species. From this it is at once apparent that the population found on Morotai, Halmahera, Ternate and Tidore differs strikingly from typical *esculenta* of Obi, Buru, the southern Moluccas, Celebes (Sulawesi) and New Guinea in being dark below, the abdomen being clouded over. The feathers of the abdomen have dark greenish or dark greenish fuscus centers with white edges only. In this character *nubila* is similar to *dodgei* of Borneo or *bagobo* or *isonota* of the Philippines. This population, however, is smaller than these, more northern forms, and also far more glossy on the back, matching typical *esculenta* in this. In addition the abdomen is even more suffused than in the Philippine races.

Wing measurements of *nubila* are; 6 ♂ 93 - 96; 3 ♀ 92 - 95; 5 sex indet. 90 - 96 mm. Weight, 1 ♂, 6 grams.

This new form is extremely interesting from a zoogeographic point of view, showing as it does a strong relationship to the populations of the southern Philippines.

I am grateful to Dr. Junge at Leyden, Professor Stresemann at Berlin and Dr. Amadon of the American Museum of Natural History in New York for the loan of specimens in their care.

14.) *Hemiprocne mystacea confirmata* Stresemann

A pair were in breeding condition in early September and weighed ♂ 76, ♀ 69 grams.

15.) *Ceyx lepidus uropygialis* (Gray)

Weight; ♂ ♂ 11 - 20 (mean 16); ♀ ♀ 17, 22, 30 grams.

16.) *Halcyon diops diops* (Temminck)

Common in cultivated areas, often on telephone wires. In addition to the character of the breast band in the female, the lack of the white neck ring and so forth, there is a pronounced weight difference between the sexes. A young male which answers to the description of the "young female" in Sharpe (1892) weighed 37 grams. Two ♂ adult weighed 43,45; ♀ ♀ ad. 65, 65 grams. Local name "Chawahiru."

17.) *Halcyon funebris* (Bonaparte)

This heavy-set dark brownish green kingfisher, while possessing a plumage pattern of spots and neck ring rather like the *chloris* assemblage has a superficial resemblance to the brightly colored *winchelli-hombroni* group of the Philippines.

18.) *Tanysiptera galatea isis* Gray

Comparison of a small series of Racquet-tailed Kingfishers from Halmahera and Batjan shows that Halmahera birds have an ultramarine crown only very narrowly bordered on the sides with cobalt which forms a superocular stripe. In the Batjan population the cobalt is much more pronounced, being broad, extending onto the crown and making a noticable nuchal ring. G. R. Gray (1860) described *isis* from "Batchian and Gilolo," a name which has been merged with *margarethae* of Heine (1859) from Batjan. I hereby restrict the type locality of *isis* to Gilolo (= Halmahera) which thereby becomes available for the Halmahera population.

A female called with a single soft mewing note. Weight ♂ 55, ♀ ♀ 64, 78 grams. Local name, "Menyalum."

19.) *Eurystomus orientalis pacificus* (Latham)
Weight ♂ ♂ 175, 182 grams.

20.) *Hirundo tahitica frontalis* Quoy and Gaimard
One, sex indet. weight 15 grams.

21.) *Artamus leucorhynchus leucopygialis* Gould
Male, weight 46 grams.

22.) *Aplonis metallica metallica* (Temminck)

Starlings were in small flocks in scrub-edge of forest areas about 650 feet above sea level. They made a series of short tinkling calls. Weight ♀ 60 grams. Local name "Hidis."

23.) *Corvus validus* Bonaparte
Local name "Bokogk."

24.) *Lycocorax pyrrhopterus pyrrhopterus* (Bonaparte)

This crow-like bird of paradise occurs from sea level to the tops of the mountain ridges. Normally the call is a very harsh rasping "tschak tschak." A pair at Achango were sitting closely side by side on a coconut palm frond. Both birds had enlarged gonads on September 7. A third bird was sitting near by. One bird, the male, was making a very deep, low "om" sound, evidently a display note. It seemed to swell up and bow slightly as it called. Local name "Siamit."

25.) *Lalage aurea* (Temminck)
A bird of open scrub; ♂ weight 32 grams.

26.) *Coracina atriceps magnirostris* (Bonaparte)
Weight ♂ 150, ♀ 128 grams.

27.) *Coracina papuensis melanolora* (Gray)
Weight ♀ 82 grams.

28.) *Hysipetes affinis chloris* (Finsch)
Specimens from Halmahera seem slightly more bronzey, less pure yellow green above and below than those from Batjan. There is no difference in size, however, and this distinction does not seem marked enough to warrant nomenclatoral recognition.

Birds were in breeding condition in September. Weight ♂♂ 38, 41, ♀♀ 41, 42 grams. Local name "Klaitua."

These bulbuls were often in small family parties of from two or three to nearly a dozen. On one occasion I found *Monarcha trivirgatus* flocking with them evidently in a mixed feeding association. They occurred in open scrub or dense forest from sea level up to nearly five thousand feet without evident altitudinal or habitat preference.

29.) *Myiagra galatea galatea* Gray
A male in breeding condition weighed 11 grams. The bill of this specimen shows no evidence of mal-formation but in form resembles typical *Monarcha* species, being laterally compressed, with little of the tumid appearance of *Myiagra*. No other specimens collected, or examined in the series in the American Museum of Natural History show this appearance, perhaps a mutant gene for bill shape approaching the related monarch flycatchers.

30.) *Monarcha trivirgatus bimaculatus* Gray
Male in breeding condition, weight 15 grams.

31.) *Nectarinia sericea auriceps* Gray
A male had enlarged gonads although a female showed no enlargement. Weight ♂ 8, ♀ 7 grams.

32.) *Melitograis gilolensis* (Bonaparte)

A male with gonads enlarged was taken in substage forest growth at 850 feet above sea level. The bird called with a single harsh rasping note. Weight 54 grams. Local name "Sotosoto."

This honeyeater was always seen as a solitary individual and seemed to show aggressive behavior. On one occasion as I have described elsewhere (1959) I saw a single bird disperse a flock of bulbuls.

33.) *Lonchura ferruginosa jagori* (von Martens)

A male with gonads slightly enlarged was taken out of a small flock in heavy weeds on the edge of a garden at Achango. Weight 13 grams. Local name "Kotolor"

Like *Hypsipetes*, *Collocalia esculenta nubila* and perhaps *Pitta maxima* and *Halcyon funebris*, the occurence of *Lonchura ferruginosa jagori* on Halmahera emphasizes the zoogeographic link between the northern Moluccan islands and the Philippine Archipelago. Although the predominant early avifaunal influence in the area can be said to have come from the Australian-New Guinea region with these islands containing the most westward extensions of the families of the Birds of Paradise and the Honeyeaters, represented in each case by endemic genera, still the importance of the Philippines should not be underemphasized. It is instructive in this regard to be in Halmahera during the migration as we were, and to note the arrival daily of such species as the warblers, *Phylloscopus* and *Locustella*, the flycatchers, swallows, and the others, so many of which have obviously come directly from the islands to the northwest on passage. These connections can only have been adventitious, over water, but the route is there ready to hand.

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CHARACTER DISPLACEMENT IN INDIAN NUTHATCHES (*Sitta*).

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Is connection with work on the birds of India, I have had occasion to arrange the various nuthatches of the genus *Sitta* occuring in India in a purely linear listing suitable for a check-list. Arrangement of this sort at once reveals that far more is at stake than a mere listing can indicate. Some aspects of the problem are given in the recent comprehensive treatise by Voous and Van Marle (1953) who have attempted to recreate the distributional history of the several species of *Sitta* of Southeast Asia.

It is quite clear from a study of these nuthatches that several species are involved, that they are all closely related and that they tend to replace each other. However, where these species are sympatric they show character displacement as well as a degree of niche specificity, thus a tendency to special adaptations as discussed by Brown (1958). That closely related species of nuthatches exhibit this type of speciation allowing geographical overlap and ecological specificity has been well illustrated by Vaurie (1950, 1951) in his two papers on *Sitta neumayer* and *S. tephronota* of west central Asia. These two species of Rock Nuthatches are admitted to be most closely related to each other. Voous and Van Marle (*ibid*: 54) feel that the Rock Nuthatches are in addition a central Asian offspring of the common European Tree Nuthatch adapted to a xeric environment. That these forms could have split off from the tree-inhabiting nuthatch at opposite geographically isolated ends of two glacial refugia in the southeastern Mediterranean and central Asia respectively seems conceivable. At a later stage the two populations, almost indistinguishable morphologically and with similar habits and ecological requirements, having spread into contiguous areas have evolved adaptively so that both can coexist in the same range without hybridization. Morphologically the two species differ in the area of overlap by a significant change in bill size. Whereas isolated populations at the ends of the range have similar bills, the overlap populations differ greatly, the Asian *tephronota* possessing a large bill, the Mediterranean *neumayer* a relatively small bill. In addition whereas both species possess a black facial stripe of equivalent size and length, running from the base of the bill through the eye and back to the nape, the overlap populations differ greatly, the eye stripe in Asian *tephronota* being much enlarged and prolonged farther backwards, that of the Mediterranean *neumayer* being greatly reduced to a strip between bill and eye passing backwards to just above the auricular region. Thus two species which are virtually sibling species have developed prominent recognition marks and adaptations for food gathering sufficient to prevent interbreeding and reduce competition.

That competition is a factor seems inevitable from what is known of the habits of these species, both living in xeric areas of cliffs, rocks and low stunted trees. Both occur in the same areas and have been collected together at the same altitude. This biotope would appear to be homogeneously diverse to use Hutchinson's term (1957) and would confirm his supposition that in stable homogeneously diverse biotopes the abundances of different species are arranged as if the realized niches were non-overlapping.

A different series of constants are involved in the Himalayan ranges of India and Pakistan. From the lowlands to the heights of 15,000 feet above sea level, a number of biotopes occur which are essentially heterogeneously diverse, woodland of different types ranging from cultivation and tropical thorn scrub to tropical, subtropical, pine, temperate and alpine forest. The following species of *Sitta* may be listed, giving such ecological details as are known:

Species	*Habitat Preference*	*Altitudinal Range*
1) *Sitta castanea castanea*	mango groves, orchards, cultivation, tropical deciduous forest	lowlands to 3,500 feet in central India; lowlands to foothills 1,000 ft. in Himalayas
Sitta castanea neglecta	tropical lowland forest, also scrub and cultivation	lowlands to 2,500 ft.
Sitta castanea cinnamoventris	masonry walls, gardens, bamboo clumps, scrub, sub-tropical forest	edge of the plains (winter) to 4,500 ft.
Sitta castanea cashmirensis	mixed forests at all levels, lower parts of trees	4,500-11,500 ft.
2) *Sitta europaea,* various subspecies	mixed forests at all levels	4,500-8,500 ft.
Sitta europaea montium	mixed alpine and fir forests	4,500-12,000 ft.
3) *Sitta himalayensis,* various subspecies	heavy mixed forests, usually deciduous, strong preference for oaks; may descend to undergrowth	5,000-10,000 ft.
4) *Sitta leucopsis*	almost exclusively upper parts of trees in fir and pine forest	7,000-12,000 ft.
5) *Sitta victoriae*	alpine forest, avoids pines	7,500-9,200 ft.
6) *Sitta yunnanensis*	barren fir forest association	9,000-15,000 ft.

As pointed out by Voous and Van Marle (ibid:59-61) all these species are roughly similar in size and close to each other in pattern. Some wing and bill measurements can indicate relative size:

	bill (mean length m.m.)	Wing (mean m.m.)
1) *castanea castanea*	19.1	75.5
" *neglecta*	19.8	79.9
" *cinnamoventris*	23.2	83.7
" *cashmirensis*	21.8	85.2
2) *europaea*, various subspecies	18.8	78.6
" *nagaensis*	19.1	78.2
" *montium*	19.1	80.2
3) *himalayensis himalayensis*	15.9	72.3
" *australis*	16.6	73.6
4) *leucopsis leucopsis*	21.6	79.2
" *przewalskii*	17	75.1
5) *victoriae*	14.5	70.2
6) *yunnanensis*	17	73

Status of Sitta castanea

Sitta castanea with its various allopatric subspecies has often been listed as part of the common Palaearctic Tree Nuthatch species, *Sitta europaea*. It is obvious that it is most closely related to *Sitta europaea* and it satisfies a taxonomist's criterion by being strictly allopatric, both geographically and ecologically. However, *Sitta castanea* differs from *europaea* by having pronounced sexual dimorphism and a strikingly different color pattern on the under surface of the males. Its distribution throughout the Gangetic plain and hills of the Indian Peninsula, with the development of a distinct subspecies in the Eastern Ghats, gives strong evidence for a long colonization similar to that of some of the double invasions and relict forms discussed by me previously (1949). I feel that it belongs to an early break-off of *europaea* stock, separated from that species in time and by the imposition of two other old Palearctic invasions into the Himalayan chain, the earliest *Sitta leucopsis*, the second *Sitta himalayensis*. *Contra* Voous and Van Marle (*ibid*:53, 55) I believe that the hill populations of *castanea*, namely *cashmirensis, almorae, cinnamoventris* and *tonkinensis,* which are all larger in measurements than the lowland populations, *castanea* and *neglecta* (see measurements) have developed from the older lowland stock which has been able to capture and exploit vacant niche space in the adjacent hills in post-pluvial times. That this has been done more than once is shown by the isolated eastern, Indochinese population of *tonkinensis* which has developed a highland form in the same way that the western forms have evolved.

Sitta leucopsis and *Sitta himalayensis*

I would have listed these in my zoogeographic study of the Indian avifauna (1959) except that by ranging into the Indochinese and Chinese subregions, these species did not fit my criteria for such a listing. However, I would include them here along with species I did list (*ibid*:79) such as *Zoothera wardi, Parus melanolophus, Sitta formosa* and *Pyrrhula erythrocephala* and *P. aurantiaca* as Palaearctic relicts.

Sitta victoriae

From the list of measurements it will be noted that this isolated species, confined to the summits of the Chin Hills, Mount Victoria, of western Burma, is relatively small in size. It has been listed in the past as a sub-species of *S. himalayensis,* indicating obvious affinity, (Voous and Van Marle, *ibid*: 58) but they as well as other authors have overlooked the fact that *himalayensis* has been taken on the same mountain.

A view of a map should prove instructive here. Surveying the Himalayan chain from Kashmir east to Sikang and northern Indochina, I have indicated the zones of ecological overlap between the species under discussion. Although the ranges overlap geographically, it can be seen that there is very little overlap among these species:

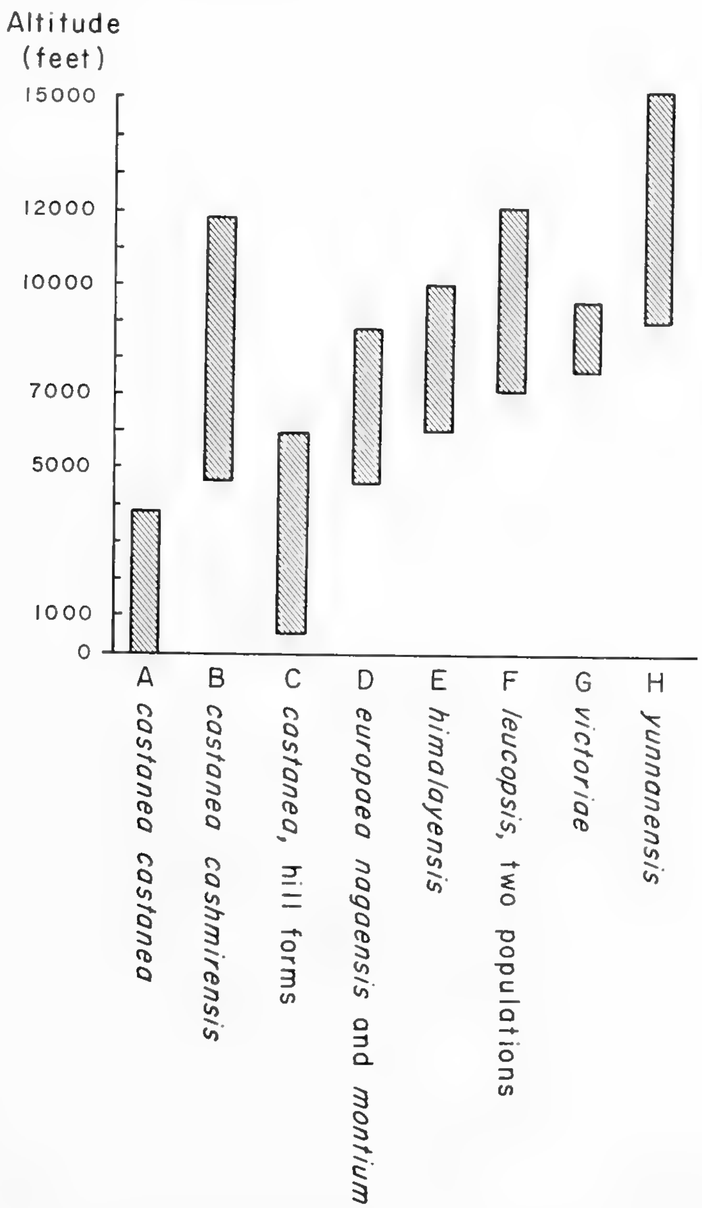

Figure 1. Altitudinal Ranges of Species and subspecies of *Sitta.*

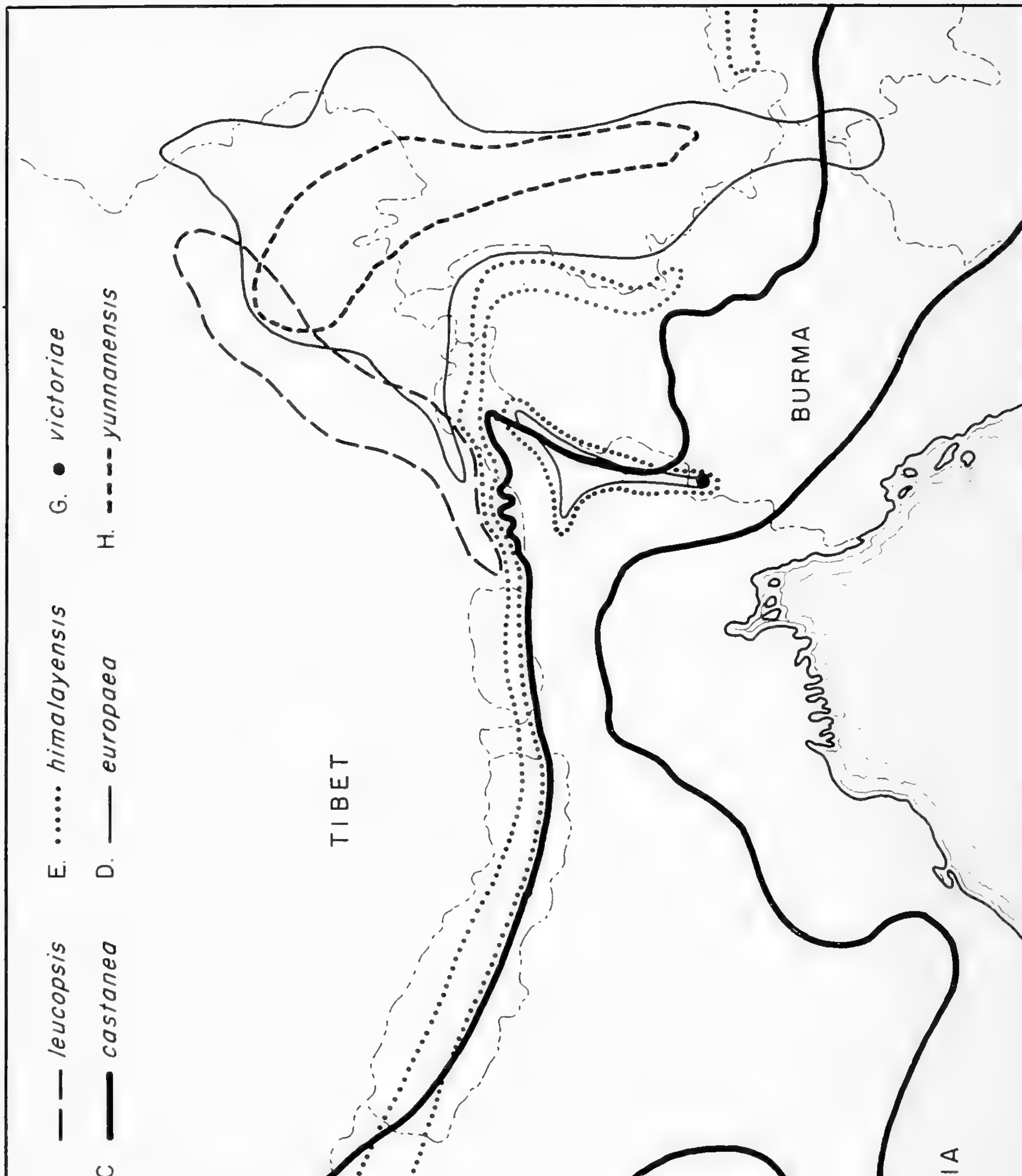

Figure 2. Map showing geographical orientation of species of *Sitta*.

From the above it can be seen that there are only a few cases of overlap which need to be explained. Among the subspecies of *castanea* there is no overlap. The apparent range overlap is due to wintering birds of the montane subspecies descending into the range of the lowland form out of the breeding season. In addition A, B and C are allopatric with E, G, and H. The following range overlaps then need some word of explanation.

1. In Kashmir and adjacent areas of West Pakistan and eastern Afghanistan, *Sitta castanea cashmirensis* overlaps with *S. l. leucopsis* but is ecologically separated, the latter prefering the upper branches of firs and pines, the former the lower branches of mixed deciduous and evergreen hardwoods. These two species then occur within the mosaic elements of a heterogeneously diverse biotope. There is no competition, hence no character displacement.

2. In eastern Assam in the hills south of the Brahmaputra River, although *castanea* has a separate population, *koelzi*, it is allopatric with *europaea*, the latter not occuring below 4,500 feet, the former being a lowland and submontane form up to 4,500 feet. However, a population of *himalayensis* overlaps with *europaea* in these hills and occupies the same altitudinal range and much the same biotope. Both inhabit mixed forest. The only known ecological difference is the preference of *himalyensis* for oaks, rhododendrons, and lower areas of trees. Evidently a degree of interspecific competition exists here. In the contact area both have evolved recognizable distinct populations showing character displacement. The character displacement follows the same general pattern as in the case of the Rock nuthatches. (See Fig. 3, Page 8)

As the figure indicates, the overlap population of *europaea*, called *nagaensis*, has become very pale on the under surface with a slimmer bill and a pronounced facial stripe. The overlap population of *himalayensis*, called *australis*, has become richer buff on the under surface with a stouter bill and a shorter facial stripe. Thus morphological differences emphasizing both feeding habits and recognition are involved in this interspecific situation. That characters having recognition

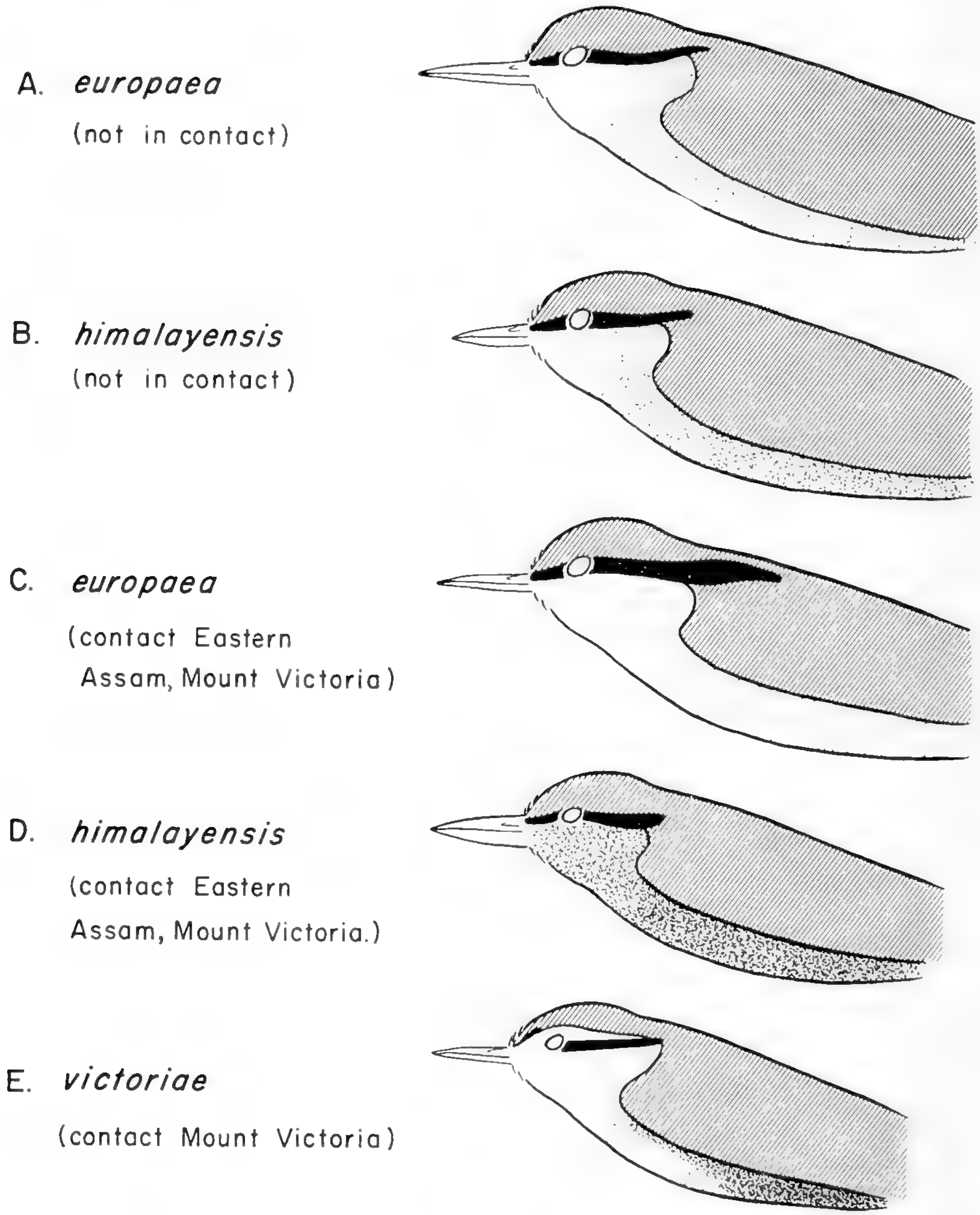

Figure 3. Outline sketch to show differences between sympatric populations of species of *Sitta* (C., D., E.) compared to two populations not in contact (A., B.).

value are developed even between these two fairly distinct species would imply that selection pressure towards plumage pattern differences is heavy. In a similar way North American warblers have evolved marked phenotypic differences as well as behavioral and food gathering adaptations as discussed by Mac Arthur (1958).

On Mount Victoria south of the Assam Hills, a third sympatric species is introduced, *Sitta victoriae.* This species with a range of 7,500-9,200 feet overlaps altitudinally on the mountain stopes with *europaea*, which reaches 8,500 feet, and with *himalayensis*, with which it is assumed to be most closely related, which also reaches 9,200 feet. It would appear from a biogeographical point of view that *victoriae* is an old relict species, first to arrive of a double invasion by *himalayensis* stock. It has a known ecological preference for alpine forest and avoids pines. *Himalayensis* also avoids pines and co-occurs with *victoriae* in mixed and alpine forest. *Europaea* may occur in alpine as well as mixed forest. In this case *europaea* and *himalayensis* have a wide range in eastern Assam of co-occurence and their morphological characters have been described. The third species *victoriae* differs by being noticably smaller with a more weak and slender bill and different facial pattern.

3. Eastwards in Tibet, Burma, Thailand, Indochina and Yunnan there is little actual overlap. Wherever *europaea* has invaded the mountains of southeast Asia, *castanea* keeps at lower altitudes. In the single instance where *castanea* invades the mountains, *europaea* is absent. *Himalayensis* occurs at predominantly higher altitudes.

4. The single instance of co-occurence is in the case of three species in Sikang or eastern Tibet. Here are found a population of *europaea*, one of *leucopsis*, and *Sitta yunnanensis. Leucopsis* has developed rich bright color on the underparts in contrast to the population of *leucopsis* found in the Himalayas. The population of *europaea*, known as *montium* is intermediate in color of underparts, while the palest of the three is *yunnanensis. Leucopsis* lacks an eye stripe, possessed by the other two of differing lengths, longer in *europaea*, and has a short bill, the shortest of the three. In this instance *yunnanensis* has a relatively long needlelike bill, and *europaea* an intermediate, stouter bill. From the table of measurements it will be seen that *europaea montium* differs from other populations of the species by being larger with a larger bill, thus showing character displacement in the presence of the other two species. Schäfer (1938) reports that *europaea* and *yun-*

nanensis were found together, although the latter was found only in rather barren, fir forest. He found *leucopsis* less often, in more open parkland. In the presence of *yunnanensis* the population of *europaea* found with it appears to have developed a shorter, stouter bill, larger size, and a longer eye stripe, as well as somewhat more richly colored underparts, all tending towards character displacement. Even *leucopsis*, not apparently in close competition, would appear to have been affected, so markedly does it differ from the other population of the species.

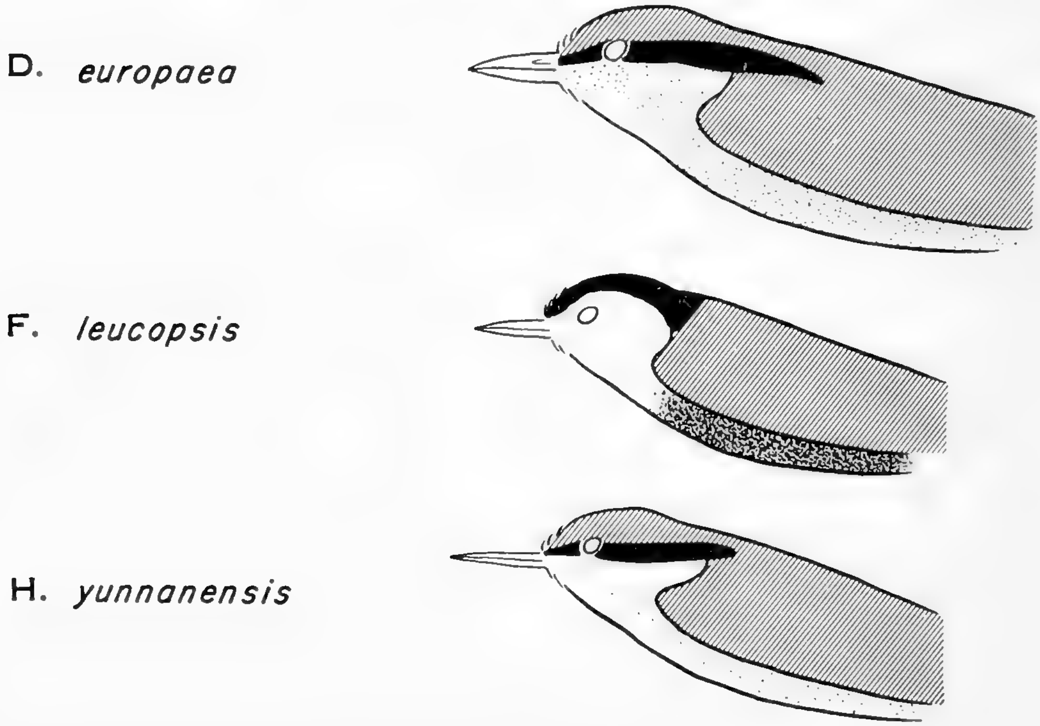

Figure 4. Outline sketch showing differences between sympatric populations of three species of *Sitta* located on the map, Fig. 2.

Summary

Character displacement including external features of recognition value has been shown to occur among nuthatches in the heterogeneously diverse biotope of the mountains of the eastern Himalayan chain. Species of nuthatches which are allopatric elsewhere, replacing each other at various altitudes or in differing forest associations, here come together and dem-

onstrate adaptive characters indicating the presence of interspecific competition, and a lessened degree of niche specificity. As would be anticipated, the biotope of the eastern Himalayas appears to be more rich, more diverse, capable in at least two cases of supporting a greater number of potentially competing species. The more boreal biotope in the western Himalayas exhibits an expected mosaic pattern of distribution of potentially competing species. This pattern with the phenomenon of character displacement would seem to agree with the niche model postulated by Hutchinson and Mac Arthur (1959).

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Postilla

YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 43 January 4, 1960 New Haven, Conn.

TWO NEW BIRDS FROM ANGOLA

S. DILLON RIPLEY

During the course of his first collecting trip for the Peabody Museum in Angola, Mr. Gerd Heinrich secured two interesting new birds in Malange District in the northeast of that fascinating Country. The Museum is most grateful to the Department of Overseas of the Government of Portugal, the Government officials in Luanda and the officials of the Diamond Company who aided Mr. and Mrs. Heinrich unstintingly during their expedition.

Psalidoprocne albiceps suffusa, new subspecies.

Type: ♂ ad. (Y.P.M. no. 46454), collected January 6, 1958, by Gerd Heinrich 15 kilometres southwest of Cacolo, Malange Dist. Angola.

Diagnosis: Two males taken at this locality differ from *albiceps* by having the under wing coverts and axillaries pale creamy grayish-brown rather than brown. The ear coverts also are grayish rather than deep brown, or mixed brown and white. The two specimens have dark grayish rather than white throats, although this may represent a plumage succession stage. In addition the white crown is much reduced, confined to a small white cap. Comparison of these birds with the series in the American Museum of Natural History fails to reveal any correlation with various stages of immature plumage in the species. I am indebted to the authorities of the Museum in New York, as well as to Mrs. B. P. Hall of the British Museum (Natural History) for cooperation in comparing these birds with specimens in their care.

Measurements: 2 ♂ ♂, wing 101,102; tail 68, 70.5; culmen (from skull) 7, 7mm.

Remarks: These two males are coming into breeding condition with slightly enlarged testes. They were taken in a clearing in savannah and gallery forest at 1400 metres altitude asl., and represent an apparently new record for Angola as well as a range extension westward for the species of several hundred miles from the southeastern Belgian Congo.

Nectarinia sororia, new species.

Type: ♀ ad. (Y.P.M. no. 46455), collected November 7, 1957, by Gerd Heinrich 42 kilometres northeast of Duque de Bragança, Malange Dist., Angola.

Diagnosis: From *Nectarinia verticalis* this species differs in the only specimens known, both adult females, by lacking the brilliant green metallic cap, which is replaced with soft, dark brownish-gray, the edges of the feathers having a faint light greenish metallic iridescence. In addition the underparts are darker, dark grayish olive, rather than grayish olive with a faint vinaceous tinge as in *verticalis*. On the upper parts the specimens are otherwise similar to *verticalis*, although perhaps a trifle brighter, more yellowish olive. Finally in proportions these specimens vary distinctly from females of *verticalis cyanocephala* taken in the same area;

	wing	tail	bill (from skull)	wing/bill index
sororia	64.5, 65.5	45, 46	21.5, 23mm.	33, 35%
verticalis cyanocephala ...	60, 60.5	40, 42	25, 26	41, 43%

Thus in body size these specimens are larger but the bill is noticeably shorter. In a series of females of *verticalis*, both *cyanocephala* and *viridisplendens*, in the American Museum collection, individual wing measurements reach 65, but such specimens possess correspondingly long bill measurements up to 28mm. The wing/bill index brings this difference out rather forcibly.

Remarks: Both females of this new species are adult with completely ossified skulls according to Mr. Heinrich who noted the difference in the head plumage pattern in the field and first drew my attention to the specimens. These two birds were taken at Duque de Bragança and Cacolo nearly seven hundred miles apart, both at an altitude of 1400 metres and in gallery forest. I should hesitate to describe a new species of sunbird on females alone were it not for the interest biologically of the different bill ratio. Evidently this sibling form can co-occur ecologically, in a competitive situation with a virtually identical sister species. It will be interesting to discover the plumage of the males, which may perhaps be similarly reduced in brightness.

Range: Known only from 42 kilometres northeast of Duque de Bragança and from 15 kilometres southwest of Cacolo, Malange District, Northeast Angola.

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YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 44 February 15, 1960 New Haven, Conn.

SINOPA FROM THE CUCHARA FORMATION OF COLORADO

by PETER ROBINSON

Peabody Museum, Yale University

In June of 1958 the writer collected a fragment of a skull of *Sinopa* cf. *vulpecula* Matthew from the Cuchara formation near La Veta, Huerfano County, Colorado. Only two other fossil mammals are known to have been collected from the Cuchara formation: one of these is lost (letter from R. C. Hills to Walter Granger, dated December 7, 1916, in the files of the American Museum of Natural History); the other specimen is misplaced. The lost specimen was a P^3 of *Phenacodus intermedius* (letter from Walter Granger to R. C. Hills, dated November 23, 1916) and the misplaced specimen is a lower jaw of *Hyracotherium* (=Eohippus). Granger did not determine the species of the *Hyracotherium* specimen. Both *Hyracotherium* and *Phenacodus intermedius* are found throughout the early Eocene.

The *Sinopa* specimen, Yale Peabody Museum (YPM) No. 16460, is from the lower part of the Cuchara formation, probably less than 1000 feet above its base. The Cuchara formation is approximately 5000 feet thick in the La Veta area (Johnson 1958 p. 565). The exact locality is shown on aerial photograph No. CL22-30, of the 1:20,000 series flown by the Forest Service in 1937. Using the coordinate system described by Olson (1948 p. 189), the locality is placed on the photograph at 1.22-4.74 starting from the lower left hand collimating mark. This exposure is in SW¼ S19 T29S R67W approximately four miles east of La Veta.

Order CARNIVORA
Suborder CREODONTA
Family Hyaenodontidae
Sinopa cf. *vulpecula* Matthew 1915

YPM No. 16460 is most similar to *Sinopa vulpecula* Matthew. The specimen consists of the orbital region of the skull with parts of P^4-M^3 of both sides preserved. M^1 is slightly smaller than referred specimens of *S. vulpecula* in the American Museum of Natural History. P^4 and M^2 agree well with the referred specimens. The M^2 possesses a lingual cingulum; the lingual portion of M^1 is missing. M^3 had a metacone, but it is broken off. The presence of a metacone on M^3 and the lingual cingulum on M^2 show that this specimen is not referrable to *Tritemnodon*. The buccal portion of M^3 overlaps the metastyle of M^2; how much of the present condition is due to post-mortem crushing is not certain.

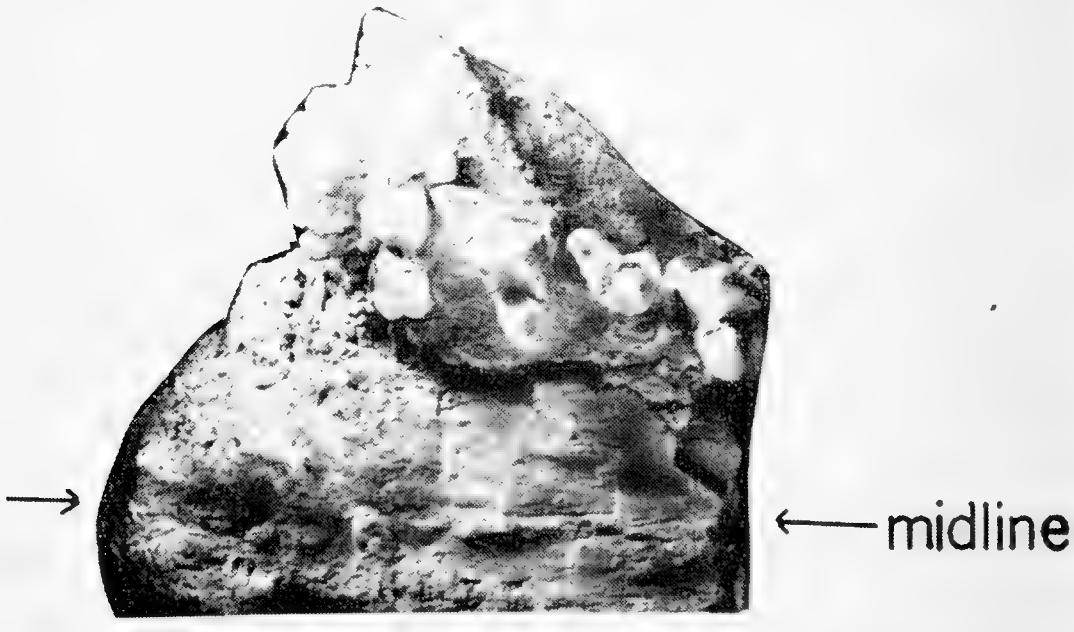

Figure 1. *Sinopa* cf. *vulpecula* Matthew, YPM No. 16460, from the Cuchara formation, Huerfano County, Colorado. Palatal view of the right side of skull fragment with P^4-M^3 present. Magnification 2X linear.

The buccal lengths of teeth of YPM No. 16460 are:

left P^4	left M^1	right M^1	right M^2
6.3mm	5.3mm	5.1mm	6.8mm

The type specimen of *S. vulpecula* came from the Lost Cabin level of the Bighorn Basin (Matthew 1919 p. 80). Referred specimens are found as low as the upper Grey Bull level of the same basin (Matthew 1915 p. 80). Gazin (1952 p. 53) referred a specimen from the La Barge fauna of the Knight formation to this species. Gazin correlates the La Barge fauna with the type Lost Cabin of the Wind River Basin (Gazin 1952 p. 10). Therefore known specimens of *S. vulpecula* occur through the upper half of the lower Eocene rocks of Wyoming. The possibility that the species occurs also at earlier levels is good since specimens referrable to it are rare and coeval species of *Sinopa* (*S. strenua* and *S. multicuspis*, Matthew 1915 p. 74,80) occur throughout the lower Eocene. The presence of *Sinopa* cf. *vulpecula* in the lower beds of the Cuchara formation indicates an early Eocene age for the beds from which the specimen came, and perhaps a late early Eocene age. The occurrence of *Hyracotherium* and *Phenacodus* supports this age determination; the locality(ies) of these specimens is(are)not known. Recent work by Johnson (1958 p. 565) cites a probable early Eocene age based on stratigraphic position.

The Cuchara formation can, by inference from its thickness, include beds of middle Eocene and perhaps younger rocks. The writer is currently describing the fauna of the Huerfano formation; he believes that the Cuchara and Huerfano formations are in general correlative. However, detailed discussion of this will appear later.

The writer wishes to thank Dr. E. H. Colbert of the American Museum of Natural History for allowing him to study the *Sinopa* material and for allowing him to refer to the correspondence of Walter Granger and R. C. Hills. Mrs. Rachel H. Nichols of the same institution kindly helped locate specimens and correspondence. Dr. Joseph T. Gregory of Peabody Museum graciously criticized the manuscript.

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YALE PEABODY MUSEUM

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Number 45 February 15, 1960 New Haven, Conn.

NOTES ON THE EMBRYOLOGY AND EVOLUTION OF THE MEGAPODES (AVES: GALLIFORMES)

By GEORGE A. CLARK, JR.
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Members of the family Megapodiidae of Australia and the Pacific Islands incubate their eggs artificially using such heat sources as fermentation, volcanic activity, or the sun. The available data suggest that young megapodes receive almost no parental care. Young birds are exceedingly precocious, being able to fly on the day of hatching and feeding actively only a few days after hatching.

Portmann (1938, 1951, 1955) has listed as reptile-like the following characters of megapodes: no egg tooth at hatching, lack of down feathers in embryos or nestlings, lack of parental care, primitive method of incubation (by solar heat), long incubation period (8 weeks for *Leipoa*; Frith, 1956), large number of eggs laid, slow growth to adult size (especially for *Alectura*), primitive structure of the brain. These features have been interpreted as showing that the megapode method of reproduction has evolved directly from that of reptilian ancestors.

Contrary to this idea, Pycraft (1900, 1907, 1910) thought that the megapode reproductive adaptation had evolved from a more typical galliform reproductive pattern (see Fig. 1).

THE EGG TOOTH

In several embryos of *Talegalla jobiensis* a white spot on the anterior end of the upper jaw is in the same relative position as the egg tooth in a chick embryo (*Gallus domesticus*) shortly before hatching (see Fig. 2). The egg tooth is not so conspicuous in older *Talegalla* embryos. In *Megapodius pritchardii* an egg tooth is not apparent shortly before hatching (Friedmann, 1931). Megapodes hatch by kicking their way out of the shell (Campbell, 1903). The vestigial egg tooth indicates that the megapodes have evolved from birds which hatched relatively earlier in ontogeny. An analogous example of a vestigial character of phylogenetic significance is the egg tooth found in embryos of certain marsupials (Hill and de Beer, 1950).

THE LABIAL GROOVE

The labial groove of the upper jaw is conspicuous in the *Talegalla* embryo with the most prominent egg tooth (see Fig. 2). This groove was not found in somewhat older *Talegalla*

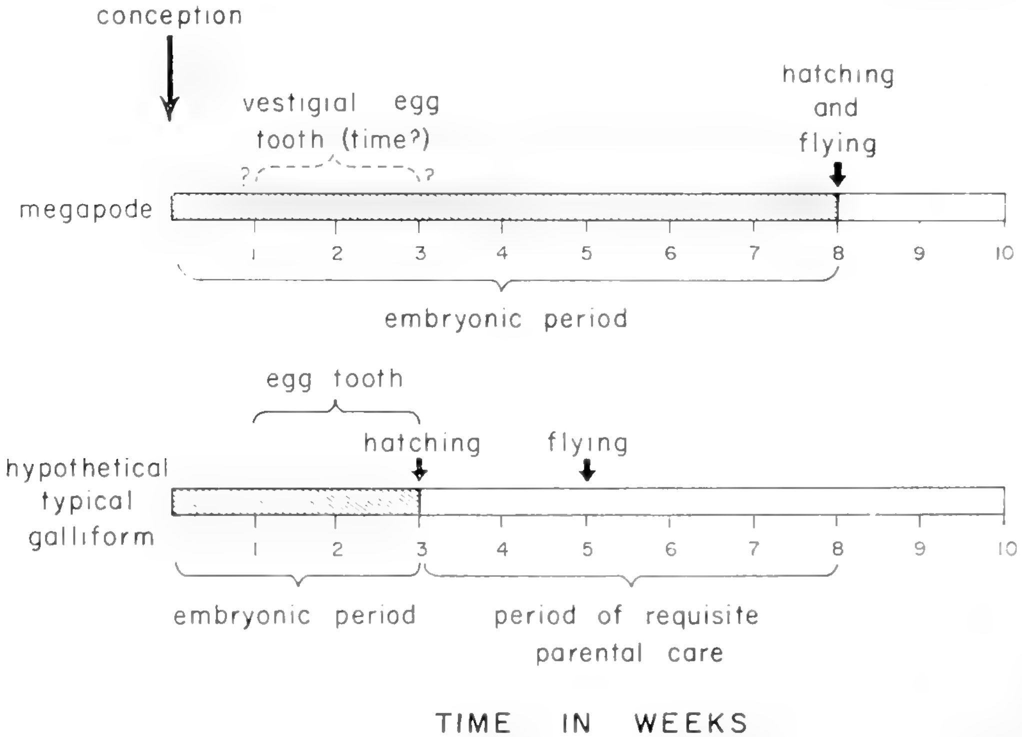

Figure 1. Diagram of the hypothesized morphological and behavioral development of the megapode compared with that of more typical gallinaceous birds.

embryos. According to Hamilton (1952: 375), the remnants of the labial groove are shed on the nineteenth day of incubation in the chicken.

EARLY PLUMAGE SEQUENCES

The newly hatched megapode bears primarily pennaceous feathers in contrast to the "downy plumage" of more typical gallinaceous birds at hatching. Studer (1877, 1878, 1889) reported finding down feathers at the tips of the pennaceous feathers in *Megapodius* embryos. Both pennaceous feathers and down were ensheathed. Studer believed that the down feathers were lost before hatching. Blaszyk (1935) thought that what Studer had termed a down feather was merely the result of making a section through the distal end of an ensheathed pennaceous feather. Blaszyk (1935) and Becker (1959) found no traces of embryonic down feathers in *Megapodius.* Neither Blaszyk (1935) nor Becker (1959) commented on a study by

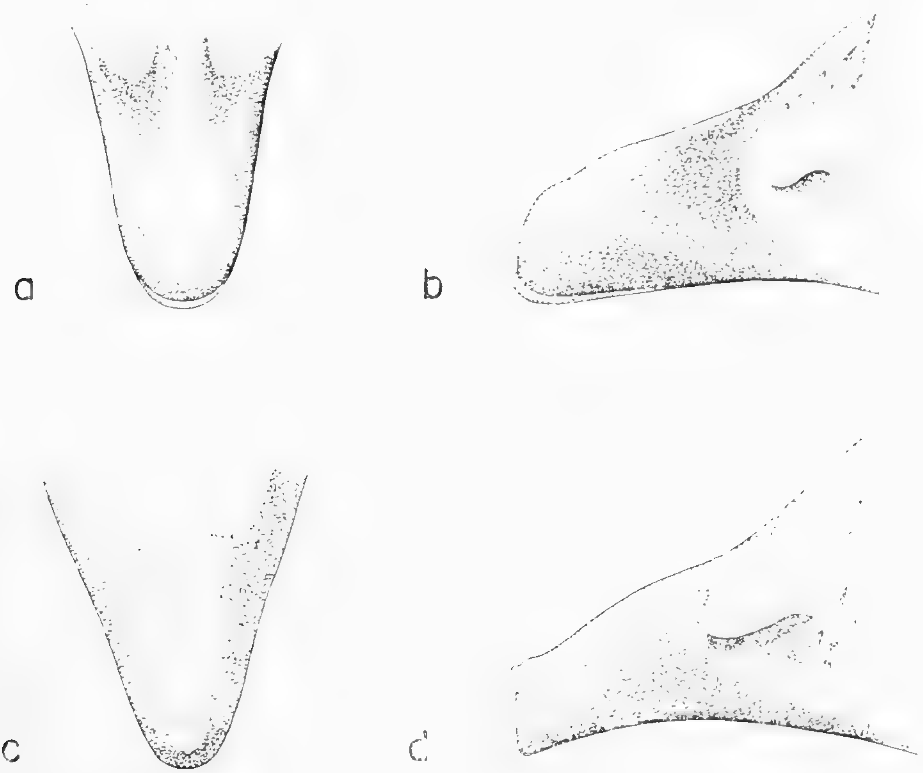

Figure 2. *a.* Dorsal view of the upper jaw of a *Talegalla* embryo; note the vestigial egg tooth. *b.* Lateral view of the upper jaw of the same *Talegalla* embryo; note the labial groove. *c.* and *d.* Dorsal and lateral aspects of the upper jaw of a chicken at the time of hatching.

Pycraft (1900), who had reported finding down-like rudiments on the tips of the first pennaceous feathers in *Megapodius* embryos. I have made a preliminary examination of embryonic *Talegalla* feathers and have found evidence that Pycraft's account is fundamentally correct.

Both the five week old pheasant (*Phasianus colchicus*; Westerskov, 1957: 20) and the newly hatched megapode bear predominantly juvenal plumage. Thus at roughly 8 weeks postconception the megapode and typical gallinaceous birds appear to reach similar levels of plumage development. Wallace (1860) commented that the newly hatched megapode behaves about as maturely as a chicken at one month posthatching.

SPECIAL EMBRYONIC ADAPTATIONS

Correlated with the prolongation of the prehatching period, certain embryonic adaptations are present in the megapodes. Meyer (1930: 5) reported that in *Megapodius* yolk weight was about 60% of total egg weight in boiled eggs; this was compared with a figure from the literature of 30% for *Gallus domesticus*.

Megapode eggs are usually incubated with the small end pointed downward. Bellchambers (1921) thought that this aided the escape of the newly hatched bird from the mound. Umanski (1926) reported on the effects of placing incubating chicken eggs on end. The proportion of teratological effects was greater in eggs placed with the blunt end down than in ones with the pointed end beneath. Normally when the chicken egg lies horizontally, the early embryo lies in a horizontal plane. Umanski suggested that the teratological forms found in eggs placed upright might result from the failure of the blastoderm and early embryo to reach a horizontal plane.

Experiments (Marshall, 1939) have shown a failure in hatching success in chicken eggs unturned during incubation. Megapode eggs usually are not turned and yet hatch relatively successfully. Marshall (1939) concluded that there must be anatomical and/or physiological differences between megapodes and the domestic fowl with respect to turning.

One of the presumed embryonic adaptations related to the long embryonic period of the megapodes is a general lack of coordinated movement of the embryo until shortly before hatching. It is obvious that a megapode at six weeks postconception (about two weeks prehatching) would not be so active as a chicken six weeks postconception (three weeks posthatching). I suggest that a physiological barrier prevents extensive coordinated behavioral activity of the megapode embryo during the latter part of the prehatching period. It would be profitable, perhaps, to examine the cholinergic system in the megapode embryo (Boell, 1955: 547).

In species using fermentation as a heat source for incubation the presence of aerobic bacteria should presumably greatly deplete the available oxygen supply. It has been suggested that one of the functions of mound regulation in such species is to provide oxygen for the embryos which would otherwise be under anaerobic conditions (Meyer and Stresemann, 1928: 68; Mayr, 1930: 105-106). *Megapodius* apparently does not open the mound during temperature regulation (Frith, 1959: 57). It would be of considerable interest for studies of developmental metabolism if megapodes were found to have an extended period of embryonic anaerobic respiration (Boell, 1955: 522-523).

Further studies on the egg tooth, plumage development, and other aspects of megapode embryology and anatomy are currently in progress at this laboratory.

ACKNOWLEDGEMENTS

Dr. Renate Becker, Mr. H. J. Frith, and Dr. K. Westerskov have kindly given useful references. I am grateful to Mr. H. J. Frith, Dr. J. P. Trinkaus, Dr. E. J. Boell, Prof. G. E. Hutchinson, and Dr. S. D. Ripley for helpful discussion of the problem. I wish especially to thank Dr. Philip S. Humphrey for initially suggesting this study and for his most valuable suggestions and comments. I am greatly appreciative of the extended efforts of Dr. E. T. Gilliard, who collected for the Yale Peabody Museum of Natural History a number of embryos of *Talegalla* during his recent expedition to New Guinea. Miss Shirley Glaser has generously given of her time in preparation of the figures. The studies reported here were conducted

using the facilities of the Department of Zoology and Peabody Museum of Yale University.

SUMMARY

A vestigial egg tooth in embryos of *Talegalla* is strong evidence that megapodes have evolved from gallinaceous birds which hatched relatively earlier in ontogeny. It is hypothesized that much of the maturation which occurs during the post-hatching development of typical gallinaceous birds occurs before hatching in megapodes. The vestigial egg tooth, the labial groove of the upper jaw, and vestiges of down feathers plus the state of plumage development and behavior in newly hatched megapodes support this hypothesis. Some speculations on possible unusual embryonic adaptations are presented.

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YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 46 June 30, 1960 New Haven, Conn.

FOSSIL AMPHIBIANS FROM QUARRY NINE

by

MAX K. HECHT[1] AND RICHARD ESTES[2]

The original intention of this investigation was to determine the identity of *Eobatrachus agilis* Marsh. It was soon evident to us, as to other workers, that the type materials represented more than one species. Fragments referred to this form by Moodie (1912, 1914) represent an ilium of a reptile, a femur of a salamander, an unidentifiable fragment of a tibiofibula of a frog and two distinctly different types of frog humeri. Unavailable to us at this time are the vertebra and urostyle illustrated but not discussed by Moodie (1914). Marsh (1887) described this form in the following words: "More recently, various bones of small, anourous amphibians (*Eobatrachus agilis*) have been found, the first detected in any Mesozoic formation." Moodie (1912) described Marsh's material and selected the larger humerus as the type (Yale Peabody Museum no. 1862). He stated that the elements represented a form close to *Bufo* and later (1914) actually placed it in the Bufonidae. Simpson (1926 a and b) merely records the presence of a modern frog in the fauna.[3] The importance of these specimens is that the frog remains are among the oldest known and the salamander is the earliest record of that group. Appli-

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[3] Reig (1957) for unknown reasons referred *Eobatrachus* to the Discoglossidae.

cation of names to such fragmentary material is in part a matter of taste, but the antiquity of the material and its close correspondence to modern forms make it useful to place the material within the established system of classification.

The senior author is responsible for the sections dealing with anurans; the junior author for the remainder of the specimens.

Class Amphibia
Superorder Salientia
Order Anura
Suborder Aglossa?
Family *incertae sedis*
Eobatrachus agilis Marsh

Plate 1, figs. 1, 3, 5

Holotype: Yale Peabody Museum no. 1862, the distal portion of a humerus.

Locality: Quarry 9, Como Bluff, Wyoming.

Diagnosis: Distinguished from all known frog humeri by the following combination of characters: A) base of the shaft of the humerus perpendicular to the main axis of the humeral ball (*eminentia capitata* of Gaupp, 1894, henceforth referred to as the ball), B) a deep triangular fossa present (*fossa cubitus ventralis*) at the upper end of the ball, C) the ball a fully developed spherical articulating surface which is proportionately large in size, D) a small olecranon scar which is nearly triangular in form but with its apex nearest the lateral border of the humerus, E) weakly developed epicondyles, the medial epicondyle larger than the lateral epicondyle but reduced in size as compared to other frogs, F) narrowest cross-section (or neck) of the humerus is just above the ball.

Description: A broken distal portion of a right frog humerus measuring 6 mm. in length. On its distal portion is a completely rounded but abraded ball, with a diameter of 2 mm. The medial epicondyle is a small slightly abraded nubbin medial to the ball. On the opposite side of the lateral epicondyle is a slight ridge with no evident rise or mound. From the two epicondyles, two distinct ridges run proximally on the main shaft of the humerus. Lying between the two ridges is a distinct fossa (*fossa cubitus ventralis*) which is roughly triangular. The base of the triangular pit is formed by the ball and its deepest area is on the medial side above the ball. It gradually becomes shallower both proximally and laterally. The apex of the triangular fossa is rounded and lies midway between the two epicondyles. The lateral surface of the medial epicondyle forms a weak flange which projects slightly medially. The olecranon scar, on the posterior surface of the ball, is a small triangular area whose apex is the same height as the ball and lies miday between the two epicondyles. The neck of the humerus (the area of smallest cross-section) is apparently long and begins far above the ball. There are no indications of a ventral ridge or crest on the neck of the humerus. Comparisons of the fossil with living frogs are based on the following genera: (Unless otherwise indicated only one species of each genus has been examined.)

Leiopelma, *Ascaphus* (Leiopelmatidae); *Pipa*, *Xenopus* (Pipidae); *Discoglossus*, *Barbourula*, *Bombina*, *Alytes* (Discoglossidae); *Rhinophrynus* (Rhinophrynidae), *Pelobates* (2 species), *Scaphiopus* (3 species), *Megophrys* (3 species) (Pelobatidae); *Pelodytes* (Pelodytidae); *Leptodactylus* (2 species); *Batrachophryne*, *Calyptocephalella*, *Eupsophus*, *Physolaema*, *Telmatobius*, *Ceratophrys*, *Eleutherodactylus*, *Pleurodema*, *Adelotus*, *Kyarranus*, *Limnodynastes*, *Lechriodus*, *Helioporus*, *Rhinoderma* (Leptodactylidae); *Dendrobates* (2 species), (Dendrobatidae); *Atelopus* (Atelopodidae); *Bufo* (25 species), *Ansonia*, *Nectophrynoides* (Bufonidae); *Hyla* (10 species), *Acris*, *Gastrotheca* (2 species), *Diaglena*, *Smilisca* (3 species) (Hylidae); *Pseudis* (Pseudidae); *Rana* (5 species), *Arthroleptides* (Ranidae); *Phrynomerus* (Phrynomeridae); *Astylosternus*, *Dyscophus*, *Probreviceps*, *Kaloula*, *Uperodon*, *Gastrophryne* (Microhylidae); *Hyperolius*, *Rhacophorus*, *Megalixalus* (Hyperoliidae).

Discussion: The humerus of anurans is one of the most easily identifiable structures because of the presence of the prominent ball on the distal end. The basic morphology of the humerus is discussed by Gaupp (1894) and the terminology to be followed will be based on this work. Unfortunately this classic study is based only on members of the genus *Rana* and therefore many described features of the humerus are characteristic only of that family or even that genus. The main aspects of the morphology of the humerus are amply illustrated in Figures 39-41 of this work. The discussion will be restricted to the distal portion of the humerus. On either side are two epicondyles, the *lateral* and the *medial.* In most frogs the medial is larger and more prominent, whereas the lateral epicondyle is usually small or represented by a slight nubbin. Immediately above the ball there may be a slight or relatively deep depression, the *fossa cubitis ventralis* (Gaupp 1894, hereafter referred to as the fossa). On the posterior surface of the humeral ball there is almost always a roughened triangular area which will be called the *olecranon scar.* This represents the area which articulates with the olecranon process of the radio-ulna. Immediately above the widened distal end of the humerus, there usually is a neck region which generally has the narrowest diameter of the entire humerus. On the proximal end of the humerus of almost all frogs there is a *crista ventralis* (Gaupp 1894). In many frogs this ridge is quite long and extends onto the neck of the humerus but usually it is absent on the neck region.

On the basis of morphology the humerus of *Ascaphus* and *Leiopelma* have much in common. There is a distinct fossa and reduced epicondyles in *Leiopelma. Eobatrachus* can readily be distinguished from *Leiopelma* by the more advanced structure of the ball. *Ascaphus* has a modern type of ball but the fossa is very small and shallow. The nature of the fossa and the expanded lateral and medial epicondyles and their flanges distinguish it readily from *Eobatrachus.* The Pipidae is characterized by a small but well developed ball, with equally developed epicondyles and a deep triangular fossa. The symmetry of the pipid fossa is much greater than that of *Eobatrachus* but the fossa is relatively better developed than in any other known living or fossil frog. The ball of *Eobatrachus* is much more advanced than either genus although the reduction in size in the pipids may be due to aquatic adaptation and reduction of jumping abilities. The Discoglossids are precluded from relationship to *Eobatrachus* by the lack of the fossa. Other features are characteristic of the Discoglossidae which eliminate them from further discussion. The Pelobatidae and the Pelodytidae can be eliminated because there is no sign of the fossa (except a tiny fossa-like depression in *Megophrys*) and the apex of the olecranon scar tends to lie laterally rather than medially. The condition of the humerus among the leptodactyloid frogs (including Leptodactylidae, Dendrobatidae, Atelopodidae, Rhinodermidae following Griffith, 1959) is most variable with the single exception that the fossa is never present except weakly in *Batrachophrynus*, which differs from *Eobatrachus* by the presence of a low ventral crest on the neck region (*crista ventralis*) and reduced medial epicondyle in the living species. The Pseudidae and Centrolenidae may be differentiated from *Eobatrachus* in the same manner as the other leptodactyloid families. The bufonids can be easily distinguished by the complete lack of the fossa, the generally curved humerus and by the apex of the olecranon scar being more laterally than medially oriented. The distal portion of the humerus of Hylidae is variable, but is usually characterized by the complete lack of a fossa or at best a lunate deep trench just above the proximal border of the ball. The medial epicondyle is usually moderately or weakly developed and the lateral epicondyle is variable in size from very small to very large. The ranid humerus can be distinguished from the fossil by the small pit-like fossa which lies just above the ball, very prominent medial epicondyle, laterally oriented apex of the olecranon scar, and by the general curvature of the humerus. The phrynomerid humerus is distinguished by its very small ball, elongate diaphysis, and reduced olecranon scar. The fossa in this form is very shallow, triangular, and extremely short. Both the Ranidae and Hyperoliidae have a deep fossa just above the proximal end of the ball. This fossa is distinctly different in its form from those of *Eobatrachus.* It appears that in both of these families the depression may merely be formed by enlargement of the sphere-like pattern of the ball. Both these families also differ from the fossil by the great development of lateral extensions or flanges from the epicondyles, the relatively large size of the medial epicondyle and the lateral position of the olecranon scar.

From the above discussion it appears that there is no clear relationship between *Eobatrachus* and any of the living families of frogs. The large size of the ball, the development of the fossa, the reduced medial epicondyle, the shape and form of the olecranon scar and the perpendicular position of the humeral shaft all indicate a unique association of characters not found in any living or fossil frog seen. The only frogs which approach *Eobatrachus* as far as the development of the fossa is concerned are the Pipidae and perhaps *Leiopelma.* In all of these the fossa is a symmetrical trough which is not the case in *Eobatrachus.* In both *Xenopus* and *Pipa* the humeral ball is very small with relatively large epicondyles, whereas in *Eobatrachus* the humeral ball is very large and the epicondyles are reduced. Certainly as far as the ball is concerned the humerus is an advanced structure but the development of the fossa may indicate a more primitive condition. The assignment of *Eobatrachus* to Montsechobatrachidae is at best a guess and perhaps it should be considered a more advanced frog than that. Validity of the assignment of *Eobatrachus* to this family (Romer 1945) cannot be determined from the published material of *Montsechobatrachus.*

Superorder Salientia
Order Anura
Suborder Neobatrachia
Family *incertae sedis*
Comobatrachus aenigmatis, new genus and species
Plate 1, figs. 2, 4, 6

Holotype: Yale Peabody Museum No. 1863, the distal portion of a frog humerus.

Locality: Quarry 9, Como Bluff, Wyoming.

Diagnosis: Distinguished from *Eobatrachus* by its shallower, symmetrical triangular *fossa cubitus ventralis* and less developed medial epicondyle; similar to some leptodactylid, microhylid and hyperoliid frogs in the presence of the *fossa cubitus ventralis,* but distinguished from these groups by the poorly developed medial epicondyle, the medial position of the apex of the olecranon scar and straight shaft of the base of the humerus.

Description: A broken distal portion of a right frog humerus measuring 5 mm. long. At the distal end of the fragment there is a large distinct abraded ball (*eminentia capitata*) which has a diameter of approximately 1.3 mm. On the medial side there is a small indistinct slightly abraded medial epicondyle and on the opposite side there is no distinct evidence of a lateral epicondyle. The surface of the area of the lateral epicondyle is slightly abraded. The area of each epicondyle forms slight rounded ridges which meet at the base of the neck. Between the two ridges is a fossa the shape of an isosceles triangle whose base is the upper end of the humeral ball. The fossa is shallow; the deepest area being at the upper border of the humeral ball. Posteriorly, the olecranon scar is triangular in form and its apex is slightly higher than the humeral ball. The apex lies midway between each epicondyle. The neck of the humerus is relatively low and begins above the expanded distal end of the bone.

Discussion: The relationships of *Comobatrachus* are apparently with the more modern frog families. The development of the ball and the general shape of the fossa indicate no relationship to Leiopelmatidae, Pipidae, Discoglossidae, or Pelobatidae. Among the Neobatrachia the Bufonidae, Atelopodidae, Dendrobatidae, Pseudidae (and other groups now placed in the Leptodactylidae by Griffith, 1959) and Hylidae are precluded from consideration by either the complete lack of a fossa or only the slightest indication of such a structure. The fossa of the Ranidae is merely a lunate cleft above the humeral ball. Among the Hyperoliids there is no fossa in *Rhacophorus* or *Megalixalus* but a distinct one in *Hyperolius*. The base of the humerus of *Comobatrachus* bears a distinct resemblance to *Eupsophus* (Leptodactylidae), *Hyperolius* (Hyperoliidae), *Probreviceps* and *Kaloula* (Microhylidae). There are distinct differences between the aforementioned modern frogs and *Comobatrachus*. In all the modern frogs the medial epicondyle is better developed and the fossa is distinctly shorter than in the fossil. As a result of these comparisons there is apparently no family of living frogs to which *Comobatrachus* can be assigned, though it appears to be a member of the more advanced families of the Neobatrachia (Reig 1958). It is probable that the medial epicondyle has been eroded or broken away and if so the humerus would perhaps conform more closely to one of the above genera. Assuming that the epicondyle has not been too badly damaged, it would appear that no family of living frogs would include the features of *Comobatrachus.* Therefore we can only conclude that it represents one of the more advanced families, possibly something related to the more generalized Leptodactylidae or perhaps a family as advanced as the Microhylidae or Hyperoliidae. On the basis of probability a leptodactyloid affinity appears more likely.

Order Urodela
Family *incertae sedis*
Comonecturoides marshi, gen. et. sp. nov.
Plate 2, figs. 3, 4; Plate 3, fig. 6

Holotype: Yale Peabody Museum 3919, complete right femur.

Type locality: Quarry 9, Como Bluff, Wyoming.

Diagnosis: Distinguished from living salamanders principally by the presence of endochondral ossification and heavier ossification of the perichondral diaphysis.

Description: The femur is characteristically urodele, with narrow diaphysis, expanded and unossified proximodistal extremities, and tiny, anteroventral twiglike trochanter. The head in cross section is rounded dorsally, and has a slight ventro-posterior angle. The tip of the trochanter is missing, and the point of separation of shaft and trochanter is about one millimeter distal to the preserved proximal edge of the head. The trochanter is continued on the diaphysis by a crest which diminishes distally, but remains discrete almost to the preserved distal edge of the bone. The dorsal surface of the distal end is swollen and pitted for ligamentary attachment. Ventrally the distal end bears two tiny foramina. The outline of the distal end is oval, slightly concave ventrally and convex dorsally. In cross section, the bone of the shaft is quite thick and there is endochondral ossification within the expanded extremities. Maximum length of femur, 11.5 mm.; maximum diameter of distal extremity, 3 mm.; maximum diameter proximal end, 2.3 mm.

Discussion: Femora and humeri of urodeles may be distinguished easily by the following characters. In cross section, the distal end of the femur is always convex dorsally and concave ventrally; both dorsal and ventral edges are convex in humeri, giving a lobate appearance. The humeri always possess a strong bladelike crest ventrally, continuous with the head, and a smaller trochanter is sometimes present dorsally (e.g. in Salamandridae, see Francis 1934, pl. 7, fig. 42). Femora of living families of urodeles are quite distinct, particularly with respect to the outline of the head in cross-section, and to a lesser degree the shape and orientation of the trochanter. The outline of the distal extremity is less characteristic but may also be helpful. Plate 3 shows outlines of femoral heads of all families (except Sirenidae which lack hind limbs) of living urodeles. Each drawing is based on several specimens and is intended to reflect the characteristic shape for each family rather than that of any particular individual. The following material was seen: (numbers in parentheses indicate specimens examined)

Ambystomidae
- *Ambystoma tigrinum* (3)
- *A. opacum* (1)
- *Rhyacotriton olympicus* (1)
- *Siredon mexicanum* (1)

Hynobiidae
- *Hynobius stejnegeri* (1)
- *Batrachuperus pinchonii* (1)

Cryptobranchidae
- *Andrias scheuchzeri japonicus* (4)
- *Cryptobranchus allegheniensis* (1)

Salamandridae
- *Salamandra atra* (2)
- *S. maculosa* (1)
- *Mertensiella caucasica* (1)
- *Taricha granulosa* (1)

Amphiumidae
- *Amphiuma tridactylum* (3)
- *A. means* (1)

Proteidae
- *Proteus anguinus* (1)

Necturidae
- *Necturus maculosus* (4)
- *N. punctatus* (1)
- *N. beyeri* (1)

Plethodontidae

Plethodon cinereus (2)
Leurognathus
marmorata (1)
Desmognathus fuscus (2)
Pseudotriton ruber (1)

The shape of the head of the femur was found to be relatively constant in all families except Ambystomidae. *Rhyacotriton* resembles *Ambystoma*, both differ from *Dicamptodon ensatus*. The proximal ends of femur and humerus are difficult to distinguish in *Siredon mexicanum*, probably due to lack of ossification. Comparison of the figures will show that the closest resemblance to the Como Bluff specimen is with *Necturus* (considered here as a family separate from *Proteus*, following Hecht 1957). There is some similarity to *Amphiuma*, from which it is distinguished by the less sloping posterior border of the head and the slightly different angulation of the trochanter. Characters of the shaft, trochanter, and distal end are shown in Plate 2. Ambystomids have a relatively divergent trochanter, often connected proximodistally to the shaft by thin crests or webs of bone. The short stubby femur of the cryptobranchids with its blunt trochanter is easily recognizable, and the outline of the distal end is especially characteristic. Salamandrids often have ossified extremities and the trochanter is falcate with a rounded excavation between trochanter and head. This condition is also found in plethodontids, though they may be separated by the proximal outline of the head. *Proteus* has a very reduced femur, with only a tiny ridge instead of a trochanter. Necturids are characterized principally by the rounded outline of the femoral head, which lacks any prominent crests or angles, and in this respect *Comonecturoides* most closely resembles this family. Comparison with *Necturus beyeri* and especially *N. punctatus* was difficult due to reduced ossification in limb extremities of these forms. Both of these species show a little more anteroposterior compression of the head of the femur than does *N. maculosus*, but this is in part due to lack of ossification in the most proximal part of the shaft. In perennibranchiate or larval types only the larger specimens or species are well ossified enough for comarison.

Interrelationships of the various families based on the outline of the femoral head are as follows. The similarity is greatest between hynobiids and *Ambystoma*, to be expected due to the close relationship between the two groups. The salamandrid outline is easily derived from this type as is the plethodontid. The necturid outline is probably closer to the hynobiid or perhaps the salamandrid than to any of the others (the latter relationship suggested by Noble (1931) on the basis of reproductive structures) and the similarity of *Amphiuma* (probably a salamandroid derivative) to *Necturus* may strengthen this suggestion, though of course no particular weight may be placed on this single character. The stubby outline of the cryptobranchid femur is unlike any other.

Class Reptilia

Order Sauria?

Plate 1, figs. 7, 8

Yale Peabody Museum 1568.—right ilium.

Description: The ilium is a flattened blade, smooth medially, with no indication of a sacrel attachment. Dorsally and ventrally there are crests developed, giving a lenticular cross-section. Posteriorly these crests disappear and the cross-section is circular at the tip. Anteriorly there is a prominent crest with a boss laterally for muscle attachment. The acetabular area is broken ventrally and no trace of attachment for pubis or ischium remains. A tiny part of the acetabulum is present.

Discussion: This bone was first discussed by Moodie (1912), p. 287) who indicated that it was "quite peculiar" and would "possibly be sufficiently characteristic to sustain the validity of Professor Marsh's genus *Eobatrachus*." Later (1914, p. 533) he indicated that there were four pits on the articular surface marking the "synchondrosteal union of the halves of the pelvis." These pits are breakage surfaces; no evidence of the actual articular surface remains. Reference of this bone to the Reptilia indicates that it must be the right ilium with the narrow tip pointing posteriorly, rather than the left bone with anteriorly pointing tip as Moodie suggested. There is a superficial resemblance to raniform frogs, principally due to the size of the dorsal crest, but anuran ilia in general lack the ventral crest and are relatively much longer than this specimen. The short, compressed bladelike shape most closely resembles that of the Sauria. Ilia of all families of lizards have been examined, as well as those of other recent and many fossil reptiles. The general shape of the bone conforms most closely among lizards to certain gekkonids (e.g. *Thecadactylus*) but the latter differ in the less well developed dorsal muscular crest. Breakage of the acetabular region renders further comparison fruitless; the primary reason for discussion of the bone here is indication of its reptilian nature.

SUMMARY AND CONCLUSIONS

The type materials of the earliest known North American fossil frog *Eobatrachus agilis* Marsh are redescribed. The holotype of *E. agilis* is a right humerus and the genus is tentatively referred to the Aglossa (Reig 1958). No comparison is possible at this time with *Montsechobatrachus* and family reference is left open. The other anuran humerus associated with the type is distinctly different and is made the type of a new genus and species *Comobatrachus aenigmatis* which is referred to the Neobatrachia (Reig, ibid) without family assignment, though it is possible that it is of leptodactyloid relationships. The associated femur is identified as a urodele, *incertae sedis*, described as *Comonecturoides marshi* and a similarity to Necturidae noted. The associated ilium is not anuran and is probably that of a lizard or closely related reptile. The distinctive characters of frog humeri and urodele femora are discussed.

Mook (1918) characterized the environment of the Morrison formation as a broad floodplain with abundant running water. Wieland (1925) suggested a temperate to cool climate, while Simpson (1933) favored a warm to tropical climate. Salamanders are primarily North Temperate today and seek cooler, moister habitats. This may indicate a temperate to warm temperate rather than a tropical environment during Morrison time.

ACKNOWLEDGEMENTS

We are most grateful to Dr. J. T. Gregory for allowing us to study the Como Bluff specimens, to Dr. E. H. Colbert for generously providing the facilities of the American Museum of Natural History, and to Mr. C. M. Bogert and Dr. Richard Zweifel, Department of Reptiles and Amphibians, American Museum of Natural History, and Dr. Ernest Williams, Museum of Comparative Zoology, Harvard College, for allowing us free access to comparative material in their collections. The authors wish to thank Drs. Maxim Lamotte, Marvin Wasserman, Theodore Cohn, and Eric Matthews for gifts of comparative materials. Research time for the senior author was made possible by National Science Foundation Research Grant and American Philosophical Society Grant which are gratefully acknowledged. Special thanks are due Chester Tarka for his excellent photographs of the specimens.

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PLATE 1

Eobatrachus agilis Marsh, type specimen, YPM 1862

Fig. 1. Ventral view of right humerus

Fig. 3. Dorsal view of right humerus

Fig. 5. Medial view of right humerus

Comobatrachus aenigmatis, n. gen., n. sp., type specimen, YPM 1863

Fig. 2. Ventral view of right humerus

Fig. 4. Dorsal view of right humerus

Fig. 6. Medial view of right humerus

Unknown reptile, YPM 1568

Fig. 7. Lateral view of right ilium

Fig. 8. Medial view of right ilium

[Present magnification x 10]

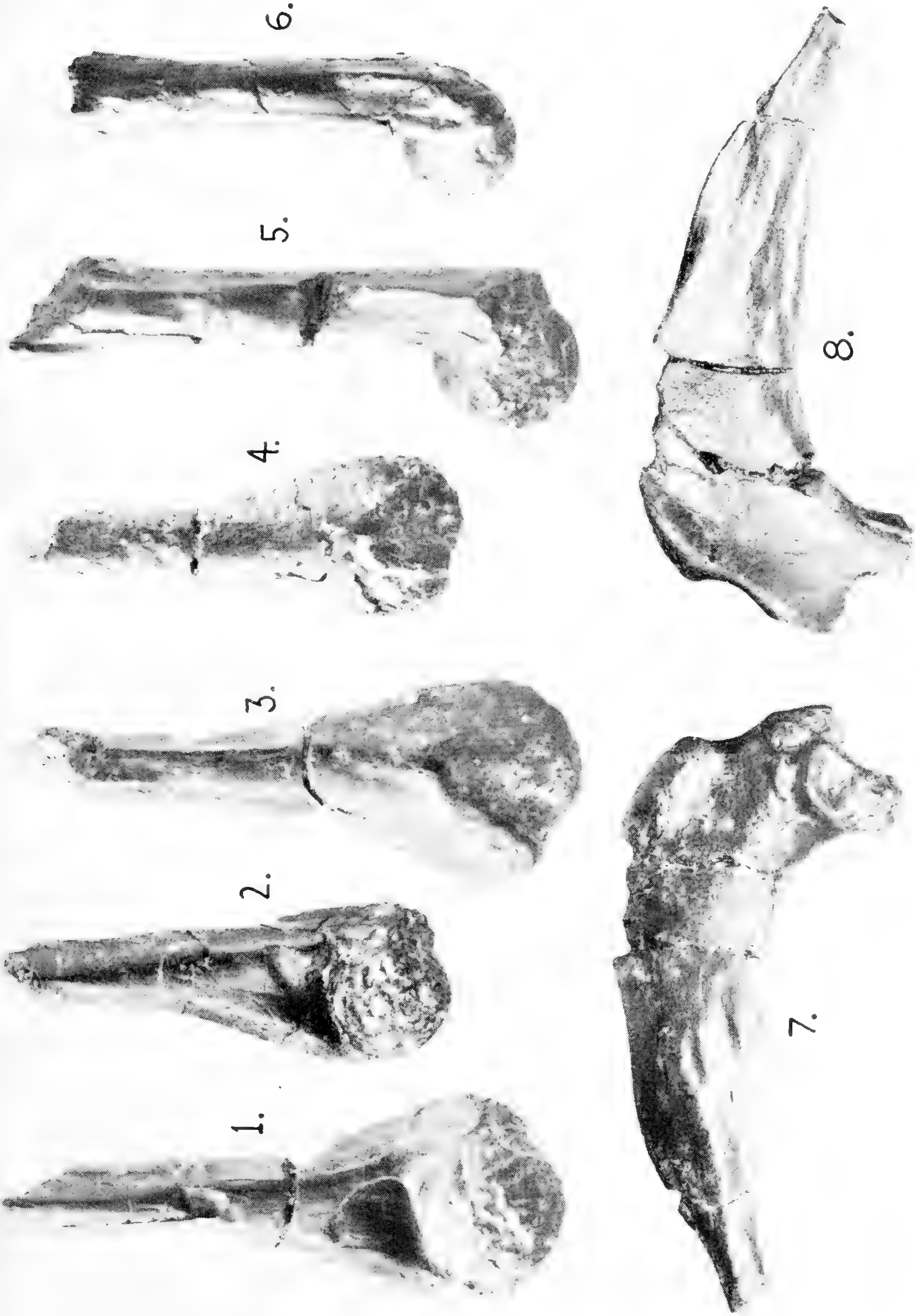
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PLATE 2.

Eobatrachus agilis Marsh, type specimen, YPM 1862

Fig. 1. Lateral view of right humerus

Comobatrachus aenigmatis, n. gen., n. sp., type specimen, YPM 1863

Fig. 2. Lateral view of right humerus

Comonecturoides marshi, n. gen., n. sp., type specimen, YPM 3919

Fig. 3. Dorsal view of right femur

Fig. 4. Ventral view of right femur

Unidentified anuran, YPM 1394 (Part of original type of *Eobatrachus agilis*)

Fig. 5. Dorsal view of distal end of tibiofibula

Fig. 6. Ventral view of distal end of tibiofibula

[Present magnification x 10]

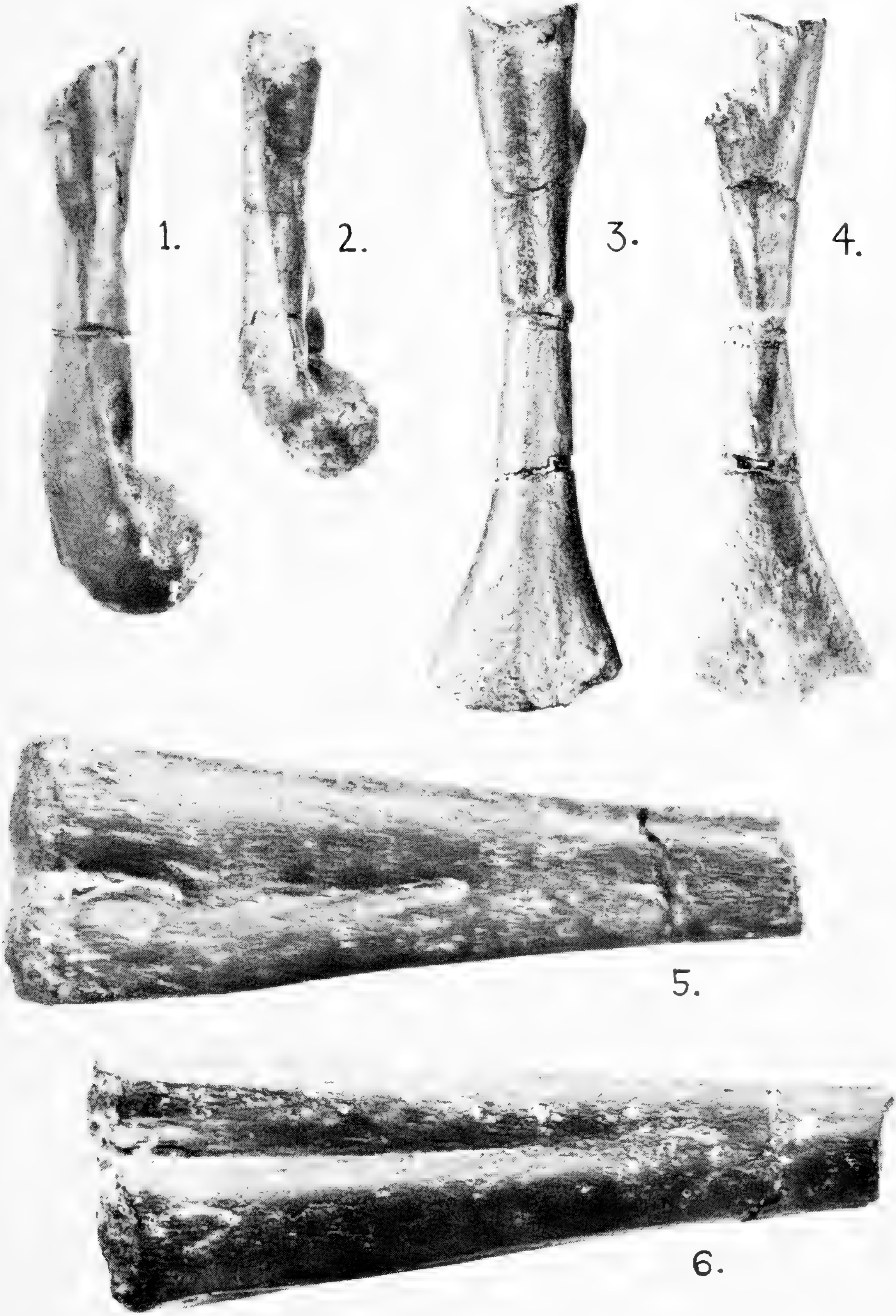
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PLATE 3.

Comparative series of urodele femora. Above: outline of right femur, anterodorsal view. Below: outline of left femoral head in section; the dorsal surface up and the anterior surface to the right. Not to scale.

Fig. 1. Plethodontidae

Fig. 2. Salamandridae

Fig. 3. Proteidae

Fig. 4. Ambystomatidae

1. *Ambystoma*
2. *Dicamptodon*

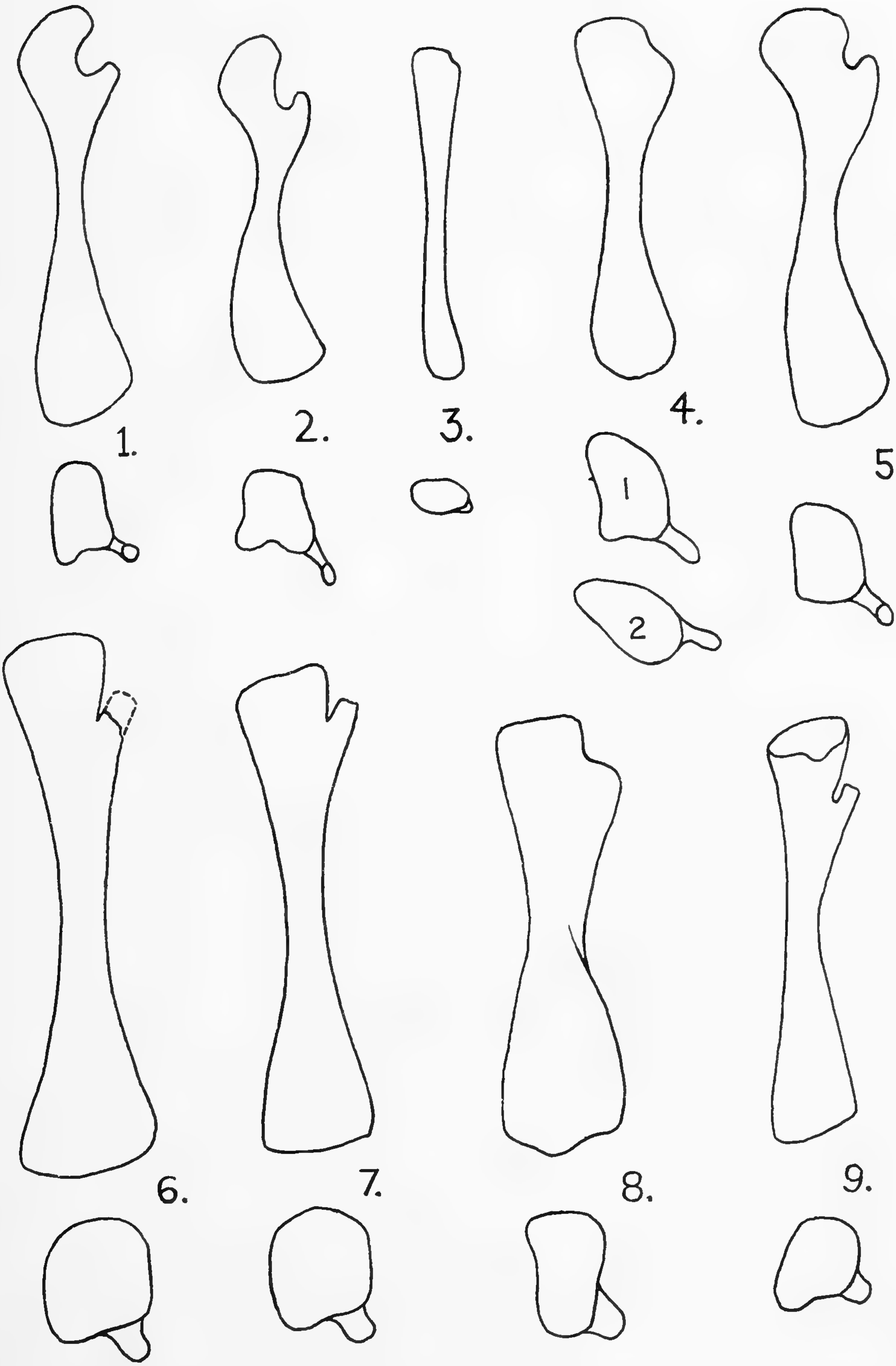
Fig. 5. Hynobiidae

Fig. 6. *Comonecturoides marshi*, n. gen., n. sp

Fig. 7. Necturidae

Fig. 8. Cryptobranchidae

Fig. 9. Amphiumidae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Number 47 July 1, 1960 New Haven, Conn.

ADDITIONS TO THE AVIFAUNA OF NORTHERN ANGOLA I.

S. Dillon Ripley and Gerd H. Heinrich

During the course of a year's visit to Angola for the Peabody Museum in 1957-58 by one of us (Heinrich) a number of interesting new records were made. Specimens have been critically compared in the Peabody Museum by one of us (Ripley) and the advice of Dr. James P. Chapin is here gratefully acknowledged. The accompanying map shows the course of Mr. Heinrich's travels. Grateful acknowledgement is made to the Diamond Company and its Museum for their wonderful hospitality.

Hieraaëtus africanus (Cassin)

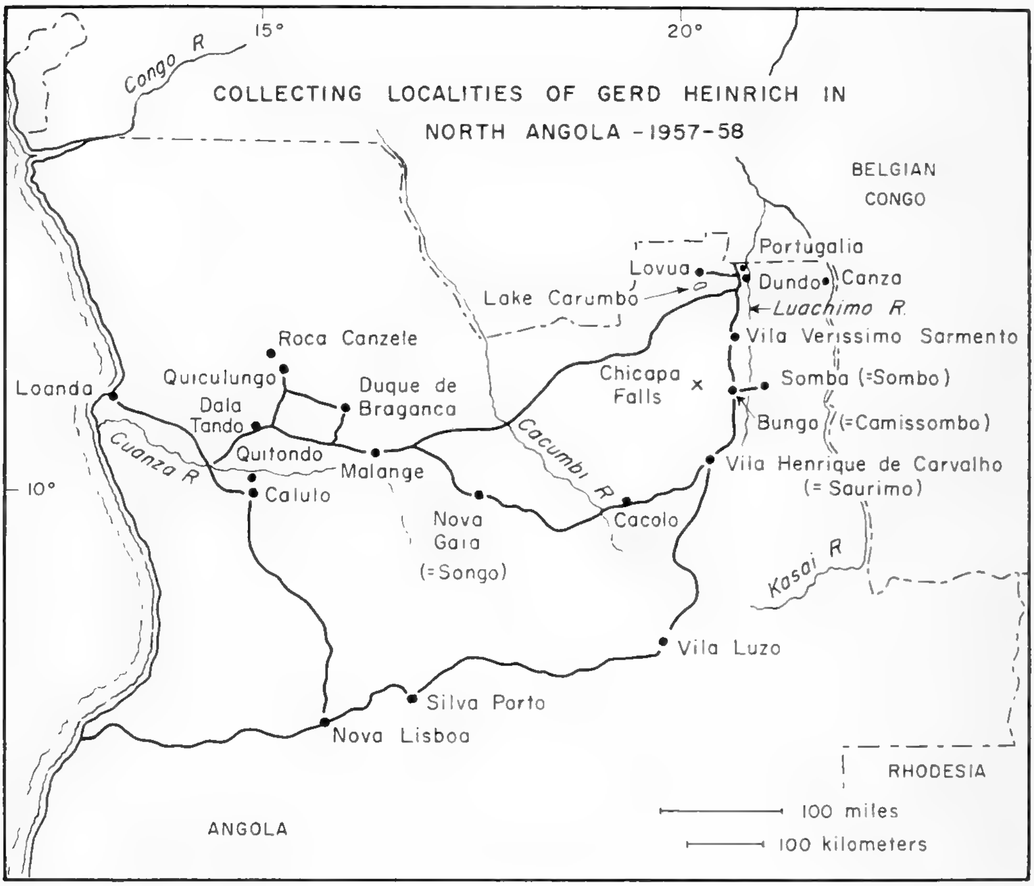
A male was shot in a coffee plantation at Roça Canzele September 26, 1957 by Prince Gustav von Schoenaich Carolath and presented to the collection.

Guttera edouardi schoutedeni Chapin

The occurrence of this form of the blue-spotted guinea fowl in Angola is hereby noted with the presentation to Yale of a female taken by the chief of the post office at Camissombo, September 17, 1958.

Numida meleagris marungensis Schalow

Cacolo, Somba and Dundo in dry savannah woods.



Turnix nana insolata, new subspecies

Type; ♂ ad. (Y.P.M. No. 50,087) collected by Gerd Heinrich February 7, 1958, 35 km. west of Camissombo, northeast Angola.

Diagnosis: from *Turnix nana* this form, known from two males, differs in color so strikingly as to suggest a new species. *Turnix nana* is distinguished from the contiguous species *sylvatica* by triflingly larger size, by the lack of a pronounced median crown stripe and by the presence of blackish bars on the neck and upper chest which may extend incompletely across the fore-neck in males. This subspecies differs from typical *nana* by being extremely pale, bleached, lacking the dark shading of the crown and solid blackish color of the lower back and rump. In this form the general coloration above is grayish with reduced black patches on the feathers, highly cross-hatched with brown. There is an indistinct median crown stripe, slightly more pronounced than in typical *nana*. The wing coverts are whitish with a sandy-buff tone. The under-parts are whitish with an incomplete buffy wash on the fore-neck and obsolete bars on the sides of the neck. In size this form is similar. Two males have wing measurements of 80.5 (type), 79; tail 30; culmen 11, 10; weight 46, 44.5 g. Soft parts: iris pale yellow with inner and outer brown rings; upper mandible blackish, lower whitish with dark tip; feet pinkish ivory.

Remarks: these birds were found on a dry, sandy, grassy plateau at 1100 metres altitude. Specimens loaned to us through the courtesy of the British Museum (Natural History) and the Chicago Museum of Natural History, come from Ndala Tando in the Benguella area of Angola, from northern Rhodesia and from the Kasai. All agree in being similarly and typically dark. Thus this bleached form occupies an isolated savannah area in the center of the range of normal *nana*.

Excalfactoria adansonii (Verreaux)

A male was taken 25 km. northwest of Nova Gaia in a grassy meadow near a brook December 5, 1957.

Sarothrura böhmi böhmi Reichenow

The bird collection of the zoological laboratory of the Diamond Company in Dundo contains a specimen of this species, a male, collected November 21, 1957, in the Luachimo valley near Dundo by a native. Length of wing 88 mm., of tarsus 23 mm.

Stephanibyx lugubris (Lesson)

A single specimen was collected on the roadside between Dundo and Calulo on the northern side of the Cuanza river.

Charadrius tricollaris tricollaris Vieillot

Taken at Luanda August 1, 5, 1957.

Larus fuscus fuscus Linnaeus

An immature female from near Luanda, taken August 7, 1957, is new for Angola.

Columba unicincta Cassin

Luachimo River, near Dundo, 800 m. altitude; Roca Canzele, north of Quiculungo, 600 m. altitude. This handsome pigeon lives in mature stands of tropical rain forest and tropical gallery woods, keeping always to the crowns of the oldest, tallest trees, usually about 100 feet above the ground. Not rare in the coffee woods north of Quiculungo, but difficult to observe and to collect on account of its dwelling above the normal reach of eye and gun.

Cuculus canorus gularis Stephens

South of Duque de Bragança, near the road to Matete, in a savannah parkwood: single, medium-sized trees and patches of low bushes alternating with open, grassy spaces.

This species seems to be very rare in Angola. During two and a half years of work it has been met with only once. When the call of the male was heard for the first time, it seemed to be the call of a dove or a barbet, rather than that of a cuckoo. It has no similarity with the familiar voice of the European *C. canorus*, being much softer, deeper, more muffled and accentuated on the second syllable instead of on the first. The calling begins usually with a few monosyllabic notes like "uk . . . . uk . . . . uk . . . . " and then changes over to a fairly short series of duosyllabic calls, each accentuated in the second syllable. The whole song thus sounds like this: "uk . . . . uk . . . . uk . . . . ukuk . . . . ukuk . ukuk . ukuk." The calling male is perched, well hidden, in the crown of one of the medium sized trees of its biotope, as described above. From a pair, chasing each other, I heard a sharp, ringing call like: "pit pit pit pit pit," fairly similar to the voice of the female of the European *C. canorus*.

Centropus grillii grillii Hartlaub

Forty km. northeast of Duque de Bragança, 1250 m.; 25 km. northwest of Nova Gaia, 1250 m. altitude; Kassai River, 40 km. northeast of Canza, 900 m. altitude in open, wide, marshy, flat and treeless stream valleys of the high plateau in stands of tall grass in the drier areas.

In both males collected in December one of the testes was maximally enlarged, the other not at all. In April, in the Kassai valley, the species was still in full breeding condition and here, for the first time, the opportunity was found to study its voice which is rather different from the other species of the genus. The call was heard only during the early morning hours, but then many times and from different directions. It is two-syllabic sounding approximately like "julup", dull in sound, but nevertheless loud and audible from afar. This call is usually repeated two to six times in succession and often followed by a short series of monosyllabic sounds, like "du - du - du - du." These notes are deeper than the main call, more muffled and not so far carrying. One morning Heinrich stalked a bird that was continuously calling in a thicket of 12-foot tall grass. It was perched on a branch of an overgrown, dead bush, some 3 yards above ground, almost uninterruptedly calling as described above. The specimen turned out to be not a male but a female with maximally enlarged ovaries. A few minutes later, and about 40 yards ahead Heinrich flushed and shot the male. It too, had maximally enlarged gonads. But there is not the slightest doubt that the caller was indeed the female, as Heinrich was close enough to observe the movements of the head synchronized with the calls.

Myioceyx lecontei lecontei (Cassin)

A female was taken at Roça Canzele in heavy forest along a brook on October 1, 1957.

Berenicornis albocristatus cassini (Finsch)

A specimen taken on the Rio Luachimo near Dundo on May 11, 1958, and another specimen, a juvenile, in the museum at Dundo presumably from Lunda province taken in 1946, extend the range of this form into northeastern Angola.

Tricholaema hirsutum chapini Bannerman

A male and female were collected near Dundo on the Rio Luachimo in February and May.

Macronyx grimwoodi Benson

In the region of Lake Carumbo at 900 m. altitude, one specimen was found on March 20th, in a marshy meadow along a stream. The biotope was not at all different from the usual habitat of *M. füllerborni*, several specimens of which were in the same meadow. A careful examination of the whole area showed that the single specimen of *M. grimwoodi* was a solitary one.

Macrosphenus concolor (Hartlaub)

The olive longbill was found on the Luachimo river, near Dundo, 800 m. altitude and on the Kassai river, 40 km. northeast Canza at 900 m. altitude.

Within the tropical gallery wood this skulking little bird has chosen a rather specialized habitat. It is rarely found in the thickets of the lower floor. Instead it searches the very densest tangles of hanging vines, the webs and veils of lianas which here and there wrap the trunk of crown of a single tree, sometimes creating an almost solid mass of clustered vegetation.

Under this excellent cover the small birds would be invisible if their lively actions and characteristic voice did not betray them. There are two slightly different versions of the warbling song, both, however, equal in timbre and in their somewhat intrusive, eager, hurried delivery. The basic tune of the first version is four-syllabic, and sounds like "tutuhuo" with the strong accent on the penultimate syllable, which is somewhat higher than the others. This four-syllabic tune is repeated many times in rapid sequence without the slightest intermission: "tutuhuotutuhuotutuhuotutuhuotutuhuo . . . ." The other version is only three-syllabic with the accent on the first syllable: "huititi." It too is repeated rapidly and eagerly many times: huititihuititihuititihuititihuititi . . . ." In both versions the volume and the speed of the delivery increases slightly and gradually toward the end of the sequence. Heinrich observed the species always in pairs.

Sylvietta denti denti (Ogilvie-Grant)

The single collected specimen, a female with slightly enlarged ovaries, was shot May 11th from the crown of a tall tree in tropical gallery woods, close to the border of the Luachimo river, near Dundo; altitude 800 m.

Apalis goslingi goslingi Alexander

Found on the Luachimo river, near Dundo, 800 m. altitude in tropical gallery wood. This species keeps always to the immediate neighborhood of the river, usually searching the foliage of branches hanging directly over the water or of bushes standing on little islands in the river.

The song is easy to distinguish from that of *A. rufogularis* and *A. alticola*, as its basic strophe is monosyllabic; it is repeated about seven to twelve times in quick succession with even accentuation of each syllable: "tchi tchi tchi tchi tchi tchi tchi." Thus the song has a somewhat twittering timbre.

Cisticola melanurus (Cabanis)

The discovery of this secies in northeast Angola proves the point made by Chapin (1953, Bds. Belgian Congo, pt. 3:380) that this form is identical with *Dryodromas pearsoni* Neave which thereby becomes a synonym of Cabanis' older name.

Found about 50 km. southwest of Cacolo, at 1400 m. altitude in the continuous dry woods of the high plateau. In contrast to most of the species of the genus this one does not depend on grassland or any other dense cover. The birds are, however, more often found in the neighborhood of grassy clearings than in the depth of the forest.

Not very elusive and not difficult to observe as they usually dwell in the branches and crowns of lower trees, searching the foliage in the same manner as *Apalis* species do, for which Heinrich mistook them several times. Disturbed, or excited specimens flip their wings with a purring noise.

Postilla

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RODENTS AND LAGOMORPHS FROM THE MIOCENE FORT LOGAN AND DEEP RIVER FORMATIONS OF MONTANA

CRAIG C. BLACK[1], Carnegie Museum, Pittsburgh, Pa.

The rodents and rabbits described below represent a part of a collection made by Dr. H. J. Koerner for the Peabody Museum of Natural History, Yale University, during the summers of 1935 and 1937 near Fort Logan, Montana. I would like to thank Dr. Koerner for the stratigraphic and locality data used below and Dr. J. T. Gregory for the opportunity to study these specimens. I would also like to thank Prof. B. Patterson, Prof. A. E. Wood, and Dr. Mary Dawson for many helpful comments and criticisms. The illustrations are by Mr. James O. Farley and were made possible by a grant from the Gulf Oil Corporation.

The following forms are described below:

Fort Logan Fm.

Niglarodon koerneri n.g. & sp.

Eumys eliensis n. sp.

Palaeolagus hypsodus

Megalagus dawsoni n. sp.

[1] This study was begun while the author was Rufus B. Kellogg Fellow from Amherst College.

Deep River Fm.
Protospermophilus angusticeps
Monosaulax cf. *M. hesperus*
Paciculus montanus n. sp.
Mookomys cf. *M. altifluminus*
Dikkomys woodi n. sp.
Hypolagus sp.

Of these forms, *Protospermophilus angusticeps* (Matthew & Mook, 1933) and *Mookomys altifluminus* (Wood, 1931) have been previously recorded from the Deep River Formation.

In addition, *Mesogaulus ballensis* (Riggs, 1899) has been reported from the Deep River Formation but it is not represented in the present collection.

The following abbreviations are used throughout:

A.M.N.H.—American Museum of Natural History, New York

U.K.—Museum of Natural History, University of Kansas

Y.P.M.—Peabody Museum of Natural History, Yale University

Class MAMMALIA

Order Rodentia

Family Aplodontidae

Niglarodon[2], n. gen.
(Figure 1a & b)

Type species: Niglarodon koerneri[3], n. sp.

Diagnosis: Jaw slender and less robust than that of *Meniscomys or Sewellelodon*; teeth rooted, more hypsodont than in

[2] From *Niglaros* Gr. whistle and *Odon* Gr. tooth.
[3] For H. J. Koerner who made the collection.

Haplomys or *Allomys*, less so than in *Meniscomys* and *Sewellelodon*; flexids persisting to, or near, tooth base; molars of equal size; posterior protoconid arm well developed, passing across the molars to prominent mesostylid on M_1-M_3; principal cusps prominent with buccal and lingual flexids deep; mesoconid extremely large on P_4.

Niglarodon koerneri, n. sp.

Type: Y.P.M. No. 14024, right mandible with P_4-M_3, lacking the incisor, coronoid process, and angle.

Hypodigm: Type only.

Horizon and Locality: Section 4, T10N, R5E, Meagher County, Montana. Fort Logan Formation, Arikareean.

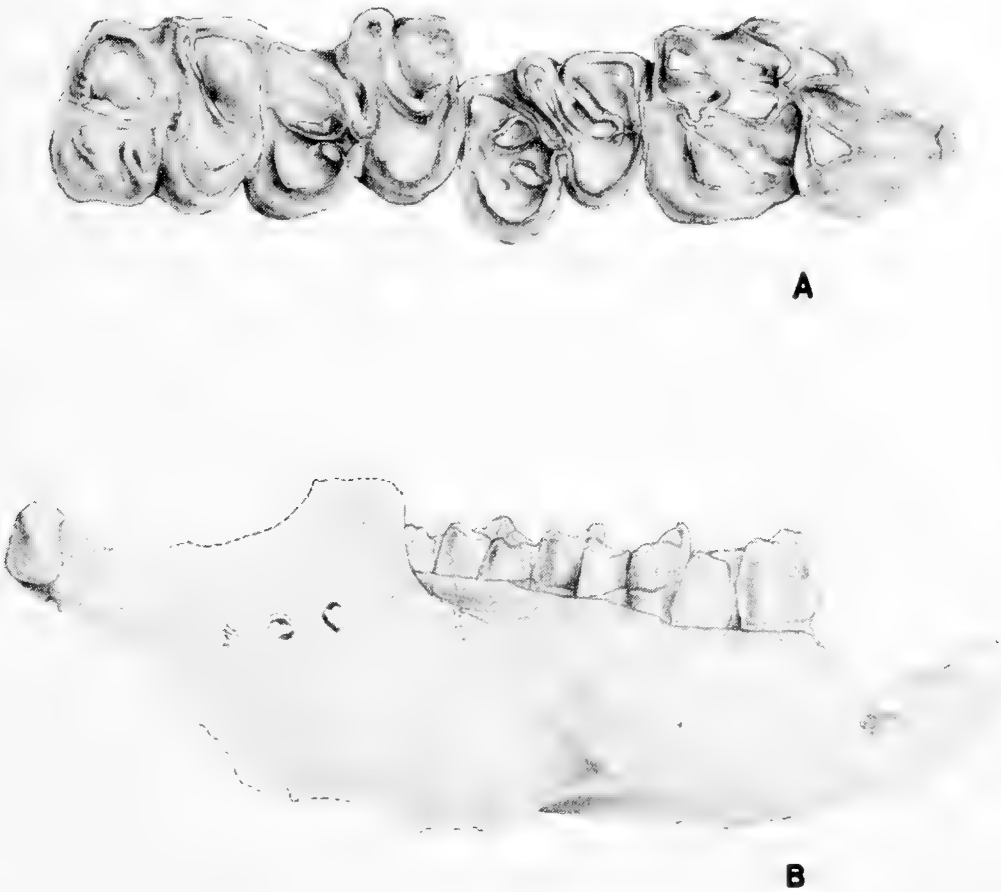


Figure 1. *Niglarodon koerneri* n. sp., Y.P.M. No. 14024, type. A. Right P_4-M_3, anterior end to the right, X10. B. Lateral view of right mandible, X5.

DESCRIPTION

The angle and coronoid process are missing but the condyle is preserved and lies in a plane only slightly above the tooth row. It is not greatly elevated as in *Tardontia* and *Aplodontia*. The masseteric ridge is weak in comparison with the other early Miocene genera although it ends in a well-defined tubercule below the anterior roots of M_1. The coronoid process rises steeply between M_2 and M_3. The mental and dental foramina are as in *Sewellelodon* and *Aplodontia*.

The fourth premolar has five well-defined major cusps. The protoconid and metaconid are joined posteriorly, the anteroflexid cleaving the anterior face of the tooth to within .5 mm. of the anterior root. There is a minute cuspule, that barely breaks the continuity of the slope, present at the base of the protoconid anteriorly. The metastylid is large and separated from the mesoconid and entoconid by a deep mesoflexid directed anteriorly. The protoflexid and hypoflexid join buccally and are extremely deep, reaching almost to the base of the crown. The metafossettid is small and shallow.

The molars are all nearly similar in structure. The hypoconid is the largest cusp. The anterior cingulum is separated from the metaconid in unworn teeth by a shallow cleft, but becomes fused with the metaconid slope after little wear. There is a distinct mesoconid on all the molars. The hypofossettid has been cut off on M_1 and M_2 as a very small lake; it is still slightly open on M_3. The protoflexid is open in all three molars and would never have been cut off to form a lake. The metafossettid is small on all molars but larger than that on P_4. The posterior protoconid arm is well developed, extending to the mesostylid but is lower on M_3 than on M_1 or M_2; it is separated from the metaconid by a narrow flexid, which would soon have closed off to form a lake on M_1 and M_2, as it has on M^3, and from the entoconid by a wider and much deeper mesoflexid. The teeth are worn in such a way that the metaconid is by far the highest cusp on all the teeth.

DISCUSSION

Niglarodon is the fifth genus of aplodontid to be described from the Lower Miocene of North America. *Haplomys*, known only from the John Day, is much too low-crowned to be closely related to *Niglarodon*. *Allomys*, also known only from the John Day, has become more highly specialized than any other Lower Miocene aplodontid through the development of numerous accessory lophs and pits in the upper and lower cheek teeth. *Sewellelodon* and *Meniscomys* (see Shotwell, 1958, for the most recent review of aplodontoid evolution) from the Middle and Upper John Day would appear to have the closest relationships with *Niglarodon*. The crown pattern is basically similar in all three genera with only minor variations. The major differences between these genera are in robustness, height of crown and depth of crown pattern. Of the three, *Niglarodon* is the most generalized. The teeth are high-crowned, although not as much so as in *Meniscomys* or *Sewellelodon*, and the depth of crown pattern has kept pace with this increase in crown height, which is not the case in the other two genera. *Niglarodon* would therefore seem to represent an earlier stage in the aplodontid line leading to *Meniscomys* and then through *Sewellelodon* and *Liodontia* to the recent *Aplodontia*. Also, because of its more generalized structure, *Niglarodon* would seem to be closer structurally, although not in time, to the point of aplodontid-mylagaulid divergence than *Meniscomys*.

MEASUREMENTS

	a-p	tr.[4]
P_4	3.10	1.80-1.95
M_1	1.90	1.60-1.70
M_2	2.00	1.75-1.70
M_3	2.10	1.75-1.60

Family Sciuridae

Protospermophilus angusticeps Matthew and Mook, 1933

[4] When two transverse measurements are given, the first is that of the protoloph or metalophid, the second is that of the metaloph or hypolophid. All measurements are in millimeters.

Horizon and Locality: Section 25, T10N, R5E, Meagher County, Montana. Deep River Formation, Upper Hemingfordian.

Referred Specimens: Y.P.M. Nos. 14029 maxillary with M^3, 14030 partial maxillary with M^1-M^2, 14031 partial left mandible with M_1-M_3, 14032 partial left mandible with M_1-M_3, 14033 partial left mandible with M_1-M_2, 14034 partial left mandible with M_1.

DESCRIPTION

The six specimens here referred to *Protospermophilus angusticeps* agree well with the type also from the Deep River of Montana. A detailed description of these specimens is deferred to a later paper dealing with the evolution of the North American Tertiary Sciuridae.

Family Castoridae

Monosaulax cf. *M. hesperus* (Douglas, 1901)

(Figure 2)

Horizon and Locality: Section 1, T9N, R4E, Meagher County, Montana. Deep River Formation, Upper Hemingfordian.

Referred Specimen: Y.P.M. No. 14035, a right mandible with M_1-M_3, lacking the anterior portion of the jaw in front of M_1, the incisor, and ascending ramus.

Figure 2. A. *Monosaulax* cf. *M. hesperus* (Douglas), Y.P.M. No. 14035, right M_1-M_3, anterior end to the right, X7 1/2.

DESCRIPTION

M_1 is only slightly worn, M_2 unworn, and M_3 unerupted. All the molars would show three fossettids with further wear. The hypostriid (sense of Stirton, 1935, p. 392) is relatively shallow and extends only halfway down the crown. There is a small fossettid on all the molars anterior to the parafossettid and another small fossettid posterior to it on M_1-M_2. This small posterior fossettid is cut off from the metafossettid and is extremely shallow. The reference of this specimen to *Monosaulax hesperus* is based on the presence of the small anterior fossettid. As Stirton (1935, p. 416) observed, however, the species of *Monosaulax* are not clearly defined and any specific assignment is at best dubious at present.

	MEASUREMENTS	
	a-p	tr.
M_1	3.45	3.00-3.50
M_2	3.30	3.20-3.40
M_3	2.90	......

Family Cricetidae

Eumys eliensis, n. sp.

(Figure 3a & b)

Type: Y.P.M. No. 14022, left ramus with I, M_1-M_3, lacking the ascending ramus and inferior border.

Hypodigm: Type only.

Horizon and Locality: Section 28, T11N, R5E, Meagher County, Montana. Fort Logan Formation, Arikareean.

Diagnosis: Teeth large in relation to jaw size; teeth progressively longer from M_1 to M_3; posterior protoconid arm joining metaconid on M_1-M_3; no lingual arm of anterior cingulum on M_2-M_3; mental foramen near inferior border of mandible below anterior root of M_1.

DESCRIPTION

The ascending ramus, angle, and inferior border of the mandible are missing. Enough of the jaw is present, however, to demonstrate that it is relatively small and slender in relation to tooth size in comparison with other species of *Eumys*. This jaw is equal in size to that of *Eumys brachyodus*, somewhat

Figure 3. *Eumys eliensis* n. sp., Y.P.M. No. 14022, type. A. Left M_1-M_3, anterior end to the left, X7 1/2. B. Lateral view of left mandible, X5.

smaller and less robust than that of *E. elegans*, yet the dentition is larger than in either of these two species. There is a small accessory foramen immediately anterior to the mental foramen. The masseteric scar terminates below the middle of M_2.

M_1 is the smallest tooth of the series. The anteroconid is small, as high as the protoconid, to which it is joined by a short anterior protoconid arm, but it is well below the metaconid. The posterior protoconid arm passes postero-lingually and joins the posterior slope of the metaconid and with wear should join with that cusp. There is a very short mesolophid and a short lophid (buccal portion of mesolophid of Wood, 1937, p. 249) which passes buccally from the ectolophid. This crest is also present on M_2. The posterior cingulum is separated from the entoconid by a relatively deep cleft. There is no lingual portion of the anterior cingulum on M_2 or M_3. The posterior protoconid arm on M_2 and M_3 would join the metaconid with further wear. The valley between the protoconid and hypoconid does not open to the buccal side where it is dammed by a thin ridge more so on M_2 than on M_3. There is no mesolophid on M_3 but the posterior protoconid arm is well developed. The posterior half of M_3 is constricted, the hypoconid and entoconid being closely appressed. The anterior and buccal sides of the incisor are rounded while the medial face is flat. The enamel is restricted to the buccal face.

DISCUSSION

There are several characters of *Eumys eliensis* that are not to be found in any öther species of the genus with which I am familiar. The extreme inferior and posterior position of the mental foramen is unique. The increase in the length of the molars from M_1 to M_3 is also unusual. In all other species M_1 is generally the longest tooth. And, finally, the large size of the teeth in relation to jaw size is striking.

The only previously described specimen which comes close to *Eumys eliensis* in tooth size and structure is U.K. No. 8483 described by Galbreath (1953, p. 73) as *Eumys* sp. This specimen is from the lower part of the Cedar Creek Member of the White River Formation. However, this specimen is described as having a large, heavy jaw, which is decidedly not the case in *E. eliensis*.

E. cricetodontoides, *latidens*, and *spokanensis* (White, 1954) are all large species comparable in overall size to *E. eliensis* but in all three forms the length of the molars decreases from

M_1 to M_3. There are also several differences in crown pattern. There is no lingual portion of the anterior cingulum in *E. eliensis*, which further separates it from *E. cricetodontoides* and *latidens*. It is probably closest in crown pattern to *E. spokanensis* from which it differs in the slight development of the mesolophid on M_1 and the buccal crest between the protoconid and hypoconid of M_2. Furthermore, *E. spokanensis* is of Middle Oligocene age.

As White (1954, p. 410) has pointed out, the intermontaine species of *Eumys* (*cricetodontoides*, *latidens*, and *spokanensis*, to which may be added *eliensis*) share certain features not possessed by the plains forms (*Eumys obliquidens*, *elegans*, *brachyodus*, *exiguus*, and *planidens*). Until a revision of the genus as a whole is undertaken, however, exact relationships will be extremely difficult to determine. It would appear, nevertheless, that *E. eliensis* was probably derived from the Middle and Late Oligocene *Eumys* complex known to have been living to the west of the Fort Logan area. It certainly shares more characters with this group than with the plains forms.

MEASUREMENTS

	a-p	tr.
I	2.3	2.1
M_1	2.50	1.7-1.95
M_2	2.60	2.3-2.3
M_3	2.75	2.25-1.75

Paciculus montanus n. sp.

(Figure 4a & b)

Type: Y.P.M. No. 14027, partial right maxillary with M^1-M^2.

Hypodigm: Type and Y.P.M. No. 14026, broken right maxillary with M^1 in place and isolated M^2-M^3.

Horizon and Locality: Section 8, T10N, R5E, and Section 3, T10N, R5E, Meagher County, Montana. Deep River Formation, Upper Hemingfordian.

Diagnosis: Relatively high crowned; teeth narrow in relation to length; all buccal re-entrants deepening toward centers of teeth; posterior cingulum short; all five crests extremely prominent; mesoloph reaching to buccal margin on all molars; no accessary lophs of *Eumys* type; no hypocone on M^3.

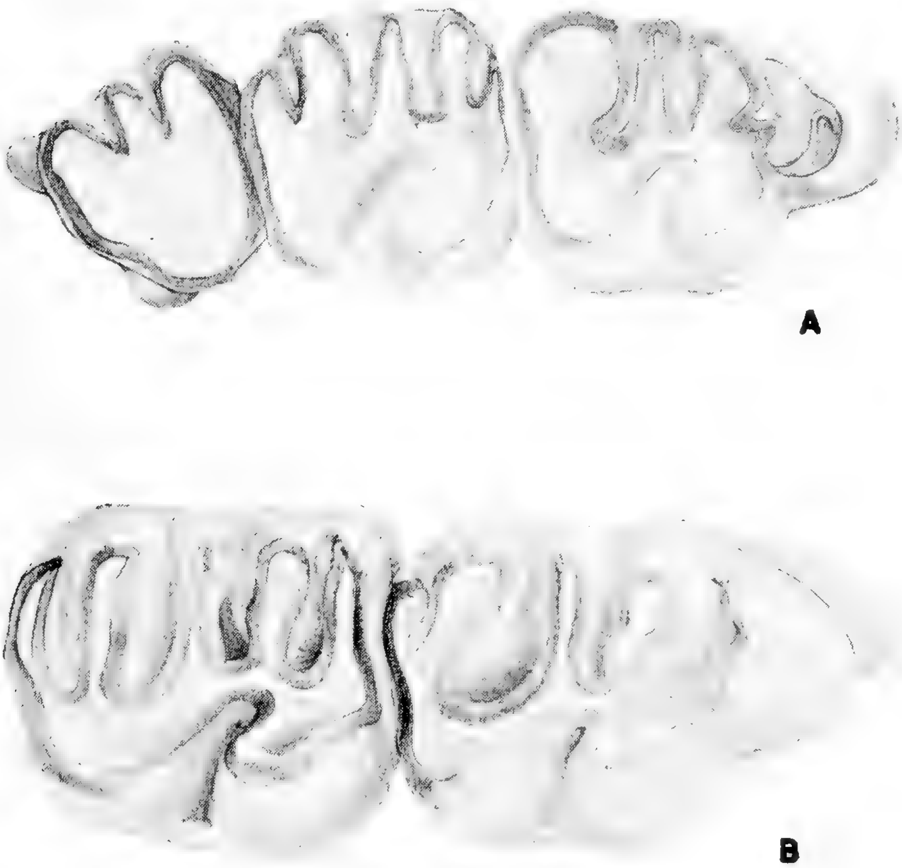


Figure 4. *Paciculus montanus* n. sp. A. Y.P.M. No. 14026, right M^1-M^3, anterior end to the right, X15. B. Y.P.M. No. 14027, type, right M^1-M^2, anterior end to the right, X20.

DESCRIPTION

The upper molars are all extremely simple when compared with those of *Eumys*, *Leidymys*, or *Scottimus*. There are no accessory lophs passing from the protocone to the anterior cingulum nor any sign of mesoloph-metacone connections. M^1 of *Paciculus montanus* is smaller than those of the various species of *Eumys* and than it is in *Leidymys*. All the teeth are narrower in relation to their lengths than are those of other eumyines with the exception of *Scottimus.* The complete mesoloph passing transversely across M^3 to the buccal margin is unique for the group.

DISCUSSION

Paciculus montanus is extremely similar to *P. insolitus* (Wood, 1936a) from the Middle John Day of Oregon. It differs somewhat in tooth proportions and is possibly somewhat higher crowned than the earlier species, but could easily have been derived from it. The relationships of the genus are still not clear. The dentition is more conservative than any other eumyine, which makes it difficult to derive *Paciculus* from any of the known Oligocene species of *Eumys.*

MEASUREMENTS

	No. 14027		*No. 14026*	
	a-p	tr.	a-p	tr.
M^1	2.3	1.6-1.5	2.35	1.8-1.7
M^2	1.75	1.8-1.65	1.80	1.8-1.65
M^3			1.50	1.60

Family Heteromyidae

Mookomys sp. cf. *M. altifluminus* Wood, 1931
(Figure 5a)

Referred specimen: Y.P.M. No. 14036, left ramus with P_4-M_3, lacking ascending ramus and condyle.

Horizon and Locality: Section 14, T10N, R5E, Meagher County, Montana. Deep River Formation, Upper Hemingfordian.

DESCRIPTION

This specimen appears to be identical in nearly all respects to A.M.N.H. No. 21360 from the Deep River Beds, 7 mi. south of Logan, Montana. The teeth are more worn but exhibit the same pattern. The only difference between the two is that M_2 is slightly larger than M_1 in Y.P.M. No. 14036 (Wood, 1931, p. 4, fig. 4) whereas it is slightly smaller in the type. In this respect it resembles *M. parvus* from Colorado. Since the type of *M. altifluminus* and Y.P.M. No. 14036 both come from the

Deep River Beds near Logan, Montana, reference to *M. altifluminus* rather than *M. parvus* is to be preferred. The possibility exists that *M. altifluminus* and *M. parvus* are conspecific but I have not had an opportunity to see the types.

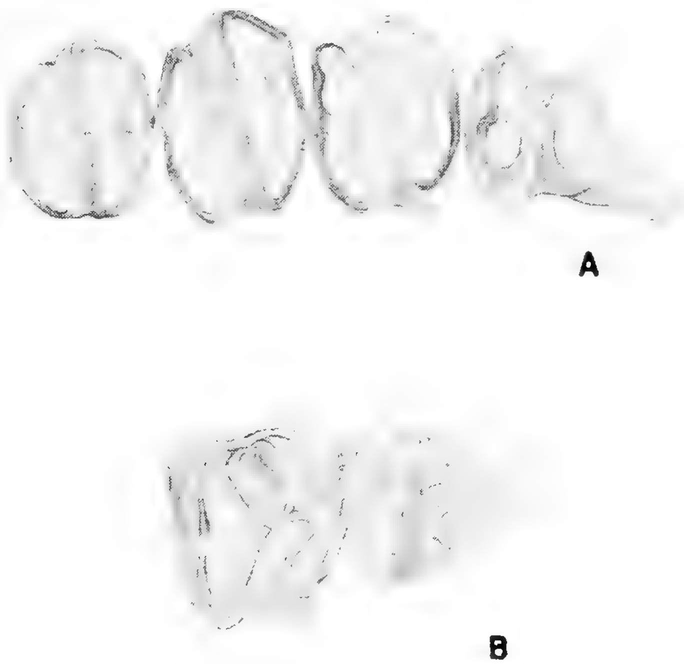


Figure 5. A. *Mookomys* cf. *M. altifluminus* Wood, Y.P.M. No. 14036, left P_4-M_3, anterior end to the right, X15. B. *Dikkomys woodi* n. sp., Y.P.M. No. 14038, type, left P_4-M_1, anterior end to right, X10.

	MEASUREMENTS a-p	tr.
P_4	.85	.70- .85
M_1	1.00	1.20-1.00
M_2	1.10	1.25-1.10
M_3	.95	1.10-1.00

Family Geomyidae

Subfamily Geomyinae

Dikkomys woodi,[5] n. sp.

(Figure 5b)

[5] Named for Dr. A. E. Wood.

Type: Y.P.M. No. 14038, left ramus with I, P_4-M_1.

Hypodigm: Type only.

Horizon and Locality: Section 23, T10N, R5E, Meagher County, Montana. Deep River Formation, Upper Hemingfordian.

Diagnosis: Crests uniting in centers of teeth; enamel complete; two cusps on anterior lophid of P_4, only slight trace of anterior cuspule; anterior column of P_4 shorter than in *D. matthewi.*

DESCRIPTION

The jaw is broken through the alveolus of M_2. M_2-M_3 are missing together with the angle and the ascending ramus. The masseteric ridge is very prominent, ending below the anterior root of P_4. The mental foramen lies antero-ventral to the anterior end of the masseteric ridge. The diastema is long and shallow.

P_4 and M_1 are similar to those of *D. matthewi* (Wood, 1936b) except that the anterior column of P_4 is not as long as in that species. The teeth are not as worn as those previously described. The anterior and posterior lophids of P_4 bear two distinct cusps. The two lophids of P_4 and M_1 unite just buccal of the center of the tooth to form the typical geomyine H-pattern. The buccal re-entrant is shallower than the lingual and is closed on M_1. On P_4, a shallow valley immediately lingual to the antero-posterior crest just fails to split the anterior lophid in two and there is a small shallow fossettid in the center of the posterior lophid. At an advanced stage of wear the metalophid and hypolophid of M_1 would unite into a single column completely ringed with enamel.

DISCUSSION

Wood (1936b, p. 26) suggested that *Dikkomys* would be an "ideal starting point for the evolution of the latter Geomyinae." This interpretation was based on the pattern of the lower premolars in which the two lophs unite at the center of the tooth to give a subcircular metalophid and a compressed hypolophid as in the later forms. Wilson (1936, p. 28), in discussing *Pliosaccomys*, said, "the genus cannot be directly ancestral to any existing gopher but in cheek-tooth characters at least, may show a structural stage through which the Geomyinae have passed." However, I may observe that worn teeth (Wilson, *op. cit.* Pl. 2, fig. 5 & 6) are certainly suggestive of those found in *Thomomys*. The absence of a groove in the upper incisor would also agree with the condition seen in *Thomomys*, although this is a rather tenuous character. Hibbard (1954, p. 357) pointed out this possible relationship, but at the same time he suggested that the genus *Gregorymys* might be ancestral to the Geomyinae, stating (1954, p. 357) that "in *Gregorymys*, the presence of the groove ("sulcus"), which varies as to position on the upper incisor, the development of the skull, and the dental pattern seem to indicate an ancestral relationship to, rather than a parallelism with, the Geomyinae." However, the dental pattern seen in *Gregorymys*, especially in P_4, is far removed from that of any geomyine. There is no indication of a central union of the anterior and posterior lophs. In the contemporary *Dikkomys*, however, we do find a premolar pattern similar to that seen in *Thomomys* and *Geomys* and also in *Pliosaccomys*.

If the suggestion that the geomyine premolars developed from a condition such as that found in *Dikkomys* and *Pliosaccomys* is accepted, the next consideration is the derivation of the single column molar of the later forms. The molars of *Pliosaccomys* are markedly different from those found in *Dikkomys*. The union of the lophs in *Pliosaccomys* begins at the buccal margin and spreads inwards until only one column remains. In *Dikkomys*, on the other hand, the union is first in the center of the tooth. The buccal margins then unite enclosing a lake, the union then proceeding lingually. On the basis of molar structure, it would seem that *Pliosaccomys* and *Dikkomys* represent two distinct lines of later Tertiary geomyine evolution. Which of these lines, if either, is leading to the modern forms it is impossible to say at present. It would appear, however, that the premolar pattern seen in the two genera is the most logical starting point so far known for the recent Geomyinae.

MEASUREMENTS

	a-p	tr.
P_4	1.45	1.15-1.30
M_1	1.50	1.60-1.65

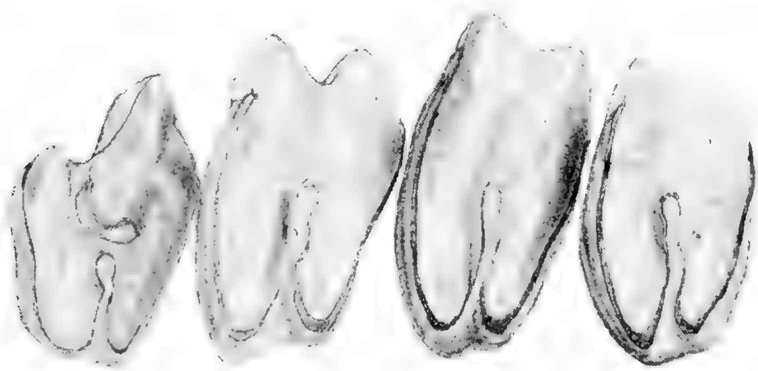
Order LAGOMORPHA

Family Leporidae

Palaeolagus hypsodus Schlaikjer, 1935
(Figure 6a)

Referred Specimen: Y.P.M. No. 14021, portion of left maxilla with P^3-M^2.

Horizon and Locality: Section 5, T10N, R5E, Meagher County, Montana. Fort Logan Formation, Arikareean.



A

B

Figure 6. A. *Palaeolagus hypsodus* Schlaikjer, Y.P.M. No. 14021, left P^3-M^2, anterior end to left, X10. B. *Megalagus dawsoni* n. sp., Y.P.M. No. 14023, type, right P^2-M^2, anterior end to the right, X5.

DESCRIPTION

The specimen consists of a portion of the maxilla with P^3-M^2 and the alveolus of M^3. P^3 has the typical abbreviated anteroloph and the persistent J-shaped crescent. The hypostria almost reaches the crescent, traversing about a third of the width of the tooth. The hypostriae on P^4-M^2 extend approximately half-way across the teeth and are persistent. Enamel is absent externally and is thin posteriorly on all the teeth. Cement is well-developed, filling the hypostriae on all teeth and the crescent on P^3. It does not appear to extend onto the main body of any of the teeth, however.

DISCUSSION

As Dawson (1958) has pointed out, it is extremely difficult to separate *P. hypsodus* Schlaikjer (1935) from *P. burkei* on the basis of isolated dentitions, particularly upper dentitions. Reference of Y.P.M. No. 14021 to *P. hypsodus* in this case is based first on size and secondly on the flattening out of the buccal face of the anteroloph of P^3. In *P. burkei* (Wood, 1940, Fig. 97) the buccal face of P^3 appears to be of rather uniform slope. Whether this character is constant remains to be seen, but it is apparent in all illustrations of the two species so far published.

This occurrence extends the range of the species as given by Dawson (*op. cit.*) from Wyoming, South Dakota, and Nebraska, into Montana.

	MEASUREMENTS	
	a-p	tr.
P^3	1.80	2.00-3.10
P^4	1.80	3.30-3.00
M^1	1.80	3.30-2.90
M^2	1.50	2.60-2.10

Megalagus dawsoni[6], n. sp.

(Figure 6b)

[6] Named for Dr. Mary Dawson.

Type: Y.P.M. No. 14023, right maxillary with P^2-M^2.

Hypodigm: Type and Y.P.M. No. 14037, left maxillary with P^2-M^3 poorly preserved.

Horizon and Locality: Section 28, T11N, R5E, and Section 23, T10N, R5E, Meagher County, Montana. Fort Logan Formation, Arikareean.

Diagnosis: Buccal roots presumably present (seen on M^2); teeth high-crowned; hypostriae cement-filled, shallow on P^3-P^4, deeper on M^1-M^2, passing one-third of the way across the crown.

DESCRIPTION

The cheek teeth are more high-crowned than in any other species of the genus, and have prominent buccal roots. P^2 exhibits two anterior re-entrants, the buccal being shallow and extending approximately 2.5 mm. down the anterior face of the tooth, the lingual deeper and extending halfway down the anterior face. The hypostriae are shallow and extend only partway down on P^3-P^4, but are deeper and extend well below the level of the alveoli on M^1-M^2. The teeth are longer in relation to their width than in any other species of *Megalagus.*

DISCUSSION

The reference of these specimens to *Megalagus* is based upon the presence of buccal roots and the shallow development of the hypostriae on P^3-P^4. The dentition of *M. dawsoni* shows several advances over other species of the genus, notably the development of cement and greater hypsodonty. In this regard, *M. dawsoni* has progressed further than *M. primitivus*, the only other Miocene species. *M. dawsoni* represents a further, more advanced level of development, derivable from *M. turgidus*, as is *M. primitivus*, but distinct from it.

MEASUREMENTS

Y.P.M. No. 14023

	a-p	tr.
P^2	1.2	2.1
P^3	3.0	2.5-3.4
P^4	2.8	3.5-3.5
M^1	2.5	3.3-3.1
M^2	2.2	3.1-2.5

Hypolagus sp.

Referred Specimen: Y.P.M. No. 14028, partial left maxillary with alveolus of P^2, broken P^3, and P^4-M^1.

Horizon and Locality: Section 25, T10N, R5E, Meagher County, Montana. Deep River Formation, Upper Hemingfordian.

DESCRIPTION

The specimen is much too poor for definite reference, but on the characters available it would seem to be close to *Hypolagus vetus*. The crenulations of the hypostriae are slight on M^1, more wavy on P^4.

MEASUREMENTS

	a-p	tr.
P^4	2.1	4.2
M^1	2.3	4.3

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RESULTS OF RESEARCH IN THE ANTOFAGASTA RANGES OF CHILE AND BOLIVIA

I. Birds: Luis E. Peña

II. Diatoms: Ruth Patrick

Color Plate: Roger Tory Peterson

I

EXPLORATIONS IN THE ANTOFAGASTA RANGE, WITH OBSERVATIONS ON THE FAUNA AND FLORA

Luis E. Peña*

Santiago, Chile

About the middle of May, 1957, I began the initial steps towards the making of an expedition to the Antofagasta Range (Chile, S.A.), a region rich in scientific possibilities, yet relatively unknown.

The Curator of Vertebrate Zoology of the Peabody Museum of Natural History at Yale University, Mr. S. Dillon Ripley, commissioned me to make a study of the birds of this range and to locate one of the lesser flamingos called "parina chica," about which little is known.

Several persons have helped me with data and suggestions. Among them I am especially thankful to the following: Dr. Luis Sandoval, Director of the Centro de Estudios Antropologicos at the University of Chile; Mr. William E. Rudolph, engineer of the Chile Exploration Company; Dr. Rudolfo A. Philippi, Chief of the Ornithology Section of the Museo Nacional de Historia Natural de Santiago, who was kind enough to classify some of the birds and critically examine these notes; Mrs. Rebecca Acevedo of the Botanical Section of the Museum who classified the plant collection; Octavio Barrios Valenzuela, my good friend and President of the Sociedad Chilena de Etomologia, who has always encouraged me in this work; Juan G. Rojas and Luis A. Flores, employees of the Chile Exploration Company who helped by supplying me with much valuable information; and Pedro and Mario Soza, also employed by the above company, who were always ready to give me their help. I must especially mention my assistant, Gerardo Barria Peredes, who collaborated on this trip with great enthusiasm and earnestness.

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My main interest was to observe and, wherever possible, to collect the birds which pass the winter on the high ranges of the Andes in the interior of the province of Antofagasta. During the spring, summer, and part of the autumn months, the bird life of this region is numerous in species which disappear during the winter, migrating to warmer climates. My other mission was to recheck the presence of some insects which I had collected on earlier trips. These were little-known species which had been classified recently. Another object of this trip was to meet the expedition that the Centro de Estudios Antropologicos of the University of Chile had sent to the region of San Pedro de Atacama. I was to show them the exact location of certain archaeological discoveries made on my past explorations through these parts. This never took place, however, since we were unable to meet each other in the field.

These notes have been arranged in two parts. They are: firstly, a synopsis of the trip with observations on what I have seen in the regions visited in chronological order; secondly, a systematic list and a discussion of the birds collected.

I do not pretend to list here all the birds of the Antofagasta range, but I have tried to discuss only what I have accomplished in these two months of exploration (June and July) in a region of Chile so little known in general and even less known during this rugged period of the year.

PART ONE

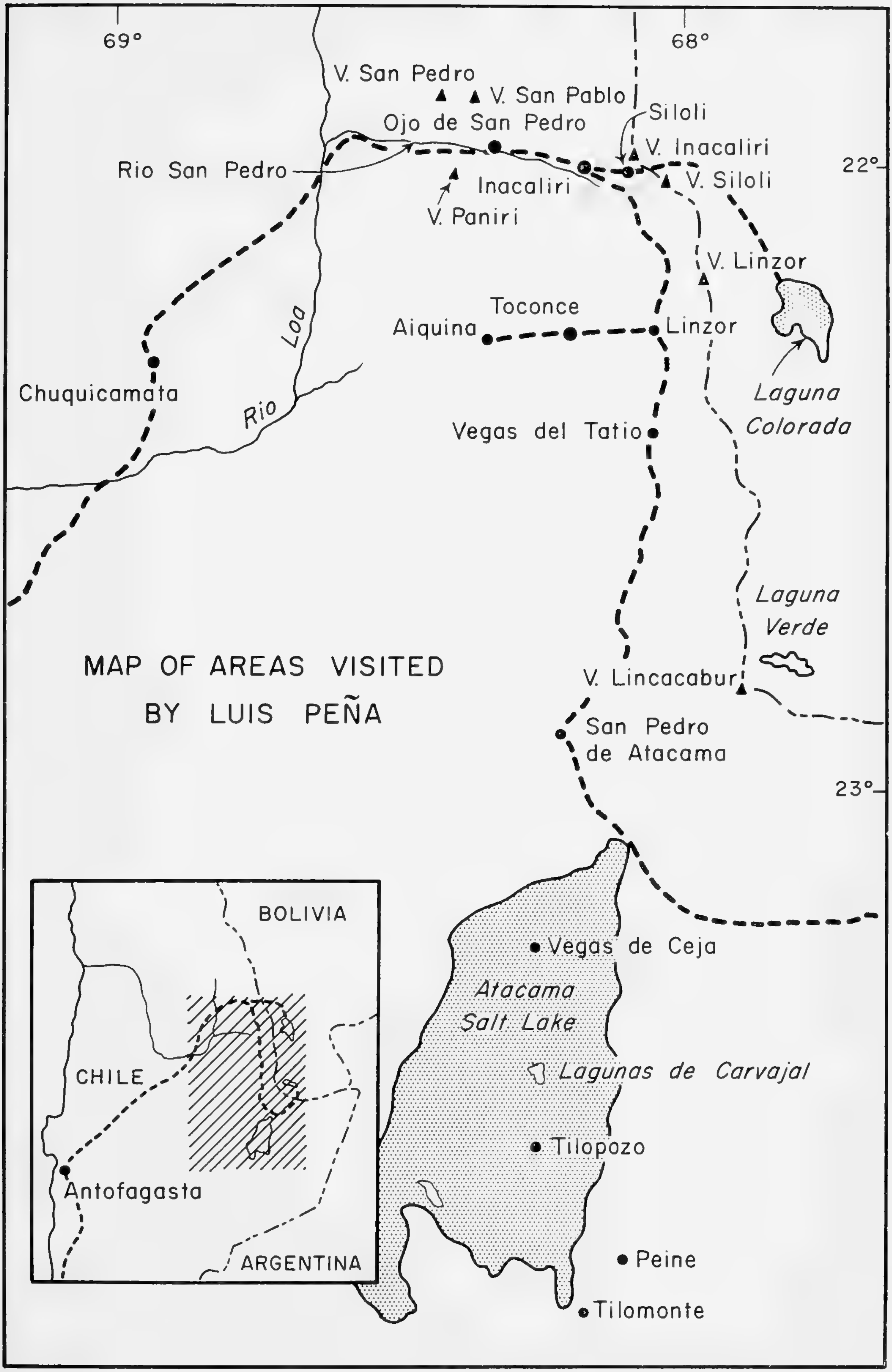
Synopsis of the Trip

I left Santiago on July 6, 1957, in my jeep with a trailer provided by the Centro de Estudios Antropologicos of the University of Chile, and with my two assistants, Gerardo Barria Paredes and Herman Varas, for Domeyko, a little village located in the province of Atacama. Two days later I arrived at Chuquicamata where I was received by Mr. William E. Rudolph who arranged for everything I needed. Valuable information was obtained from Mr. Juan A. Rojas and Mr. Luis A. Flores about the roads and about the location of the

Phoenicoparrus jamesi (Sclater)

flamingos which inhabit the mountains. I headed for Inacaliri from Chuquicamata where the Chile Exploration Company has some encampments. But on arriving at Lasana, a place located on the Loa River, I had more trouble with the trailer and had to return to Chuquicamata, leaving the encampment installed near Pucara de Lasana, one of the most important archaeological centers of the area. We finally left for Inacaliri on July 12. Before arriving at the San Pedro railroad station the road veers towards the south following the San Pedro River along the west bank. This river runs from south to north through the slope formed by the enormous San Pedro and San Pablo volcanoes. Just as I had feared, a heavy storm had broken out during the night in this region, and it was not too long before we ran into the first big patches of snow.

An enormous plain extends from the San Pedro railroad at 3,200 meters, going south in a gradual ascent until it reaches the Ojos del Rio San Pedro at 3,800 meters. This entire region is covered with "tolares," that is, fields in which the dominant plant is the "tola" (*Baccharis tola* Phil.). The drought had affected these fields enormously, and I tried without success to collect some insects from among the roots of the tola and the *Opuntia*. I found only the remains of some Tenebrionidae, of the genera *Praocis* and *Psectrascelis*, and some elytra of *Curculionidae*. A great many of the species of these groups spend the winter underground among the roots of the plants, waiting for good weather before coming out—a fact that has been proved on earlier trips to the Domeyko range and to the east of San Pedro de Atacama. In this entire stretch, I did not see a bird or any other living thing crossing our path. The Ojos del Rio San Pedro are fertile marshlands which begin at the foot of the San Pedro volcano. Generally speaking, the location of the source of a river or spring is called "ojo" (i.e., eye). Here in these lowlands I was able to observe many ducks and coots. I was not acquainted with the road, however, and hurried on, expecting to run into difficulties because of the previous night's snowfall. On arriving at Inacaliri, we were taken care of by the custodian of the dam which provides Chuquicamata with water. I spent several days in this place, establishing it



Map of areas visited by the author.

as a central point from which I planned to make trips to several diverse places: Ojos del Rio San Pedro, Cabana, Siloli, and Laguna Colorada (Bolivia).

Inacaliri: I stayed from June 12th to the 27th in this location, which is situated at an altitude of 4,000 meters. It is located in the neighborhood of the Inacaliri River and is flanked by a type of vegetation (*Festuca juncea* Phil.) used for pasture. On both sides there are thickish, vertically-cut stone palisades. These have an average height of some 40 meters and are inhabited by large quantities of rodents including vizcachas (*Lagidium viscacia*). It is not uncommon to find traces of the fox *Dusicyon* sp. as well. The tolas with their rounded hillocks are spread all over these walls.

In these surroundings one finds an undetermined species of *Opuntia* (Cactaceae) which forms very characteristic hemispheres and under which, on other occasions, I have found numerous examples of Coleoptera of various families. Some other plants which attract attention are: *Lampaya medicinalis* Phil., *Lepidophyllum quadrangulare* (Meyen) Benth. and Hook., and *Adesmia polyphylla* Phil. This last plant, when it blooms, is visited by species of Hymenoptera, and especially by bees of the family Megachilidae. There are also some species of grasses in these places, the most common of which is *Stipa venusta* Phil. As these plants dry, they leave an ever widening type of matting in the shape of a horseshoe, the edges of which are bordered by living plants.

This entire region is surrounded by volcanoes. To the north are the Colan peaks (5,500 meters) and the Inacaliri, more than 5,600 meters high, on the Bolivian frontier. Towards the south, one finds the Cerro del Leon, more than 5,700 meters high, and the open volcano Toconce with a height of almost 5,500 meters. To the east there is a chain of mountains over 5,500 meters in altitude which forms the frontier with Bolivia. Among them is the Silaguala string and the Cerro Silala, also called Siloli, 4,800 meters in height. To the west rises the majestic Paniri volcano. It borders on the Inacaliri River and, further on, the southern branch of the San Pedro. Close to 6,000 meters high, it is very similar in appearance to the

Toconce volcano. More towards the northeast are the brother volcanoes, San Pedro and San Pablo, each over 6,100 meters in altitude.

In spite of having looked diligently for insects, especially Tenebrionidae, I found nothing except some Circulionidae beneath the rocks. I was able to observe some Diptera flying among the few tolas in bloom. These were of the family Syrphidae belonging to the genus *Volucella*. The remains of Coleoptera were always found beneath stones and in the necks of plants. Close to 3,500 meters I found a species of *Praocis* (Tenebrionidae) in such bad condition that identification of species was impossible.

Inacaliri marshes and tolar region in the vicinity of my first base camp, 390 meters.

This entire region is uninhabited because of the extraordinary drought which had lasted for more than four years. As a result I was able to observe some birds, and examples of nearly all of these were collected. Close to the place of the same name, the Inacaliri River joins with the Cabana River which comes from the south. Together they form extensive marshlands where llamas and burros may often be seen grazing. These marshes are almost permanently frozen and only on very hot days, so few during these months, can one see the water flowing. As in all the marshlands of the area, there is a hard and spiny grass here which forms a compact carpet occasionally broken by the water from small streams. This pasture grass is *Oxychloe andina* Phil. There is another species of plant called *Calamagrotsis arundinacea* Phil. as well. Life in the water is meager. We found only some examples of Coleoptera of the family Elmidae. These constitute a part of the diet of the various species of birds which frequent these lowlands.

Ojos del Rio San Pedro: As in the great majority of the origins of mountain rivers, the source of the San Pedro has formed swampy areas. The "ojos" of this river are at 3,800 meters altitude and are very near the base of the San Pablo volcano. Here are lagoons and stagnant backwaters bordered with vegetation. This growth is made up in particular of two kinds of plants. One of them is *Oxychloe andina* Phil., and the other is a fairly high straw-grass which forms little islands in places and is used by birds for nesting. To the north of these marshes there is a native settlement called Ojos de San Pedro. It is made up of a dozen houses constructed of stone, mud, and straw. On the outskirts of the village there is a large watershed of lukewarm water which is the actual source of the river. These people keep sheep, llamas, and burros. While the sheep graze on the banks, this is not so with the burros. They are often seen in the water, submerging their heads in order to bring up a type of water plant which grows there and which provides them with food.

Hunters have totally driven away the birds in this area. It is painful to see the quantity of cartridge cases of all calibers and kinds which one finds scattered over the landscape. The Ojos del Rio San Pedro is an ideal region for nesting ducks, coots, and flamingos. The south side of the marsh is very swampy and white in color like a salt marsh.

Cabana: This area is located on the eastern slope of the Cabana River just a few kilometers from the marshes of Inacaliri; that is, it is in the place where these rivers meet. The altitude is close to 4,000 meters, and the atmosphere is similar to that of Inacaliri which has the same plants but is much more open.

Silala: Following the Inacaliri Pass towards the west, there is a place called Silala, or Siloli, close to the Bolivian frontier at an altitude of 4,250 meters. There is a sluice here and a hydraulic intake valve for all the waters which go as far as the city of Antofagasta. An expedition of the Chicago Museum of Natural History visited the place in 1924. Many interesting species of birds occur here.

Laguna Colorada (Bolivia): I made a trip to this lagoon, one of the objectives of the expedition, since three species of flamingos inhabit the area. The Silala, or Siloli, Pass is nearby, at 4,550 meters. There is a fairly good vehicular road used

A view of the Laguna Colorada in Bolivia taken in a southwest direction from its extreme northeast, 4,400 meters above sea level.

by trucks which transport sulphur and esparta grass from Bolivia down to the railroad station at San Pedro for shipment by rail. This mountainous pass is guarded by two Bolivian policemen who live in decidedly bleak conditions. Past the frontier, the road leads south along the east side of the Silaguala chain. There are vast, smooth expanses there where herds of vicunas (*Lama vicugna*) graze. These animals are much persecuted locally by the Bolivian police as well as the native inhabitants, although Koford (1957), in his fine paper, feels that the vicuna population has remained relatively static recently.

Laguna Colorada, covering an area of nearly 20 kilometers square, owes its name to its coloration. We arrived and circled the lagoon until we came to a place where the water springs from the slope of the hill. The water is warm here as it flows into the lagoon, and I was able to wade barefoot. It was here that we observed and later captured some species of birds such as the "caiti" and the famous "parina chica." The warmer water was observed as a long and narrow strip which fades out towards the south end of the lagoon after a few miles. The lagoon itself is quite shallow. With my helper I went over the entire length of the warm water, and its greatest depth hardly reached 60 cm. The aquatic vegetation is notable where the water is warmest, that is, near the source at the slope of the hill. A small plant here, intensely green in color, covers the surface. Beneath the water there is a species of dark-green alga in which insects swarm. I saw a species of aquatic Hemiptera belonging to the family Notonectidae, very similar to and possibly of the same species which I collected in the Loyoquis lagoon in a similar habitat. That lagoon is located deep in the interior of the range in the province of Antofagasta and is near the Argentine border. This hemipteran is under study at the University of Kansas. Thousands of Diptera were walking and flying over the water.

Laguna Colorada presents a fantastic spectacle difficult to describe. There are places where red-colored pools occur in the midst of sky-blue and gray water. The farther edge of the lagoon is red and white and has for a backdrop the snow-covered mountains on the Chilean frontier. The periphery of the lagoon has all the aspects of a salt marsh, as do most of the Andean lagoons. It is formed from hundreds of little islands which are more or less one meter square and are surrounded by calm water. A straw-grass grows in these surroundings. The beauty of the place brings to mind the lagoon and even the salt marsh at Loyoquis, mistakenly called Quisquiro on our maps. I cannot be sure, but I believe that nearly all of the lagoon was frozen, with the exception of that part which was warmed naturally by the waters from the hot spring.

From Inacaliri, our first base camp, we continued towards the south, in part skirting the eastern side of the Cabana River and passing to the east of the Toconce volcano in order to reach our second base camp at Linzor. The entire region is identical, with tolas, ravines, marshes, and enormous hills, many of which had been very active volcanoes at one time. No living thing is discernible here except "llaretero" trucks which can be seen descending from time to time with their bulky loads.

After some hours of travel, we arrived at Linzor and reached the Chile Exploration Company's encampment. This was wonderfully fitted out for the studies which I had to make. We made several exploratory field trips from this base to Toconce, the Tatio Geysers, the Tatio Marshes, Ayquina, and the Turi Marshes. Everywhere we went we found traces of the expedition of Carl Koford, who had spent months with his family studying the fauna in the mountainous regions of Chile, Peru, and Bolivia.

Linzor: The reservoirs which supply Chuquicamata with water are located at the source of the Toconce River, at some 4,100 meters altitude. The water is carried down by means of an aqueduct. The Government also takes advantage of the water in the ravine at this place, using the same type of pipeline transmission as the reservoirs to carry it down to some of the saltpeter refineries. Linzor is located southeast of the Toconce volcano. There is a good road from there to Chuquicamata passing near the outskirts of the village of Toconce and crossing the Turi Marshes.

The rivers which flow down from the mountains forming the Bolivian frontier have created marshlands in places. It is here that the birds gather, and it was here I especially came to look for them. The tolas are abundant everywhere in this region and "llareta," *Laretia compacta* (Phil.), was found in the vicinity of the camp. However, since they make excellent fuel, very few plants of this species are to be found that have not been used by man.

The proximity of the snow-covered mountains which separate Chile from Bolivia makes the climate rough. When I arrived at Linzor, I found a large part of the trail almost completely covered with snow. During my stay there the days were sunny, and the snow melted until there were only a few patches left in shady spots. Linzor is a splendid site for setting up a base camp. From here there are roads which go in all directions and paths which approach areas with special characteristics, whether they be valleys among the ranges and high peaks or marshlands and rivers. However, the flora cannot be appreciated in this weather, especially after such heavy droughts. This place has essentially the same characteristics as Inacaliri, except that there are llareta fields here. The river fauna is practically the same. Elmidae (Coleoptera) abound. My attention was attracted many times on seeing "naiads" of ephemeropterans in the waters of the river, and afterwards I was also able to see some examples of these primitive insects flying on their nuptial flight on a hot morning. This material is being studied by Dr. Demoulin of the Institut Royal des Sciences Naturelles of Belgium.

We still had hopes of returning to Inacaliri for a few days in order to revisit the Laguna Colorada of Bolivia, but it had snowed so much that it was impossible for me to attempt a new trip to that marvelous lagoon.

THE TATIO GEYSERS: The Tatio Geysers are located some 20 kilometers from Linzor and are at an altitude of 4,250 meters. On a plain surrounded by hills, dozens of steaming openings form part of the active crater of a volcano. These openings continue along the ravine and downwards, and all the spillways of salt and bitter waters join to form the Salado

River which in turn meets the Loa River near the village of Chiuchiu.

We were able to visit this curious place three times, once staying the night in order to observe these fields at sunrise. At seven o'clock in the morning the scene is unforgettable. From hundreds of openings one may see columns of vapor rising to heights greater than 60 meters. This happens because of the intense cold at that hour (−14.5C) which causes condensation. From time to time a breeze comes along and all the columns bend and undulate like serpents. As the sun comes out, the magnificence of the spectacle reaches its highest point, and little by little, as the sun rises, the columns of vapor disappear until at ten o'clock in the morning one may only see vapors coming from the most active openings.

On observing these escape valves close at hand, one may enjoy the sight of some very curious formations. The boiling waters in the interiors of the openings become activated in some cases every two to ten or more minutes to the point of leaping out to heights of a little more than half a meter. The salts in the waters form crusts of the most varied colors, in the shape of pearls in some cases or of superposed terraces in others. In many of the quieter openings beautiful lagoons have been formed, some of them up to 3 meters in diameter and quite deep. Their waters are of an extraordinary transparency, which contrasts with others where the water is muddy and from the interior of which slow bubbles of gas rise up. In many of these openings the plant and animal life is active enough. One can see fibrous aquatic plants and insects of the family Notonectidae which swarm inside. On top of the water one can see thousands of flies sliding around. The temperature in which life develops here is 30C, in spite of reports of finding species there which live in waters of temperatures near boiling point. I also observed here larvae of the batrachian species, *Telmatobius halli edentatus* Capurro, 1954. It is very dangerous to approach these openings since the ground is liable to fissure, and one risks sticking a foot or leg into boiling water as has happened on past occasions. These geysers are in the middle of swampy fields. Birds were surprisingly scarce here.

On the first of these trips we had to return early, since on the trip up the snow drifted on the road, and twice we got stuck with our jeep. A species of "vizcacha" is very common in all these places, and several times they came out of their caves to within a few meters of where they were being observed.

TOCONCE: Coming down through the Linzor ravine through a winding road, we arrived at the village of Toconce, situated at 3,300 meters altitude. Enormous blocks of vertical volcanic

The Toconce volcano (5,500 meters), and to the right the Paniri volcano (6,000 meters). In the foreground may be seen a typical tolar which is made up of the tola plant (*Baccharis tola,* Phil.).

stones form immense walls full of cavities. All along the route one sees towers of a thousand forms—esplanades of stones which resemble great rivers of rock. The vegetation gradually changes until one arrives at the branch of the road which goes to Toconce. Between 3,500 and 3,800 meters I was able to collect the following dominant plants: *Verbena seriphioides* Gill. and Hook., *Fabiana squamata* Phil., *Baccharis tola* var. *lejia* (Phil.) Reiche, *Psila boliviensis* (Wedd.) Cabrera, *Ades-*

mia polyphylla Phil., *Lampaya medicinalis* Phil., *Fabiana denudata* Miers., and *Fabiana deserticola* Reiche.

The village is on the south slope of the ravine of the Toconce River and is not accessible by vehicle. In order to arrive there one must cross the river and then climb up a long, stony grade. At the bottom of the ravine there is an encampment which is occupied with the work involved in carrying the waters of this river to the city of Antofagasta. With this usurpation of their rights the cultivated fields of the natives will remain without sufficient irrigation, all of which has produced considerable quiet indignation.

The ravine is rich in botanical species. *Cortaderia atacamensis* Phil. grows in various places near the water. On the sides there are large quantities of Cactaceae. Among those which attract special attention there is a species of high spiny cactus which has been used from time immemorial for building, since its interior contains a rather hard and resistant wood. There are two or three species of *Opuntia* and a species of "sandillón" with red thorns. On the slopes the following plants are dominant: *Ephedra americana* Humb. Bon. ex Willd., *Baccharis rupicola* H.B.K., and *Atriplex axillaris* Phil. On the cultivated terraces there is an abundance of *Baccharis juncea* Desf., and *Fabiana deserticola* Reiche. There is also a rather common species of undetermined nettle whose flowers are visited very often by the only species of hummingbird that I saw. On the banks of the ditches one sees a very abundant species of graminaceous plant called *Bromus catharticus* Vahl.

In the enormous rocks which are in front of the village on the northern stream of the river, a waterfall has bored deeply and has formed a very narrow ravine which is shady and damp. There the ancient inhabitants of the village had constructed an aqueduct in the form of an arch. It was made of stones and the water ran on top, but nowadays it is not used. In this little ravine I collected a few plants which turned out to be: *Epilobium glaucum* Phil. var. *stenophylla* Reiche; a species of *Solanum*, undetermined because of being incomplete; *Polypogon australis*, Brongn.; and a variety (or possibly an undescribed species) of *Mutisia linearifolia* Cav.

The work which has been effected by the natives for making these lands workable is admirable. The construction of Inca-type terraces covers a large area. Corn, alfalfa, onions, garlic, and carrots are harvested, as well as a large variety of flowers. At this time there were gilliflowers and carnations.

From the archaeological point of view the outskirts of the village comprise one vast field of study. There are many dry stone walls, burial grounds, and granaries in the vicinity of the village. The granaries are still used to guard grain. They are circular constructions, approximately 1.5 to 2 meters high, made of stone, and with roofs of this material. On one side they have a little door about 30 x 30 cm.

Life abounds in the waters of the ravine. From beneath each stone lifted from the bottom of the river scurry dozens of naiads of Ephemeroptera and many larvae of *Plecoptera*. I was also able to observe other insect larvae, such as those of a micro-lepidopteran which makes its cocoon beneath the submerged stones. I have seen adults of this little moth on top of the stones of the river. I saw very few Coleoptera and the few that there were belonged to the family Elmidae. There are also great quantities of planarians on these submerged stones.

Among the few insects observed were the following: vespid wasps of the subfamily Eumeninae; some examples of adult Ephemeroptera; an abundance of flying Chironomidae (Diptera); some species of Silulidae (Diptera) which let themselves be seen from time to time circling around our faces. Only two examples of butterflies were observed: a lycaenid and a species of the family *Hesperiidae*, possibly of the genus *Hylephila*.

The Turi Marshes: Following the road which goes to Chiu-Chiu, one finds a large and extensive flat region which is bordered on the north by the Toconce and Paniri volcanoes and on the south by the Toconce ravine and the Salado River more to the north. This plain is called the Marshes of Turi. This flat land which is at an altitude of 3,100 meters is well-used by burros, sheep, and some mules.

On the eastern extremity of this plain the baths of Turi are to be found. Here a volume of warm water springs into a rustic pool and is used by the natives as a medicinal bath.

At the foot of the Paniri volcano there are three native ranches or groups of farms which are dedicated to agriculture. These are the villages of Cupo, Paniri, and Topain. In Paniri there are orchards, and corn, wheat, alfalfa, beans, and prickly pears are cultivated. In the others there are no orchards, probably because of the climate. In the vicinity of the Turi baths there is an interesting archaeological site perhaps more important than Toconce.

Ayquina: From the heights of the ravine of the Salado River can be seen the ancient, picturesque village of Ayquina, elevated on the slopes of volcanic rocks at 3,000 meters altitude. Cultivation is carried out in fields constructed in the Incan manner; that is, on terraces equal to those in Toconce. Wheat, corn, alfalfa, and several species of vegetables and flowers are produced. The river has groups of typical Cyperaceae on its banks. In the marshy areas there is a type of compressed pasturage where llamas, goats, and burros graze. Some pear and pepper trees shade the village and the ravine.

The ravine contracts as it progresses east and is quite narrow, being sufficient only to let the small overflows through when they run during these months.

The Tatio Marshes: The waters which flow down from the heights such as the Tatio volcano, 5,300 meters in altitude, converge to form a ravine which is very wide at the beginning and very narrow afterwards. These waters flow from south to north and spill into the salt waters flowing out of the geysers forming the Salado River, which has a definitely volcanic origin. The wide area of the ravine is dotted by extensive marshes which are used by the inhabitants of Toconce, Ayquina, and Caspana as pastures The situation is ideal for water birds, although only a limited number of species were seen, perhaps because this was the winter season. The waters of the marshes and the river were in large part covered with ice; nevertheless, many insects were found beneath the stones submerged in the river. I observed a large quantity of a species of beetle of the family Elmidae, perhaps the same which lives in Linzor. Some Diptera were flying over the surface of the water, and they were found by the hundreds beneath the stones which were almost in contact with the water. I also observed some species of gammaridean amphipods.

From Linzor we continued south, following the road which runs parallel to the Bolivian frontier. We passed by the Tatio Geysers, the Tatio Marshes, to the west of the Putana volcano, and tried to reach San Pedro de Atacama on that same day, July 8. In the Tatio Marshes I observed a group of seven vicunas, normally so shy, grazing peacefully on the side of the road in spite of the fact that we passed them at a distance of scarcely 10 meters.

After several hours we reached the completely abandoned sulphur mines of Tatio. These mines are located in the marshes which are the source of the Putana River. Here we observed several flocks of ducks.

Then by mistake we took the wrong road, not a rare thing for those who do not know the region since there are dozens of tracks which were made by the workers of the sulphur mines and the "llaretales." We followed along the edge of the Putana River until we crossed one of its tributaries which came down from the east. From there we continued along the south side of the river and later began to go up an interminable hill. This was obviously an abandoned road, since we had to cross over landslides from time to time. It was impossible to turn back because the road was very narrow and bordered on the edge of a deep precipice. It was already night when we came to a small plateau in which enormous stones covered with the remains of llareta stood out everywhere. All the terrain was sandy and we saw dozens of tracks. We followed the trail which had been used most, but it ended, and, walking from one side to another, we found ourselves completely lost. This was at 4,200 meters and in the middle of the Llaretal del Carcanal. By luck there was plenty of dry llareta which served as excellent fuel, for it was bitterly cold. My assistant suffered a sharp attack of "puna," altitude sickness. On the following day, after heating the water from the radiator of the jeep, we retraced our steps to the marshes of the Putana River with the object of locating the road which would take us towards San Pedro de Atacama, but once again we found ourselves on another llareta road with no possibility of turning around on the narrow path. After traveling several kilometers the road ended, and we were finally able to maneuver around in order to return. Around five o'clock in the afternoon and after crossing an enormous chain of snow-covered mountains at more than 4,300 meters, we succeeded in arriving at San Pedro de Atacama. We remained here from the 9th to the 14th of July. My intention was to explore some lagoons in the interior of the Atacama salt marsh with the object of studying the flamingos there which are absent at this season from the lagoons of the high ranges. We worked in Guatin, Laguna Verde (Bolivia), and the lagoons and marshes of Ceja in the interior of the Atacama salt marsh.

San Pedro de Atacama: To the north of the Atacama salt marsh and at an altitude of 2,440 meters there is a series of fertile oases among which the oasis of San Pedro stands out. This is a village of great historical importance which has always been one of the most attractive places for scientists who are especially interested in anthropological and archaeological studies. The soil of this oasis receives weak saline water which comes from the eastern hills.

One of the outstanding sights here is that of the immense chain of mountains and volcanoes which extends from north to south, and which serves as a background when, looking towards the east, the Putana volcano, 5,700 meters high, stands out, followed by the Sairekabur mountain with an altitude of 6,000 meters. There is also the marvelous volcanic cone called Licancabur, approximately 6,000 meters in altitude, where Inca ruins have been found at the summit and at the foot of which there are vast unexplored remains. Beyond lies the Juriquez volcano, 5,700 meters; the Purico, Hekar, and Potor volcanoes; Laguna Verde; and the enormous Laskar volcano with its steaming crater. Farther to the south is the Tumisa volcano, 5,500 meters; the Miscanti mountain, 5,600 meters; Miniqui, 6,000 meters; and the immense Pular with a height of more than 6,200 meters. In the distance lie the snow-peaks of Socompa and Llullaiyaco. Towards the west the arid Domeyko range extends, with the single legendary peak of Cerro del Quimal, on the summit of which I have also found ruins.

As soon as we arrived at San Pedro de Atacama, I went to see Father Gustavo Le Paige, the parish priest of this area who has amassed valuable study material into a small archaeological museum.

Laguna Verde: On the eastern side of the Licancabur volcano, to the north of Juriquez volcano, and at 4,100 meters altitude, the Laguna Verde spreads out. It owes its name to the beautiful emerald-green color of the water. It almost has the form of an isosceles triangle. Vegetation is very spare all over the area, consisting of bunches of straw-like grass, possibly of the species *Stipa venusta* Phil. As in all Andean lagoons, the shores are covered with a white earth giving the effect of a salt marsh.

Nearly all the lagoon was covered with a thick layer of ice with the exception of a part of its eastern side. At the extreme northeast of the lagoon there is a spring of hot water which prevents complete freezing. This place is used by some birds as a wintering area. I saw about 160 grebes as well as 36 horned coots. On a previous trip in February with my friend Gerardo Melcher from the University of Chile I had seen a quantity of flamingos which were now nearly absent except for one pair of immature specimens. This observation added to those made in the Laguna Colorada (Bolivia) and the data gathered from the inhabitants of the region supports my theory that the flamingos migrate to milder climates such as the Atacama and the Punta Negra salt marshes in the winter.

The wind from the northwest began to rise a little before eleven o'clock in the morning, and shortly after noon it was already unbearable, making big waves on the part of the lagoon which was free of ice. In this period (July) it snows intensely, and in order to succeed in reaching the lagoon it was necessary to cross huge patches of snow.

Guatin: From San Pedro de Atacama, following the same route to the northwest, there is a place with cultivation located at about 3,500 meters above sea level and with waters originating from the Puritama baths not far distant. Guatin is an extension of artificially watered pastures which are used for the cultivation of a curious variety of corn of great yield and which has become acclimatized to these altitudes and to the saline waters. Alfalfa is also cultivated there. On the river bed there is an exuberance of vegetation. The entire area indicates ancient habitation, as has been proven by Father Le Paige with his archaeological discoveries.

On the slopes there is an abundance of tola and a large quantity of cactus of the genus *Opuntia*, as well as other types.

Salar de Atacama: Between the ranges of the Andes and those of Domeyko, and divided through the middle by the Tropic of Capricorn, extends the Atacama salt marsh. In area it is close to 2,700 square kilometers, and its appearance, observed from the air at an altitude of 2,000 meters, is that of an immense white plain dotted with occasional mounds. In its depressions there are lagoons of the most diverse colors, greenish blue being the dominant. From the air one perceives semicircles which seem to be salt formations and give an appearance of snowdrifts.

On reaching the surface level the appearance is totally different from that observed from the air. Only an immense plain can be seen, bordered by mountains on all sides. Advancing towards the interior of the swamp, the trees disappear. The swamp is dominated in parts by a halophytic species of pasture grass. Here nitrous formations jut out of the ground in irregular shapes, making walking very difficult. Little by little the grass disappears. The salt excrescences have diverse forms. In some cases they are snow-white and form tiny spheres. In others the ground is like a checkerboard divided into polygons, the angles of which are made up of walls of salt crystals which stick out somewhat in the manner of chains no more than 10 cm high. These formations originate generally in the areas around the waters which are in the salt marsh. I observed the hard nitrous excrescences which jut out to 50 cm from the ground at the edge of the area of vegetation.

The lagoons are not very deep in general. The bottom is of a soft, smooth, slippery material which has been precipitated very slowly. This is formed of layers of different colors: green, white, yellow, rose, and black, perhaps due to fungus and other vegetable matter which has found an ideal environment for growing. I noted that the bottom surface of these lagoons was always whitish in color. It seems probable that the guano of the birds which abound there plays an important part in the growth of certain material. There are tongues of saline structures below the surface of these lagoons which have the most capricious forms.

In January, February, and sometimes March, the waters of the salt marsh increase; they increase again during the season of snowfalls and rain in the range, i.e., June, July, and August. I believe that a study of the plankton of these waters will be very rewarding. The east side of this marsh has never been visited by a scientist. Here there are extensive unknown lagoons, grasslands, and strange salt formations.

Marshes and Lagoons of Ceja: With a very strong north wind blowing, my assistant and I, riding on mules, penetrated the northern Atacama salt marsh on July 13. Going in a southerly direction and in a straight line towards Socompa volcano which could be seen on the horizon, we should have arrived at a little path which would take us to our destination, the Tebenquiche lagoon. When we had once abandoned the tree area, we entered extensive fields. Everywhere were the burrowings of a rodent, possibly of the genus *Ctenomys* known in the region by the name "ucultur" or "tunduco." Here salt water lies about 5-10 cm below the surface.

With an unbearable heavy wind blowing behind us, we arrived, after two and a half hours of intermittent galloping, at the marshes and lagoons of Ceja. There we left our mounts, as the mules sank up to their hocks in very sticky, gray mud. The waters of these lagoons are quite salty, but in the neighborhood there are some wells opened by the inhabitants who from time to time pasture their cattle in these remote regions. This water, though not sweet, is potable.

Very few birds were observed. Some flamingos flew off at our arrival. Only one flamingo was captured, and it turned out to be the common species which we know in the central zone of the country. The others flew off to adjacent lagoons.

It was impossible to get to Tebenquiche lagoon, the largest in the salt marsh, since we would have needed perhaps two more hours of walking. My greatest fear was to lose our way because of the dust and gravel clouds which hindered our sight. This nitrous dust cloud blasted our faces and the mules, sometimes making movement almost impossible. The gusts of dust would pass, losing themselves in the distance, only to return a few moments later. They could be seen coming as dark, dragging clouds, and at times it was difficult to have to put up with them. Our eyes suffered terribly, since we were not provided with adequate protection. All the plants collected disappeared in the midst of a series of gusts, and we did not have the spirit to get down and round them up again.

We arrived back at San Pedro de Atacama when it was completely dark and found that our helpers were preparing to set out to look for us.

On July 16 I left for Talabre, a ravine which runs parallel to the one at Hekar, beginning at the eastern base of the Laskar volcano in the marshes of Saltar and Tumbre. In this ravine alfalfa is cultivated, and the family which lives there has flocks of sheep and llamas.

In Talabre I found my good old traveling companion, Fabio Soza, with whom I have explored these regions on several occasions; he is a man who knows all the corners of the Andes. He had some insects which he had collected for me, among which were species that were only recently described on the basis of specimens collected in those regions. All were Tenebrionidae and Curculionidae. Among the first were examples of *Entomochilus varius laevis* Kulzer, *Physogaster nitidus* Kulzer, and *Psectraselis intricaticollis* Fairm. Also among the insects collected by him were examples of vespoid wasps and six examples of one of the most extraordinary species of Andean butterflies, already observed by me in the Salar de Pujsa in December, 1952. It is a subspecies of *Argyrophorus lamna* (Satyridae) which will be described by Dr. Ureta.

This butterfly flies from Pujsa to Aguada de la Perdiz, to the east of the Salar de Aguas Calientes, a place near the Argentine Frontier. The species is very difficult to obtain since its flight is so rapid, and because of the height of its habitat, close to 4,300 meters, it is almost impossible to run in order to capture it.

With Fabio Soza as our guide, we returned to the camp left in Aguas Blancas and continued the trip south in order to visit the Carvajal lagoons situated in the Atacama salt marsh on its eastern side: Peine, Tilomonte, and Tilopozo.

Carvajal Lagoons: Using the jeep, we entered the Atacama salt marsh on the east side as far as the muddy ground permitted and set up one kilometer from the Carvajal lagoons. On looking over the lagoons with binoculars, I could see hundreds of flamingos in the water. I could clearly see three different species, among which was a small white form which turned out to be a female "parina chica," *Phoenicoparrus jamesi.* On entering the lagoon we found the remains of the flamingo nests. There were dozens of mounds of white mud, already much worn but still sticking out of the water a few centimeters.

On the following day, we collected a pair of *Phoenicoparrus jamesi.*

Peine: At an altitude of 2,300 meters on the western slope of the mountains which come down by the Atacama salt marsh is located the village of Peine. It is in the middle of very ancient, abandoned ruins. Surely some of them belonged to that culture and people known as Atacamena, who spoke the curious Kunsa language. This village lived in total isolation from the rest of the country, and the inhabitants were farmers. There is a profusion of "algarrobo" (Mimosaceae) here. The "chanares" (Papilionaceae) trees were slightly green as it was mid-winter. Corn, wheat, and alfalfa are cultivated principally. In the distance groups of flamingos were observed on the Peine lagoon flocking in large numbers to the center of the water. During the summer months this is the favorite place for nesting. The inhabitants of the village gather the flamingo eggs from miles around and pack them in boxes which are then

Male example of the "parina chica" (*Phoenicoparrus jamesi,* Sclater) collected at the Laguna Colorada (Bolivia).

carried on burros towards San Pedro and sold there. Last year it was calculated that they had extracted approximately 10,-000 eggs. It is reported that the flamingos lay a single egg in each nest. When this is removed, the birds will lay a second and finally a third during the nesting months of December and Febary. It appears that flamingos do not nest here every year.

Tilomonte: The oasis of Tilomonte is towards the south and in the middle of the desert, near Peine. It is a true forest of "algarrobo" and "chanares" in the middle of a plain where corn and alfalfa are cultivated, irrigated by the salt water of the ravine.

Tilopozo: On the extreme south of the Atacama salt marsh there is a large area of marsh covered with grasses. We traveled as far as the Banos de Tilopozo which spring from a hot-water overflow. This place must be ideal for birds during the summer nesting season, but they are now absent. The hurricane-force wind made continuing with the jeep impossible because of the hail of sand and rock which had already heavily scratched the windshield.

We returned to Santiago on July 26 after a fruitless visit to the salt marshes of Pedernales and Maricunga, more than 250 kilometers to the south of Atacama. Flamingos do nest on these marshes in the summer months.

PART TWO

Annotated List of Birds Collected or Observed

The list of birds reported here includes observations made in December, 1957, and in January, 1958, on a second visit with Dr. Roger Tory Peterson. Specimens collected are now in the Peabody Museum at Yale University. A series of our material is also in the collection of the Museo Nacional de Historia Natural of Santiago.

Pterocnemia pennata tarapacensis Chubb

Several pairs were observed in Inacaliri at 3,900 meters, and on the Turi pampa (3,100 meters). One specimen was captured by persons from Inacaliri and carried to the San Pedro station with the object of removing its fat, since it is highly desired as a remedy for rheumatism and arthritis. Before this, however, I took the following measurements: length from the point of the bill to the end of the tail, 144 cm; wing, 50 cm; bill, 7.2 cm; tarsus, 33 cm.

On examining the contents of the stomach, I found it replete with roots and thick stems of the tola.

Tinamotis pentlandi Vigors

This species of "partridge" is somewhat frequent in the high regions of the Antofagasta range between 3,500 and 4,500 meters. A slightly wounded specimen attacked me by flying against my face as I approached to photograph it at a distance of 3 meters; later it fled, tossing off a large quantity of fetid excrement. An example was captured in Inacaliri at

4,000 meters altitude. A small flock was observed on the Tatio volcano at 4,400 meters.

Phoenicopterus chilensis Molina

The Chilean flamingo is common in the central zone of Chile. It is found in the lagoons of the north where it is known by the name of "tococo." The specimen taken came from the lagoons of the Ceja marshlands, situated in the interior of the upper sections of the Atacama salt marsh approximately 30 kilometers to the south of San Pedro de Atacama. It was a solitary bird.

Phoenicoparrus andinus (Philippi) Bonaparte

At Ojos del Rio San Pedro two immature specimens of this "parina" were captured, locally called "hiticti." Birds were observed in the Ceja lagoons and in those of Carvajal, situated in the interior of the Atacama salt marsh. At night they could be heard calling, and it is at that hour that they move from lagoon to lagoon. It is difficult to distinguish them from the "parina chica" (*Ph. jamesi*), when they are in their habitat, since it is impossible to approach them, and their coloration and size is very similar.

Phoenicoparrus jamesi (Sclater)

One of the objects of this expedition was to study this rare flamingo. No one has had recent news of this species. In 1957, Dr. Francisco Behn, in company with Mr. A. W. Johnson and Mr. Guillermo Millie, had traveled in these areas with the sole object of finding this bird and making studies of a biological character (Johnson, Behn, and Millie, 1958). They succeeded in capturing a female example and obtained several nests of eggs, all in the Laguna Colorada of Bolivia in the month of February, 1957. In the same place, situated a few kilometers from the frontier, I succeeded in capturing an adult male example and two immature specimens. The population was reduced. I was only able to see 7 adults and about 20 nestlings already old enough to fly. The adults were extremely shy; not so the young ones which walked about tranquilly scarcely

10 meters from us, as we, with the water a little bit below our knees, were exploring the lagoon in the region not affected by ice. Later on, in the lagoons at Carvajal to the east of the Atacama salt marsh and in front of the Hekar or Camar ravine, we succeeded in capturing another example.

This "parina," called "chururu" by the inhabitants, is probably not as rare as had been thought previously. Many times my attention was called to the fact that the mountain lagoons were almost completely deserted by birds, according to information received from the inhabitants. However, the flamingos were abundant in the Laguna Colorada during the summer and nested there. This was proved by Dr. Behn, although his calculation for the species was low, 6-8% of the total of 3,000 birds of 3 species seen (*tom. cit.* 1958: 296).

With the object of studying the possible movements of the species about the Atacama salt marsh area, I traveled among the lagoons of the interior observing an immense quantity of flamingos in a number almost impossible to calculate. But, in view of the quantity of little lagoons which exist in this vast region, I cannot make any firm estimate of this population. Unfortunately, I was not able to go as far as the Punta Negra salt marsh which is south of the Imilac railroad station. I was assured that flamingos nest there by the thousands during the months from December to February. It seems to me that the Atacama salt marsh is the nesting center and the place in which the majority of the flamingos spend the winter.

These flamingos are vagrants. The mountain lagoons freeze, though not entirely, since nearly all of them receive hot springs. But the influence of hot water is only felt in a limited space, as I had observed in the Laguna Colorada (Bolivia) and the Laguna Verde. These birds migrate to salt-water lagoons of a better climate such as the Atacama salt marsh. Some specimens maintain themselves in the Andean lagoons, but they are always isolated.

In the entire region the people who know about the "parinas," including the natives who spend the summer on the Laguna Colorada as well as the people from Toconao, Peine, and Socaire, who live for a part of the year on the eggs of these birds, distinguish four well-defined species of flamingos and "parinas." They have a name for each, taken from the call which the birds emit. The first is the "tococo" (*Ph. chilensis*), the common species which is also found in the central region of Chile. The second is the "hiticti" (*Ph. andinus*) which is more reddish in color than the first one and larger in size. Its call is very similar to its name: "hi-ri-ri-ri-ri-ri." The third one is the "chururu" (*Ph. jamesi*) which is the species that was thought to be the most scarce and turns out to be the most abundant. Its characteristic call is "chu-ru-ru-ru-ru-ru." The fourth is a species which we have not been able to locate. In my opinion it comprises young examples of *jamesi*. On various occasions I was able to hear its call of "huaj-cha-ta-ta."

Upon observing the stomach contents of these birds (*Ph. jamesi*), I found only some mud of greenish-yellow color mixed up with fine sand. Under the microscope I could see that the contents represented a compact mass of diatoms, which agrees with the observations of Dr. F. Behn.

Phoenicoparrus jamesi is a common enough bird, as are all the "parinas" and flamingos of the Andes. It is very difficult to observe and capture, however, since it is very shy. It nests on the Laguna Colorada of Bolivia and almost positively on the Andean salt-water lagoons such as the Pujsa salt marsh and the Loyoquis salt marsh. According to the word of the people of the region, it lays eggs three times a year.

A second visit to Laguna Colorada made by Dr. Roger Tory Peterson and myself from December 20-27, 1958, adds to our knowledge of the relative abundance of the three flamingo species. During the second visit the observed ratio of flamingos was:

Ph. jamesi	no less than 7,000.
Ph. adinus	300.
Ph. chilensis	100.

This compares with the figures of Johnson, Behn, and Millie for January, 1957 (*tom. cit.* 1958):

Ph. jamesi	40 to 50.
Ph. adinus	1,500 approximately.
Ph. chilensis	1,500 approximately.

Chloëphaga melanoptera (Eyton)

I have observed this species always in pairs at altitudes of 3,500 meters (Ojos del Rio San Pedro) to 4,250 meters on the marshlands which are the sources of the Salado River; that is, the Tatio Geysers. It was not possible to capture examples.

Lophonetta specularioides alticola (Ménégaux)

This is perhaps the most common duck of the mountain marshlands which were explored. I observed it from 2,400 meters to 4,400 meters in Chile as well as in Bolivia. It nearly always travels in pairs and is rarely seen in flocks (the ravine of Pastos Largos, Atacama). It is known as the "pato rial" and is very much desired on account of its flesh and size. It is easily distinguished because it is much larger than the other ducks with which it lives.

Anas versicolor puna Tschudi

Rare in the region explored; I observed some examples only in the Ojos del Rio San Pedro (3,800 meters) and in the Laguna Colorada of Bolivia at 4,400 meters.

Anas flavirostris oxyptera Meyen

A common duck on the Inacaliri marshes and on the Ojos del Rio San Pedro. They were observed in flocks of from 15 to 30 examples. It was also seen on Laguna Colorada, Bolivia, at 4,400 meters; Tilopozo (2,400 meters); the Putana River; and the ravine of Pastos Largos, this last in the province of Atacama.

Fulica americana peruviana Morrison

Very common in the Ojos del Rio San Pedro where it is persecuted by hunters.

Fulica cornuta Bonaparte

This rare species is known only from the high ranges of the Andes. It is called "huari" or "socar" by the natives.

Very little is known about its habits. I observed 36 examples on the Laguna Verde at 4,100 meters. They were all swimming on the eastern side of the lagoon, since the water there is always temperate. The rest of the lagoon was frozen over with a thick cap of ice. It was very amusing to see these birds emerge from the water and try to walk on the ice, while attempting to fly. It was impossible for them to maintain their footing on the frozen surface. They lived there in common with a large group of *Podiceps occipitalis juninensis*, some pairs of *Lophonetta specularioides alticola* and *Anas flavirostris oxyptera*. Three examples were captured and were weighed as follows: ♀, 4 lbs.; ♂, 5 lbs. 12 oz.; ♂, 5 lbs. 5 oz.

The color of the bill is yellow, with greenish-olive tints. Towards the base it is somewhat reddish and the upper part of the culmen is black. The feet are greenish-black with some yellow. The iris is red.

All of the examples which were observed had fully developed caruncles. On opening their stomachs, I found little food, and this was made up of aquatic grasses which abound in the temperate parts of the lagoon. Most of the stomach contents consisted of volcanic sand.

In a little lagoon near the Laguna Verde (Bolivia) the remains of the nests of these *Fulica* were seen. For a description of the nests farther south see Ripley (1957 a and b), and Behn and Millie (1959).

Oreopholus ruficollis (Wagler)

Flocks with numerous specimens were observed in the marshlands of Turi at 3,200 meters. They were extremely shy. They flew in more or less compact groups and at a distance of more than 200 meters. They are known by the name of "chuchúri" or "tiutila."

Charadrius alticola (Berlepsch and Stolzmann)

A relatively scarce bird which was observed only in the Inacaliri marshes (4,000 meters). It was abundant at the Tatio volcano (4,250 meters) and was even more common in the

Atacama salt marsh, on the Carvajal lagoons, and the marshlands at Ceja.

This plover was seen running after food on the muddy little beaches which are formed at the shores of the salt marsh lagoons.

Phegornis mitchellii (Fraser)

It is known as "pijlulo" by the inhabitants of the Inacaliri region. Only two examples were observed in the Inacaliri marshes at approximately 4,000 meters.

Capella paraguaiae innotata Hellmayr

Only one snipe was observed in the marshes of Inacaliri. It flew off at the moment my foot was about to crush it. According to what I was told, it is quite common during the summer months.

Recurvirostra andina Philippi and Landbeck

The "caiti," known in the region as "caichón," is frequently found in the salt-water lagoons and lowlands of the Andean region. The two examples obtained are immature and come from the Laguna Colorada. At that place there were small groups of three to seven specimens resting on the warm water of the lagoon, since the rest of the water was frozen. This friendly little bird was also observed in the lagoons of the marshes of Ceja and Carvajal in the interior of the Atacama salt marsh (2,400 meters).

Thinocorus rumicivorus rumicivorus Eschscholtz

Two examples were taken in June while the camp was being set up in the desert region in front of the village of Domeyko in the province of Atacama. It is a bird which abounds in the region.

Thinocorus orbignyianus orbignyianus

I. Geoffroy St. Hilaire and Lesson

The "puco-puco" or "poco-poco" is very common in all of the marshes explored; it was observed between 3,800 and 4,300 meters. It is always seen in little flocks of three to eight. It is elusive, hiding itself among the crevices where the water from the marshes runs, always with its head sticking up. As soon as it takes flight, it utters a characteristic cry.

Larus serranus Tschudi

The "gaviota" is frequently found in all weather in the lagoons of the high ranges of the Andes. An example was observed in the Laguna Colorada of Bolivia (4,400 meters) living with "caitis" and "parinas." Others were seen on the lagoons of Carvajal and the marshes of Ceja in the interior of the Atacama salt marsh (2,400 meters). All were wearing their faded winter plumage.

Zenaidura auriculata auriculata (Des Murs)

This dove, so common in the central zone of the country, had not been captured previously in Antofagasta. In San Pedro de Atacama it is extremely abundant during the winter months. Several flocks were observed in Toconce as well as in the high desert zone of Paposo (the southern coast of the province of Antofagasta). An example was secured from Toconce (3,030 meters).

Metriopelia melanoptera melanoptera (Molina)

An example was collected in Lasana on the banks of the Loa River.

Psilopsiagon aurifrons orbygnesius (Souancé)

Several flocks of "caturros" were observed in Inacaliri (4,100 meters), in Toconce (3,030 meters), and on the outskirts of the Talabre ravine (3,200 meters). It is a rather common little parrot which nests in the area.

Crotophaga sulcirostris sulcirostris Swainson

I was surprised to find an example of this bird in Peine because it had to cross so many kilometers of desert area to arrive there. I observed it among the branches of a Bolivian pepper tree which is near the public square. According to what the natives told me, this bird had arrived there at the end of the month of March. It was not captured.

Oreotrochilus estella d'Orbigny and Lafresnaye

Common in Toconce where some examples were collected. They are to be seen in cultivated areas visiting the flowers of the nettle "ortiga."

Geositta isabellina (Philippi and Landbeck)

This species, so rare in collections, was observed on the outskirts of Potrerillos in the province of Atacama while I was on the road to the salt marshes of Pedernales. It has only been known previously from the province of Coquimbo further south.

Geositta punensis Dabbene

Very common in several places between 3,200 meters and 4,300 meters. It is found most frequently around houses and in the regions of the tolas. It is known by the name of "roilita" (Talabre). Some examples were taken on the outskirts of the Turi marshes (3,100 meters) and in the tolas of Inacaliri.

Upucerthia dumetaria hallinani Chapman

A rather common species which is difficult to capture because it is very shy. Examples were observed in Ayquina (3,030 meters), Guatin (3,500 meters), Peine (2,400 meters), and San Pedro de Atacama (2,400 meters). It is always seen traveling over the sown and cultivated terraces. It emits a strident and characteristic call. It is commonly known as the "lucho-lucho" (Toconce) or the "lichi-lichi" (Talabre).

Upucerthia ruficauda (Meyen)

This bird is quite rare. It frequents the tolas where a few examples were seen. It was observed in Linzor (4,100 meters) and Inacaliri (4,000 meters).

Asthenes modesta modesta (Eyton)

Common above 3,500 meters, it was observed among the tolas. It is frequently seen on rocks and on the ground searching out its food. It is very easy to capture since it allows one to approach to within a few meters. The vulgar names given to it in these regions are "pipo," "lucho-lucho," and "cacique" (Peine).

Leptasthenura aegithaloides berlepschi Hartert

Known as "tijerita" or "chiriviri" (Talabre) and as "quiron" in Peine, it is a very common little bird between 2,400 meters (San Pedro de Atacama) and 4,100 meters (Linzor). It frequents cultivated fields and the regions of the tolas. It is always seen among the shrubs searching out food.

Cinclodes fuscus albiventris (Philippi and Landbeck)

Very common in the marshes and rivers in Inacaliri (4,100 meters), the Ojos del Rio San Pedro (3,800 meters), Silala (4,200 meters), Vegas del Tatio (4,300 meters), Toconce (3,300 meters), Guatin (3,500 meters), Peine (2,400 meters), and the Laguna Colorada of Bolivia (4,400 meters). It is extremely tame; the natives call it "requete chico" (Toconce), "alcalde," and "itirico" (Peine), and "sapero" (Talabre). It lives in some places with the congeneric *C. atacamensis atacamensis*. In observing the stomach contents of some samples, we found insect larvae, possibly of Lepidoptera Heterocera, and many remains of aquatic vegetation.

Cinclodes atacamensis atacamensis (Philippi)

Less frequent than the previous species. Several examples were captured in Toconce (3,300 meters), Linzor (4,100 meters), and Silala or Siloli (4,300 meters). No examples were observed in Inacaliri (4,100 meters). In an example taken in Linzor, I found remains of coleopterous insects of the family Elmidae, so common beneath the stones submerged in the streams. There were also little stones and an uncountable number of little snails of the genus *Littoridina*.

Agriornis andicola albicauda (Philippi and Landbeck)

The "gaucho" is one of the rare species which with luck may be observed from time to time. It has only been found in Putre in the interior of the province of Tarapaca, Department of Arica. A specimen from Linzor was collected on the outskirts of the Ojalar River at an altitude of 4,100 meters.

Agriornis montana maritima (Lafresnaye and d'Orbigny)

Examples were observed in Inacaliri (4,000 meters) and in its immediate environs. In Linzor (4,100 meters) it seems to be more common, though not so in Toconce (3,300 meters) where it was rather scarce.

The stomach contents of one of the examples was composed of the seeds of the prickly grass (*Oxychloe andina* Phil.) which grows in the swamps and marshes, the remains of a chrysidid hymenopteran, and a species of Diptera (Syrphidae, genus *Volucella*). In a female example captured in Linzor I found its stomach full of the same seeds, water plants from the streams, and the remains of insects which were impossible to determine. In another male example I found seeds and a wing-bone of a small bird. In Peine I observed a "gaucho" in the process of killing a small mouse.

These birds frequent the tolas, the shores of streams, and marshes.

Muscisaxicola rufivertex pallidiceps Hellmayr

Known as "fraile" or "cura," it is one of the most characteristic birds of the traveled regions. It is quite common between 3,300 meters and 4,250 meters. It frequents the marshlands and streams in search of food.

Muscisaxicola capistrata (Burmeister)

As common as the previous species and with very similar habits. Examples were observed in all the places visited from 3,200 to 4,250 meters. This "fraile" dwells in Patagonia and in Tierra del Fuego and spends the winter in the ranges to the north. All of the examples had very faded plumage.

Muscisaxicola maculirostris maculirostris Lafresnaye and d'Orbigny

Called the "fraile chico," it is very common in Ayquina (3,030 meters). It has been observed running on the cultivated terraces and on the shores of running waters. In San Pedro de Atacama (2,400 meters) ground-tyrants were observed in the fields cultivated with alfalfa.

Lessonia rufa oreas (Sclater and Salvin)

Only one example was captured at the Ojos del Rio San Pedro (3,800 meters), even though some pairs were observed in the marshes which form the streams which are the sources of the San Pedro River. Few examples were observed in the lagoons of Carvajal in the interior of the Atacama salt marsh.

Anthus correndera catamarcae Hellmayr

I observed this subspecies of "bailarin chico" in the marshlands of the Ojos del Rio San Pedro, 3,800 meters; also, in a lesser quantity, in the marshlands of Ceja, which are in the interior of the Atacama salt marsh at 2,450 meters; and in great abundance at the southern extremity of the same salt marsh at the location of the Tilopozo marshes. They are always found in humid places among the tall grasses where they hide, making their capture rather difficult. It is a rather shy little bird.

Troglodytes musculus atacamensis Hellmayr

Common in the thickets of San Pedro de Atacama between 2,400 and 3,300 meters.

Turdus chiguanco anthracinus Burmeister

This species of thrush, very common in Bolivia and Argentina, has been sporadically collected in Chile. Its nesting had never been observed before in Chilean territory. On this trip I was able to observe numerous examples in the valleys of the Loa (Lasana) River. In San Pedro de Atacama, where it is known as "lachirachi," it is extremely abundant, as it is also in the oasis of Toconao (2,400 meters). According to information given by the natives, I was assured that they nest there.

Passer domesticus domesticus (Linnaeus)

The "gorrion" has now arrived at the village of San Pedro de Atacama, with its usual instincts of destruction towards the small autochthonous birds.

Phrygilus atriceps (Lafresnaye and d'Orbigny)

I found this beautiful fringilline in abundance in Toconce at 3,300 meters. Some examples were captured on the outskirts of Linzor (4,100 meters). They also abound in Guatin, a place located to the northeast of San Pedro de Atacama at more or less 3,500 meters altitude. They always travel in small flocks. The female is much rarer than the male, and we were able to capture only one example in Toconce. It is a harmful bird since it destroys vegetables and eats corn, wheat, and oats, especially when they have not yet matured. It is vulgarly known by the name of "comesebo." In Talabre it is called "chasca."

Phrygilus unicolor unicolor (Lafresnaye and d'Orbigny)

Only a few examples were observed, both in Siloli (Silala) at 4,200 meters and in Toconce (3,300 meters). An example was observed in the Laguna Colorada and another in the Laguna Verde, both in Bolivia.

Phrygilus dorsalis Cabanis

This rare little bird, known in Chile by only two or three examples found in these ranges, turns out to be extremely common and numerous specimens were observed and captured. The "sulte," as they call it in some places, was observed in Inacaliri (4,100 meters), Silala or Siloli (4,300 meters), the Tatio Geysers (4,200 meters), Linzor (4,100 meters), and Laguna Colorada in Bolivia (4,400 meters). I understand that it abounds in Tumbre, a place to the northeast of the Laskar volcano at an approximate altitude of 4,000 meters, where I was assured that it nests. It is not a shy bird and frequently approaches to within a few meters. Numbers are seen in the surrounding areas of the small streams which form the marshes of the deep ravines. When chased, they fly toward the walls of the ravine, resting themselves on the rocks. From time to time they may be seen flying directly upwards where they remain immobile in the air by beating their wings. Later they let themselves fall again toward the earth. Their presence is revealed by a fine call which they express with a penetrating "pii."

Phrygilus fruticeti fruticeti (Kittlitz)

The "yale" is known in a large part of the country as a rather destructive and damaging little bird. It is frequently seen in Toconce (3,300 meters), Guatin (3,500 meters), and Talabre (3,300 meters) where I was able to observe it in flocks of about 20 birds.

Zonotrichia capensis antofagastae Chapman

This is perhaps the most characteristic bird of agricultural sites situated between 2,400 meters and 3,500 meters in the entire region visited. It is known by the name of "chincol" and is extremely common in the village of Toconce (3,300 meters), at Ayquina (3,030 meters), San Pedro de Atacama (2,400 meters), Tilomonte and Toconao (2,500 meters). It is observed in groups or alone.

Spinus atratus (Lafresnaye and d'Orbigny)

The "canario" is very much desired by the natives as it has a beautiful song. After capturing them by means of traps, they raise them in cages. They abound in the region of Siloli in the summertime. We were not able to obtain examples in spite of having seen some in the Toconce ravine (3,300 meters).

Sicalis uropygialis uropygialis (Lafresnaye and d'Orbigny)

I only observed two flocks of this "chirigue," both very numerous. One of them was at the Ojos del Rio San Pedro (3,800 meters) and the other at the Vegas de Inacaliri, a place close to 4,000 meters.

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II

DIATOMS (*BACILLARIOPHYCEAE*) FROM THE ALIMENTARY TRACT OF *PHOENICOPARRUS JAMESI* (SCLATER)*

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During December, 1957, *Phoenicoparrus jamesi* (Sclater) was collected by Señor Luis Peña from Laguna Colorado Puna de Atacama, Bolivia, at an elevation of 4,400 meters. Walcott (1925) describes this lake as strongly alkaline with springs at the north end. On the shores were salt deposits consisting of sodium and potassium carbonate, sodium chloride, and borax. In July, 1957, Señor Luis Peña collected this species in Salt Lake, Atacama, Chile and in Lagunas de Carvajal (salt), Atacama, Chile. Both collections were taken at an elevation of 2,400 meters.

An analysis of the contents of the alimentary tracts of these birds showed that they were mainly diatoms. The most common species were *Navicula carvajaliana* sp. nov., *Amphora atacamana* sp. nov., *Navicula luisii* sp. nov., and *Nitzschia accedens* var. *chilensis* var. nov.

These findings confirm the prediction of Jenkins (1957), based upon the type of filters of *Phoenicoparrus jamesi*, that this bird would feed on algae or diatoms. It is interesting to note that the more common diatoms in the alimentary tract have a similar size range.

At all three locations the commoner diatoms were the same. This is probably due to the fact that the areas in the lake which were favorable feeding grounds for these birds supplied ecologically similar habitats for diatoms. Also, since these strongly alkaline salt-water lakes represent a very specialized

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habitat for diatoms, the numbers of kinds of species which can grow under these conditions are relatively limited, and therefore the diatom floras of these lakes would be more similar than is generally the case in the more usual fresh or brackish water lakes. The two lakes in Chile are quite close together, but it is unlikely that the birds captured in Bolivia had previously fed in the Chilean lakes.

The fact that flamingos may feed on algae has been reported by various workers. Ridley et al. (1955) and Jenkins (1957) state that in East African Lakes, *Phoeniconaias minor* (Geoffroy) feeds almost exclusively on blue-green algae and on small diatoms. Usually diatoms are mixed with the blue-green algae and sometimes diatoms without the blue-green algae seem to be the main source of food.

According to a letter written by Dr. Robert P. Allen to Mr. Ridley (Jenkins, 1957), *Phoenicopterus ruber* Linné in the Bahamas feeds on mud rich in bacteria, blue-green algae and, to a lesser extent, diatoms.

A systematic list of the species identified in this study is given below. The slides on which these identifications are based are in the diatom herbarium of the Academy of Natural Sciences of Philadelphia. The type specimens are ringed on the slides.

Suborder MONORAPHIDINEAE

Family Achnanthaceae

Genus Achnanthes Bory

Achnanthes brevipes var. *intermedia* (Kütz.) Cl.

Achnanthes brevipes var. *intermedia* (Kütz) Cl., K. Svenska Vet.-Akad. Handl., ser. 2, *27* (3): 193, 1895.

Distribution: Chile, Atacama, Salt Lake, alt. 4,400 m, coll. Luis Peña, July, 1957 (A-G.C. 26098).

Achnanthes hauckiana var. *rostrata* Schultz

Achnanthes hauckiana var. *rostrata* Schultz, Bot. Arch., *13*: 191, fig. 39, 1926.

Distribution: Chile, Atacama, Salt Lake, alt. 4,400 m, coll. Luis Peña, July, 1957 (A-G.C. 26098a); Lagunas de Carvajal, alt. 2,400 m, coll. Luis Peña, July, 1957. (A-G.C. 26100).

Family NAVICULACEAE
Genus Navicula Bory

Navicula atacamana sp. nov. Pl. 1, Fig. 10

Valva lineari-lanceolata apicibus acutis apiculatis leniter. Area axiali angusta. Area media rectangularis latus distendens ad margines valvae. Striis lineatis, parallelis in media parte valvae et convenientibus ad apices. Striis, 10-11 in 10μ; longitudo, 49-50μ; latitudo, 6-7μ.

Valve linear-lanceolate with acute, slightly apiculate ends. Axial area narrow. Central area a broad rectangle extending to the margins of the valve. Striae lineate, parallel in the center of the valve and slightly convergent toward the apices. Striae, 10-11 in 10μ; length, 49-50μ; breadth, 6-7μ.

This species is similar in shape, striae structure and angle, and narrowness of axial area to *Navicula directa* (W. Sm.) Cl. It differs in the presence of a broad rectangular central area and in its smaller size.

TYPE LOCALITY: Bolivia, Puna de Atacama, Laguna Colorado, alt. 4,400 m, coll. Luis Peña, December, 1957.

SPECIMEN ILLUSTRATED: A-G.C. 26098a, Holotype.

DISTRIBUTION: Known only from the type locality.

Navicula carvajaliana
var. **carvajaliana** sp. nov. Pl. 1, Figs. 1, 2, 3

Valva lineari ad linearem-lanceolatam. Apicibus mutabilibus in forma rotundis, cuneatis aut rostratis. Pseudosepta brevi distende supra apices. Area axiali distincta semper ferme minus quam uno quadrante latitudinis valvae. Area media mutabili, transversa formante fasciam saltem in uno latere valvae, altero latere saepe cum uno aut duobus striis positis late. Striis radiatis leniter in media parte valvae, parallelis aut conventis leniter ad apices. Angulo striarum inique facto valve concava leniter ad aream axialem. In formis angustis striis paene parallelis et valva non concava ad aream axialem. Striis fractis inaequaliter, punctis obscurissimis, si adsunt. Striis, 14 in 10μ in media parte valvae ad 18 in 10μ ad apices valvae; longitudo, 36-70μ; latitudo, 8-15μ.

Valve linear to linear-lanceolate. Apices variable in shape, rounded, wedge-shaped or rostrate. A short pseudoseptum extending over each of the apices. Axial area distinct, usually less than one-fourth the width of the valve. Central area variable, transverse, forming a fascia at least on one side of the valve, the other side often with one or two widely placed striae. Striae slightly radiate in center of valve, parallel or slightly convergent at the apices. Angle of striae partially caused by the valve being slightly concave toward the axial area. In narrow forms the striae almost parallel and valve not concave toward axial area. Striae irregularly broken. Puncta if present very indistinct. Striae, 14 in 10μ in center of valve to 18 in 10μ at ends of valve; length, 36-70μ; breadth, 8-15μ.

This taxon is highly variable as to the shape of the valve, and one would recognize some of the variations as separate subspecies or varieties if they did not intergrade into each other. On plate 1, figs. 1, 2, 3 are illustrations showing some of the extremes of variation of these intergrading populations. Some specimens have been found, that are not illustrated, in which the apices of the valve are not drawn out, but the valve simply narrows to a rounded end.

This species is a member of that group of taxa which are intermediate between *Stauroneis* and *Navicula*, that is, it seems to be closely related to *S. thermicola* (Peters.) Lund (New Phytol., *45*(1): 61, figs. 3 K-AA, 1946) and *Navicula incomposita Hagelstein* (New York Acad. Sci., Sci. Surv. Porto Rico & Virgin Isl., *8*(3): 286, pl. 7, fig. 2, 1939). This taxon resembles *Stauroneis* in that the specimens have a transverse hyaline area which in girdle view seems to be slightly thickened, particularly at the central nodule of the valve. However, it does not have striae which are radiate at the ends of the valve and resolvable into puncta, which characters are typically associated with species belonging to the genus *Stauroneis*. This species has a pseudoseptum at the ends of the valve which is found in species belonging to the genera *Stauroneis* and *Navicula*. Since I cannot be sure that the central area is a true stauros and since the striae, although breaking into irregular pieces, do not resolve into puncta and are slightly convergent at the ends, it seems wiser to place this species in the genus *Navicula*.

This taxon is also related to *Navicula allorgei* Manguin (Algues Guadeloupe, p. 58, pl. 3, fig. 51, 1952) but differs in the angle of the striae and the usual presence of a distinct fascia at least on one side of the valve. It is also larger and the shape is more variable.

Type locality: Bolivia, Puna de Atacama, Laguna Colorado, alt. 4,400 m, coll. Luis Peña, December, 1957.

Specimen illustrated: A-G.C. 26098a, Holotype, fig. 1; Cotypes, figs. 2, 3.

Distribution: In addition to the type locality: Chile, Atacama, Carvajal Lake, alt. 2,400 m, coll. Luis Peña, July, 1957 (A-G.C. 26100); Atacama, Salt Lake, alt. 2,400 m, coll. Luis Peña, July, 1957 (A-G.C. 26099a, b).

Navicula carvajaliana var. **attenuata** var. nov. Pl. 1, Fig. 12

Valva lineari lanceolata, apicibus rotundis attenuatis. Pseudoseptis praesentibus. Area axiali angusta, distincta. Area media fascia transversa interdum stria praesenti in ea in uno latere valvae. Striis radiatis leniter in media parte valvae, plus aut minus convenientibus ad apices. Striis intermissis inaequaliter sed non punctatis. Striis, 13 in 10μ in media parte valvae usque 16 in 10μ ad apices; longitudo, 44-60μ; latitudo, 6-11μ.

Valve linear-lanceolate with attenuated, rounded apices. Pseudosepta present. Axial area narrow, distinct. Central area a transverse fascia sometimes with a stria present in it on one side of the valve. Striae slightly radiate in the center of the valve, more or less convergent at the ends. Striae irregularly interrupted but not punctate. Striae, 13 in 10μ in middle part of valve to 16 in 10μ at apices; length, 44-60μ; breadth, 6-11μ.

This taxon is distinguished from the nominate variety by the narrow attenuated ends of the valve. No intergrades were found between this form and the other forms which are highly variable.

Type locality: Chile, Atacama, Salt Lake, alt. 2,400 m, coll. Luis Peña, July, 1957.

Specimen illustrated: A-G.C. 26099a, Holotype.

Distribution: Known only from the type locality.

Navicula luisii sp. nov. Pl. 1, Fig. 4

Valva lineari lanceolata, apicibus rotundis acutis. Pseudosepto ad apices. Area axiali distincta circa unum quadrantem latitudinis valvae. Area media fascia transversa. Striis attingentibus aream crassioribus quam alterae striae. Striis radiatis leniter per magnam partem valvae, parallelis ad apices. Striis, 14-17 in 10μ; longitudo, 63-89μ; latitudo, 9-14μ.

Valve linear-lanceolate with acute, rounded ends. Pseudoseptum present at apices. Axial area distinct, about one-fourth the width of the valve. Central area a transverse fascia. Striae bordering the central area a little thicker than the other striae. Striae slightly radiate throughout most of the valve, parallel at the apices. Striae, 14-17 in 10μ; length, 63-89μ; breadth, 9-14μ.

This species is distinguished from *Navicula carvajaliana* by the striae bordering the fascia being distinctly thicker than the other striae and by its larger size. It is near *N. incomposita* Hagelstein (New York Acad. Sci., Sci. Surv. Porto Rico and Virgin Isl., *8*(3): 386, pl. 7, fig. 2, 1939) but differs in the regularity of the striae which are a little coarser than in *N. incomposita*. The shape of the valve is also different and the axial area is broader.

This species is named for Señor Luis Peña who collected the flamingos which were examined for this study.

Type locality: Chile, Atacama, Salt Lake, alt. 2,400 m, coll. Luis Peña, July, 1957.

Specimen illustrated: A-G.C. 26099a, Holotype.

Distribution: Known only from the type locality.

Navicula oppugnata Hust.

Navicula oppugnata Hust., Arch. Hydrobiol., *40*(4): 925, pl. 42, fig. 1, 1945.

Our specimens differ from those illustrated by Hustedt in that the central area is a little larger and the striae in the middle of the valve are slightly curved. The central area of these specimens is similar to those illustrated by Foged (Folia Limnol. Scandinavica, no. 6, pl. 2, figs. 12-14, 1954).

This species was fairly common in Laguna Colorado.

Distribution: Bolivia, Puna de Atacama, Laguna Colorado, alt. 4,400 m, coll. Luis Peña, December, 1957 (A-G.C. 26098a).

Navicula pseudosepta sp. nov. Pl. 1, Fig. 5

Valva lanceolata, apicibus rostratis ad rostratis-capitatis. Pseudoseptis praesentibus. Area axiali angusta, distincta. Area media non dissimili areae axiali. Striis radiatis in media parte valvae et parallelis ad convenientibus leniter ad apices. Interdum striis in uno latere nodulis mediae crassioribus quam in latere altero. Striis non decernunt in puncta. Striis, 13-15 in 10μ ad mediam partem valvae usque 18 in 10μ ad apices; longitudo, $51\text{-}68\mu$; latitudo, $11\text{-}13\mu$.

Valve lanceolate with rostrate to rostrate-capitate ends. Pseudosepta present. Axial area narrow, distinct. Central area not differentiated from axial area. Striae radiate in the center of the valve and parallel to slightly convergent at the apices. Sometimes striae of one side of the central nodule coarser than on the other side. Striae do not resolve into puncta. Striae, 13-15 in 10μ at center of valve to 18 in 10μ at apices; length, $51\text{-}68\mu$; breadth, $11\text{-}13\mu$.

This species is most closely related to *N. carvajaliana* which is described in this paper. It differs in the lack of a central area which is a fascia on one or both sides of the valve. Also, the striae are not irregularly broken. It resembles in shape of valve and structure of axial and central areas *N. cuspidata* var. *ambigua* (Ehr.) Cl. It differs in the formation of the striae which do not resolve into puncta forming longitudinal lines. Nor are pseudosepta present in *N. cuspidata* var. *ambigua* (Ehr.) Cl.

Type locality: Chile, Atacama, Lagunas de Carvajal, alt. 2,400 m, coll. Luis Peña, July, 1957.

Specimen illustrated: A-G.C. 26100a, Holotype.

Distribution: Known only from the type locality.

Navicula salinicola var. **boliviana** var. nov. Pl. 1, Fig. 11

Valva lineari attenuata ad apices acutos. Area axiali angusta, distincta. Fissuris terminalibus distinctis. Area media vix dissimili areae axiali. Striis lineatis parallelis in media parte valvae et conventis leniter ad apices. Striis, 10-12 in 10μ; longitudo, 16-30μ; latitudo, 4-6μ.

Valve linear, narrowed toward the acute apices. Axial area narrow, distinct. Terminal fissures distinct. Central area scarcely differentiated from axial area. Striae lineate, parallel in center of valve and slightly convergent at the apices. Striae, 10-12 in 10μ; length, 16-30μ; breadth, 4-6μ.

This taxon is very similar to the nominate variety *N. salinicola* Hust. (Abhandl. Naturwiss. Verein zu Bremen, *31*: 638, figs. 61-69, 1939) in size, shape, structure of axial and central areas, and type and angle of striature. It differs in the number of striae, which are much coarser in this taxon.

Type locality: Bolivia, Puna de Atacama, Laguna Colorado, alt. 4,400 m, coll. Luis Peña, December, 1957.

Specimen illustrated: A-G.C. 26098a, Holotype.

Distribution: Known only from the type locality.

Family Cymbellaceae

Genus Amphora Ehr. emend. Kütz

Amphora atacamana sp. nov. Pl. 1, Fig. 8

Margine dorso valvae convexo valide, margine ventrali concavo leniter. Raphe propiore ad marginem dorsum quam ad marginem ventralem. Area axiali angusta, distincta. Area media parva. Striis punctatis subtilissime. Striis, 26-28 in 10μ; longitudo, 31-52μ; latitudo, 6-9μ.

Dorsal margin of valve strongly convex, ventral margin slightly concave. Raphe nearer to dorsal margin than to ventral margin. Axial area narrow, distinct. Central area small. Striae very finely punctate. Striae, 26-28 in 10μ; length, 31-52μ; breadth, 6-9μ.

The valves of the frustules are very convex and therefore the shape varies greatly according to the angle at which they lie on the slide. In some specimens the raphe appears very close to the dorsal margin. Sometimes, as in the illustration, a hyaline area is present near the ventral margin. One rarely finds this diatom in girdle view, but in such specimens as I have seen the intercalary zone is complex.

This species is distinguished by the convexity of the valve, the raphe which is fairly near the dorsal margin, and the very fine striae. The portion of the valve ventral to the raphe lies in a distinctly different plane from the portion dorsal to the raphe.

Type locality: Bolivia, Puna de Atacama, Laguna Colorado, alt. 4,400 m, coll. Luis Peña, December, 1957.

Specimen illustrated: A-G.C. 26098a, Holotype.

Distribution: In addition to the type locality: Chile, Atacama, Salt Lake, alt. 2,400 m, coll. Luis Peña, July, 1957 (A-G.C. 26099a); Lagunas de Carvajal, alt. 2,400 m, coll. Luis Peña, July, 1957 (A-G.C. 26100).

Amphora boliviana sp. nov. Pl. 1. Fig. 9

Margine dorso valvae convexo valide, margine ventrali concavo leniter. Area axiali angusta. Area media lanceolata in forma in latere ventrali raphis, obscuro in latere dorso. Striis punctatis crasse in latere dorso raphis, punctatis obscure in latere ventrali. Striis 18 in 10μ in latere dorso raphis praeter ad apices ubi sint 20 in 10μ. Striis in margine ventrali 22-23 in 10μ, punctatis obscure; longitudo, 57-58μ; latitudo, 7-8μ.

Dorsal margin of valve strongly convex, ventral margin slightly concave. Axial area narrow. Central area lanceolate in shape on ventral side of raphe, indistinct on dorsal side. Striae coarsely punctate on dorsal side of raphe, indistinctly punctate on ventral side. Striae 18 in 10μ on dorsal side of raphe except at the apices where they may be 20 in 10μ. Striae on ventral margin 22-23 in 10μ, indistinctly punctate; length, 57-58μ; breadth, 7-8μ.

This species is characterized by the striae which are coarse and distinctly punctate on the dorsal side and fine and indistinctly punctate on the ventral side. The central area is absent on the dorsal side of the valve and lanceolate in shape on the ventral side. This species does not seem to be very closely related to any species which I have seen. It belongs in the general group of species comprising *A. coffeaeformis* Ag. and *A. acutiuscula* Kütz.

TYPE LOCALITY: Bolivia, Puna de Atacama, Laguna Colorado, alt. 4,400 m, coll. Luis Peña, December, 1957.

SPECIMEN ILLUSTRATED: A-G.C. 26098a, Holotype.

DISTRIBUTION: Known only from the type locality.

Amphora carvajaliana sp. nov. Pl. 1, Fig. 7

Valva marginibus ventralibus concavis et margine dorso convexo valide. Apicibus valvae rostratis-capitatis. Raphe prope marginem ventralem valvae. Area axiali distincta, nulla area media in latere dorso valvae. Striis absentibus in latere ventrali valvae; in latere dorso punctatis crasse, radiatis leniter. Striis, 18 in 10μ; longitudo, 10-28μ; latitudo, 4-5μ.

Valve with ventral margin concave and dorsal margin strongly convex. Apices of valve rostrate-capitate. Raphe near ventral margin of valve. Axial area distinct, no central area on dorsal side of valve. Striae absent on ventral side of valve; on dorsal side coarsely punctate, slightly radiate. Striae, 18 in 10μ; length, 10-28μ; breadth, 4-5μ.

This species is characterized by the lack of striae on the ventral margin of the valve and the coarsely punctate striae on the dorsal side of the valve. This species, in size and shape, resembles *A. banyaiana* Greguss and Weber ? (Botanikai Kozlemenyek, *35*: 287, pl. 3, fig. 55, 1938) but differs in that it does not have a broadening of the axial area into a recognizable central area on the dorsal side of the valve, and the striae are distinctly and coarsely punctate. It also resembles *A. turgida* Greg. (Trans. Roy. Soc. Edinb., *21*(4): 510, pl. 12, fig. 63, 1857) but differs in the striae which are coarsely punctate and finer.

TYPE LOCALITY: Chile, Atacama, Lagunas de Carvajal, alt. 2,400 m, coll. Luis Peña, July, 1957.

Specimen illustrated: A-G.C. 26100a, Holotype.

Distribution: In addition to the type locality: Chile, Atacama, Salt Lake, alt. 2,400 m, coll. Luis Peña, July, 1957 (A-G.C. 26099a).

Family Nitzschiaceae

Genus Nitzschia Hass

Nitzschia accedens var. **chilensis** var. nov. Pl. 1, Fig. 6

Valve linear with rounded ends. Keel puncta short, distinct, distinctis, 12-13 in 10μ; striis distinctis, non decretis facile in puncta, 26-28 in 10μ; longitudo, 56-90μ; latitudo, 5-6μ.

Valve linear with rounded end. Keel puncta short, distinct, 12-13 in 10μ. Striae distinct, not easily resolved into puncta, 26-28 in 10μ; length, 56-90μ; breadth, 5-6μ.

This variety differs from the nominate variety (Hust., Abh. Naturw. Ver. Bremen, *31*: 663, fig. 115, 1939) in the more rounded apices, size of the valve, and the fine keel puncta.

Type locality: Chile, Atacama, Salt Lake, alt. 2,400 m, coll. Luis Peña, July, 1957.

Specimen illustrated: A-G.C. 26099a, Holotype.

Distribution: In addition to the type locality: Chile, Atacama, Lagunas de Carvajal, alt. 2,400 m, coll. Luis Peña, July, 1957 (A-G.C. 26100).

Nitzschia amphibia Grun.

Nitzschia amphibia Grun., Verh. Zool.-Bot. Ges. Wien, *12*: 574, pl. 18, figs. 23 a-c, 1862.

This species was common in the collection.

Distribution: Bolivia, Puna de Atacama, Laguna Colorado, alt. 4,400 m, coll. Luis Peña, December, 1957 (A-G.C. 26098a).

Nitzschia epithemoides Grun. in Cl. and Grun.

Nitzschia epithemoides Grun. in Cl. and Grun., K. Svenska Vet.-Akad. Handl., ser. 2, *17*(2): 82, 1880.

This species was fairly common in the collections. It is a brackish to marine species.

Distribution: Bolivia, Puna de Atacama, Laguna Colorado, alt. 4,400 m, coll. Luis Peña, December, 1957 (A-G.C. 26098a). Chile, Atacama, Salt Lake, alt, 2,400 m, coll. Luis Peña, July, 1957 (A-G.C. 26099a); Lagunas de Carvajal, alt. 2,400 m, coll. Luis Peña, July, 1957 (A-G.C. 23100).

Nitzschia hungarica Grun.

Nitzschia hungarica Grun., Verh. Zool.-Bot. Ges. Wien, *12*: 568, pl. 18, figs. 31 a-b, 1862.

This is a brackish to fresh-water species. It was fairly frequent in the one collection.

Distribution: Bolivia, Puna de Atacama, Laguna Colorado, alt. 4,400 m, coll. Luis Peña, December, 1957 (A-G.C. 26098a).

Nitzschia palea (Kütz.) W. Sm.

Nitzschia palea (Kütz.) W. Sm., Syn. British Diat., *2*: 89, 1856.

This species can stand a great variety of water conditions and often develops in large masses in polluted water.

Distribution: Bolivia, Puna de Atacama, Laguna Colorado, alt. 4,400 m, coll. Luis Peña, December, 1957 (A-G.C. 26098a).

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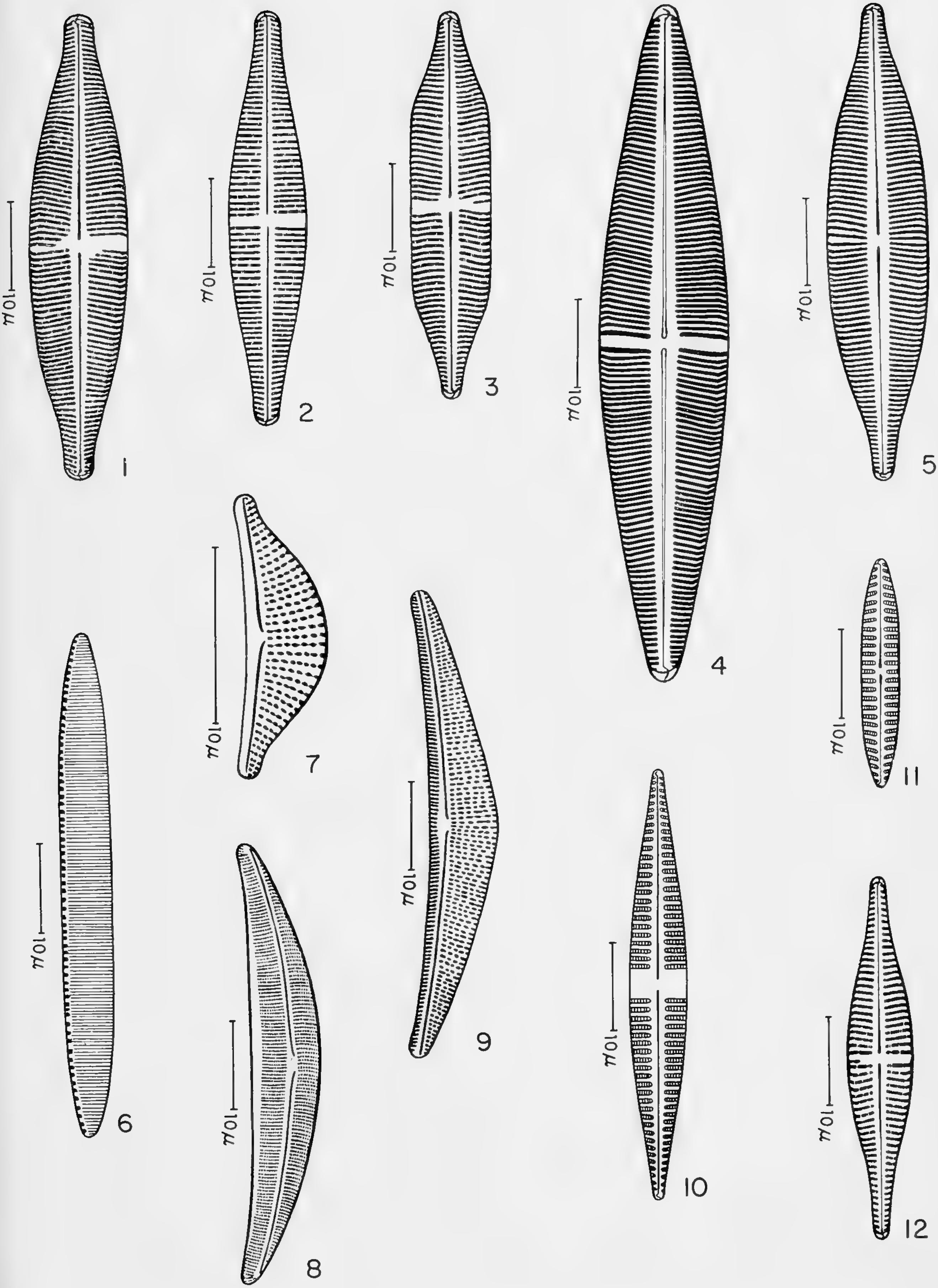
PLATE 1

Fig. 1, 2, 3	*Navicula carvajaliana* sp. nov.
Fig. 4	*Navicula luisii* sp. nov.
Fig. 5	*Navicula pseudosepta* sp. nov.
Fig. 6	*Nitzschia accedens* var. *chilensis* var. nov.
Fig. 7	*Amphora carvajaliana* sp. nov.
Fig. 8	*Amphora atacamana* sp. nov.
Fig. 9	*Amphora boliviana* sp. nov.
Fig. 10	*Navicula atacamana* sp. nov.
Fig. 11	*Navicula salinicola* var. *boliviana* var. nov.
Fig. 12	*Navicula carvajaliana* var. *attenuata* var. nov.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YALE PEABODY MUSEUM

OF NATURAL HISTORY

Number 50 June 26, 1961 New Haven, Conn.

THE AVIFAUNA OF MOUNT KATANGLAD

S. Dillon Ripley

and

D. S. Rabor

In April-May and again in the last week of December 1960, the Peabody Museum of Yale and Silliman University jointly sponsored a small trip by Professor Rabor's assistant, Mr. R. B. Gonzales, and a group of Silliman University students to Mount Katanglad, Bukidnon Province, central Mindanao Island. This area had been visited once before by ornithologists of the Danish Philippine Expedition (Salomonsen, 1953). Mount Katanglad is most interesting as it reaches an altitude of over 7,800 feet above sea level and lies in a range of hills in central Mindanao, somewhat isolated from the high massif of Malindang and Dapiak to the west in the eastern edge of the Zamboanga Peninsula. Likewise, it is separated from the Mount Apo hills of the southeast by the drainage valley of the Mindanao River and from the Diuatan Mountains of the northeast by the similar but narrower valley of the Kalgasan River.

Of the endemic subspecies of montane birds of Mindanao found on Mount Katanglad, four prove to belong to more western Malindang forms and six to southeastern Mount Apo or Mount McKinley forms. Twelve others are shared in common with both areas of mountains, while five forms are found to be endemic to this central mountain massif alone.

The discovery of two new species, a finch and a fire-tail finch, illustrated herein by Robert Verity Clem, is particularly noteworthy.

Accipiter trivirgatus extimus Mayr

A pair of crested goshawks from Mount Katanglad have prompted us to re-examine the Mindanao population. We have, therefore, borrowed material kindly loaned by Dr. A. L. Rand of the Chicago Natural History Museum and Mr. R. M. de Schauensee of the Philadelphia Academy of Natural Sciences. Mayr (1949) reviewed the races of this species and pointed out the differences between the male and female plumages in the adult.

Adult females of *extimus* are very dark tawny rufous on the breast with a variable amount of rufous sometimes forming an almost solid rufous breast-shield as in the male. The flanks are variably barred more lightly or more heavily. When heavily barred they are very close to *trivirgatus* and in fact would be very difficult to separate except for size, being much smaller. When the underparts are lightly barred, the appearance is close to the continental forms except again for size. The Palawan race *palawanus* Mayr is far more distinct from its neighbors, the female's pattern of droplets of blackish rufous on the breast being close only to *layardi* of Ceylon.

Males of *extimus* are far more distinct *interalia* than females, their pale light-rufous underparts setting them apart from *palawanus* or *trivirgatus* with minor variation. The single male from Katanglad is astonishingly dark, approaching *javanicus*. Two Negros males are very light in color with somewhat reduced barring, although they can be matched by a Davao male. A Negros immature tends to be very darkly spotted on the underparts. Altogether, this population shows considerable variation in color which, were it not for its small size, would make it difficult to identify with certainty.

Writing of Ceylon and South India birds, Mayr (*tom. cit.:* 8) questions Whistler's diagnosis of the difference between females from the two areas. Comparing a female of *layardi* from Ceylon with one of *peninsulae* from Kerala, the differences cited by Whistler are shown to be correct. The Ceylon female has smaller and darker markings on the lowerparts, exactly as pointed out by Whistler.

Trichoglossus johnstoniae johnstoniae Hartert

A large series from Mount Katanglad belongs to the Mount Apo form rather than *pistra* Rand and Rabor from Mount Malindang.

Prioniturus montanus waterstradti Rothschild

Six specimens from Mount Katanglad seem as bright about the head as *waterstradti* from Mount McKinley and Apo and also similar to birds from Mount Malindang which have been kept separate as *malindangensis* Mearns by Rand and Rabor (1960). We feel that these Katanglad birds span the slight differences enumerated by Rand and Rabor and that Salomonsen was right in combining the Mindanao populations.

Collocalia esculenta bagobo Hachisuka

A male was taken May 1 above 4,200 feet.

Cuculus saturatus horsfieldi Moore

A female from Katanglad enlarges our collection of this migrant cuckoo from the Philippines to include Luzon, Mindoro, Samar, and Mindanao. Found from sea level to 5,000 feet; all specimens taken in April and early May. Weight: ♂♂ 92.5, 106.5 g, ♀♀ 80, 80 g.

Otus bakkamoena everetti (Tweeddale)

A pair taken on Mount Katanglad at 4,200 feet are in the rufous phase of this small owl as listed by Delacour and Mayr (1946), agreeing well in size and color with two additional specimens from Davao in the Hachisuka collection. A male from Bohol, *boholensis auctorum*, agrees in size with the Mindanao birds but is in the gray phase. The race *nigrorum*

Rand (1950) is a striking one. An adult male in the Yale collection from Cuernos de Negros has a wing measurement of 148 mm; tail, 75; culmen, 20.

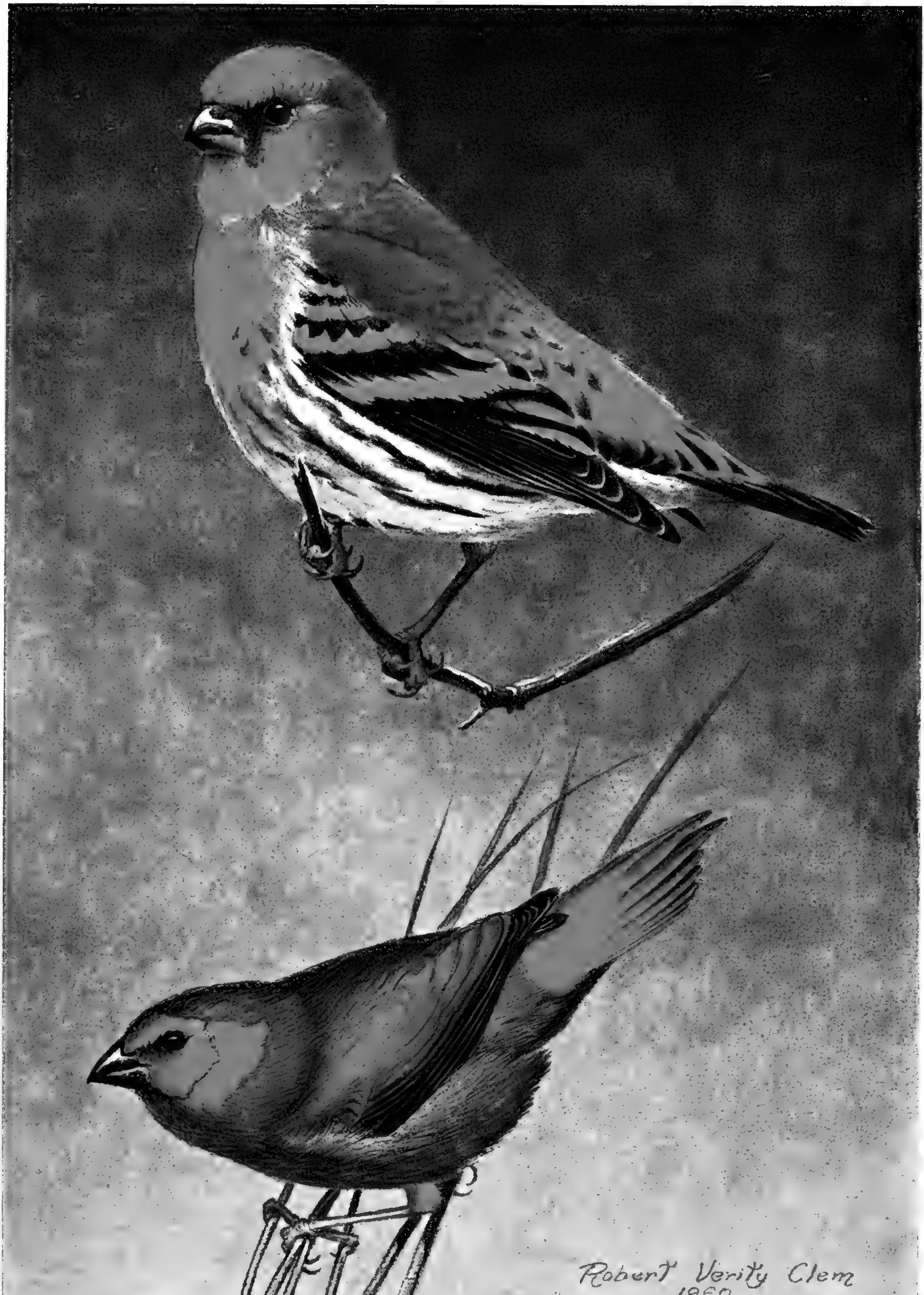
Mimizuku gurneyi (Tweeddale)

A female taken on Mount Katanglad at 4,300 feet represents perhaps the sixth known specimen of this rare species. It measures: wing, 274; tail, 139; culmen (from cere), 26. The description of this genus in Hachisuka (1934) emphasizes the cere which is indeed tumid and in which the external nares are large and prominent. The bill is heavy, the maxillary tomia are buttressed with a cutting tooth-like point before the downward sweep begins towards the tip, a feature totally unlike the smooth bills of *Otus* species. The upper surface has a softly mottled appearance, not heavily vermiculate as in *Otus*, the scapulars ornamented with patches of whitish buff, tipped black, the patches on both inner and outer webs. The back is heavily streaked with black as in the head, the nuchal collar is very broad, the feathers only tipped with black, and the primaries and secondaries have a much reduced, barred pattern.

Until more is known of the habits and behavior of this rare owl, we would hope that its distinct appearance and huge size would entitle it to remain as a monotypic genus.

Batrachostomus septimus septimus Tweeddale

A juvenal sexed as a female was collected May 6. Presumably just out of the nest, this bird has well-formed wings and tail feathers capable of flight, but the feathers about the head and face are still downy. Overall, the plumage can be characterized as juvenal. Some downs, barb downs, carried on the ends of barbs of the juvenal feather tips, may be seen, especially on the throat and undersurface. On the back this bird is indistinctly barred with wavy bars of blackish brown. Some feathers are much darker than others, perhaps indicating a replacement stage. On the undersurface the throat and breast are barred, the belly whitish, the lower tail coverts pale buff.



above *Serinus mindanensis*

below *Erythrura coloria*

Lanius validirostris hachisuka Ripley

Two females of this species have wing measurements of 86.5, 90; culmen (from skull), 20, 20. In size, therefore, they agree with both *hachisuka* Ripley from Mount Apo and *quartus* Rand and Rabor from Mount Malindang. The type and one other specimen of *hachisuka* measure: wing, 87.5, 87.5; culmen (from skull), 20, 19.5. (In the original description [1949] I measured the culmen from the beginning of the feathers of the forehead.) The type and unique *quartus* (1958) measure: wing, 93.5; culmen, 22.

Rand and Rabor separated *quartus* on size and color. The breast and abdomen are whiter, the under tail coverts white, and the flanks richer and deeper rufous. The Katanglad specimens are mixed in color. One resembles *hachisuka* in having a rich rufous wash on the underparts. The other has this confined to the flanks. Dr. Rand has kindly examined these and states (*in litt.*): "One specimen [pale-breasted with rufous flanks] is very similar to the type of *quartus*, differing only in the 2 mm shorter wing, the slightly more pale gray in the forehead (in *quartus* the forehead is almost like the back), and the faint rufous wash on the breast."

These wholly unexpected specimens representing 40% of the known specimens of Strong-billed Shrikes from Mindanao, occurring as they do on an isolated mountain in central Mindanao separating eastern Mount Apo from western Mount Malindang, are surprising in bridging exactly the essential color differences which allowed *quartus* to be described from the west and *hachisuka* from the east. It appears likely that additional Mindanao material would show that these shrikes are oversplit.

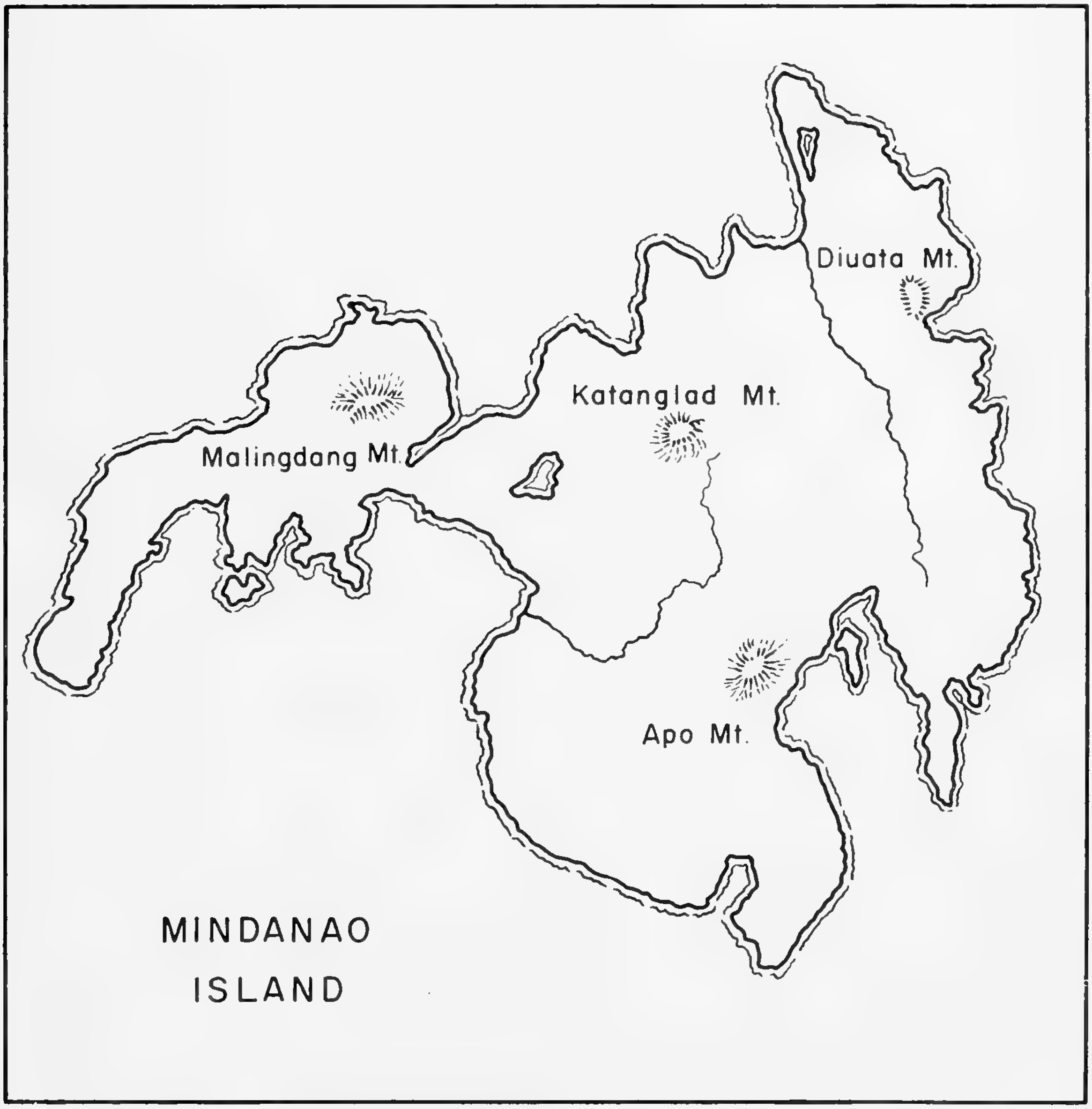
Coracina mcgregori Mearns

We have examined 39 specimens from Mount Katanglad and 15 from Mount Malindang, and we find individual differences in the shade of the color of the flanks are great enough in each population to prevent assigning them to a geographical locality. There is no appreciable difference in the color of the breast. In size we note the following:

Mount Katanglad wing adult ♂♂ 103-108 (104.6), ♀♀ 99-104 (100.8).

Mount Malindang wing adult ♂♂ 104-109 (107.2), ♀♀ 101, 103.

These wing measurements imply an overlap of all but 1 millimeter which seems far too small to be significant. Re-examination of Salomonsen's description and comparison of these specimens forces us to the conclusion that *peterseni* Salomonsen (1953) should be regarded as a synonym of *mcgregori*.



Pericrocotus flammeus gonzalesi subsp.n.

Type: ♂ ad. (Y.P.M. No. 58896), collected May 10, 1960, by R. B. Gonzales on Mount Katanglad, Malaybalay, Bukidnon Province, Mindanao Island, Philippines.

Diagnosis: From *johnstoniae* of Mount Apo, this form differs in the male by being more richly orange-yellow on undersurface, wing edgings, and tail. Two females appear to bear this color difference out, although in one specimen the difference is only readily observable in the color of the tail. Compared to *novus* of Luzon, males are paler, far less vermilion, especially on the rump and tail. Similarly, *gonzalesi* is far less vermilion than is *leytensis*. In general then, *gonzalesi* is a very well-marked intermediate, especially in the males, representing a discontinuous cline in a stage from the lemon-yellow or egg-yellow populations, *johnstoniae* and *marchesae* of Sulu, and the rich vermilion orange of *novus* and *leytensis*.

Measurements: Wing, ♂♂ 78, 83, ♀♀ 78, 80; tail, ♂♂ 76, 83, ♀ 80.

Range: Mount Katanglad, central Mindanao from 4,000 to 5,000 feet.

Turdus poliocephalus katanglad Salomonsen

Salomonsen's description (1953) brings out very well the striking characters of this well-marked subspecies.

Zoothera andromedae Temminck

Another record for Mindanao, taken in May and December.

Ptilocicichla mindanensis mindanensis (Blasius)

A single female of this little-known form was taken December 26, between 4,500 and 5,200 feet.

Macronus striaticeps mearnsi Deignan

A small series of this species confirms the dark-rufous tone of the montane forms of *striaticeps* from Mindanao. It appears as if the Katanglad birds are even darker than those from Mount Apo and Mount Malindang.

Bradypterus caudatus unicolor (Hartert)

Two females were taken on Mount Katanglad April 24 and May 9. They measure: wing, 57, 61; tail, 67, 77; culmen, 15, 14.5. These two specimens are the first of this rare species received at Yale. The bird with smaller measurements is presumably subadult. In any case, the throat is buffy with reduced white patch, no blackish spotting, and the gray of the breast is patchy. It compares favorably with the type of *unicolor* which is also in immature plumage according to Dr. Amadon (*in litt.*) who has kindly compared our specimens in New York. The adult bird appears indistinguishable from *malindangensis* (Mearns) according to the plate in Hachisuka (1935). Under the circumstances, it seems wiser to combine the Mindanao populations under the oldest name *unicolor* for that island pending securing additional material from the Philippines.

Megalurus palustris forbesi Bangs

Taken at 4,000 feet.

Phylloscopus trivirgatus flavostriatus Salomonsen

A series of this form exhibits the distinctive character cited by Salomonsen, darker, more olive crown, more buffy superciliary and pale, washed-out looking underparts. Collected from 5,800 to 7,400 feet above sea level.

Phylloscopus olivaceus olivaceus Moseley

Apparently common from 4,200 to 5,500 feet.

Phylloscopus borealis borealis (Blasius)

Found from 4,200 to 5,200 feet.

Orthotomus cucullatus heterolaemus (Mearns)

Apparently common in the forest from 4,200 to 6,200 feet.

Rhinomyias gularis goodfellowi Ogilvie-Grant

Two males and a female of this little-known form were taken on Mount Katanglad in April at 6,200 feet. The males with wing measurements of 95, 96 are larger than the female (wing

93.5), but otherwise indistinguishable, being perhaps only a trace darker, more slaty on the back.

Muscicapa hyperythra montigena (Mearns)

Three males and five females belong to the rufous-tailed Mount Apo form of this thicket flycatcher. There appears to be no difference in size or color between these birds and the latter race.

Muscicapa panayensis nigriloris (Hartert)

Apparently common above 4,200 feet on Mount Katanglad.

Muscicapa mugimaki Temminck

A female from Mount Katanglad taken December 22 represents our second specimen of this migrant flycatcher from the Philippines, the first being a male from Cuernos de Negros, Negros I., taken December 25, 1952, by Rabor.

Rhipidura nigrocinnamomea hutchinsoni Mearns

This is a somewhat intermediate population, as might be expected, between *hutchinsoni* of northwest Mindanao, Mount Bliss, and Mount Malindang, and southeast Mindanao, *nigrocinnamomea* from Mount Apo. In a series of 22 specimens, all have a more or less broad band of white across the forehead, although the makeup of the skins is often poor in this region. However, 2 of the 22 show traces of white on the upper breast. One of these has the white area as well-developed as typical *nigrocinnamomea*. The other is paler only on the upper breast.

Sitta frontalis apo Hachisuka

A series of 25 specimens from Katanglad is nearer the southeastern Mindanao *apo*, of which the type is in the Ripley collection at Yale. One Katanglad bird, a male, is as dark below and washed with lilac as Rand and Rabor's *zamboanga* (1957). Three specimens of the latter from Mount Malindang show a considerable range of color from very dark washed with lilac below to closely similar to our Katanglad and Mount Apo birds. Evidently, this is a somewhat variable population.

Rhabdornis inornatus zamboanga Rand and Rabor

The smaller creeper from Mount Katanglad appears to match closely *zamboanga* from Mount Malindang, although here we lack the race *alaris* from Mount McKinley.

Dicaeum anthonyi kampalili Manuel and Gilliard

As Salomonsen has pointed out (1960), the Katanglad population agrees with southeastern Mindanao *kampalili*. Our 4 specimens are smaller than those measured by Salomonsen and are, therefore, closer in size to the race named by Manuel and Gilliard. Measurements: wing, ♂ 55, 57.5; ♀ 56, 57. At present there appear to be 10 known specimens of this species. We are grateful to Dr. Gilliard for comparing our male with the American Museum specimen of *kampalili*.

Dicaeum ignipectus apo Hartert

Five males and two females of this rare form were collected at the 4,200 foot level.

Nectarinia jugularis jugularis (Linnaeus)

A pair were collected at 4,200 feet, and agree well with lowland specimens.

Aethopyga primigena primigena (Hachisuka)

A series of 33 specimens from Mount Katanglad agrees perfectly with the type and another male in the Ripley collection at Yale from Mount Apo. These birds were found up to 6,000 feet. An immature specimen taken April 3 has a paler throat with more pronounced yellow on the longitudinal central streak and more noticeable yellow breast spot. The yellow color on the flanks and underparts is paler, also more citrine than in adult examples.

Aethopyga boltoni malindangensis Rand and Rabor

These birds are closer to the west Mindanao race than to that of Mount Apo. They are somewhat darker below, the feathers of the breasts of males and females having pronounced greenish-olive centers, but above they are indistinguishable, sharing with *malindangensis* the tendency to iridescence on the head which is nearly absent in typical *boltoni*. It seems best, then, to keep this population combined with that of Malindang.

Arachnothera clarae malindangensis Rand and Rabor

This newly described form (1957) proves to be represented on Mount Katanglad from whence Gonzales has sent one male taken March 20 at 4,200 feet in breeding condition, and a further 5 specimens in December.

Zosterops montana montana Bonaparte

Apparently very common from 4,000 to 6,200 feet. We cannot distinguish the slight differences between these birds and those of Mount Apo cited by Salomonsen (1953).

Apoia goodfellowi goodfellowi (Hartert)

This mountain whiteye belongs to the Mount Apò subspecies and was found from 4,200 to 7,400 feet.

Hypocryptadius cinnamomeus Hartert

A series of 34 specimens from Mount Katanglad proves to be intermediate when compared with 7 specimens from Mount Apo (topotypical *cinnamomeus*) and 17 specimens from Mount Malindang (*malindangensis* Rand and Rabor). The latter form was described (1957) as being "like *cinnamomeus* of Mount Apo but upperparts brighter cinnamon rufous; breast tinged with brighter cinnamon; abdomen and under tail coverts whiter (less grayish)." One individual from Mount Apo is as bright and whitish below as any specimen from Mount Malindang. Katanglad birds are in general rather somberly colored below, more grayish throughout, but on the upperparts they are indistinguishable from those of Mount Malindang. These differences may be described below:

	Upperparts	Lowerparts
Apo	darker?	darker (86%)
Katanglad	lighter	darker
Malindang	lighter	lighter

If, then, these characters are to be taken at face value, the Katanglad birds should be combined with the Malindang population on the basis of the color of the upperparts, and with the Apo population on the basis of the lowerparts. There is no difference in size.

As the differences at best seem relatively slight, perhaps indicative only, faced with this solomonian choice it seems wisest to us to include all the Mindanao birds under a single name and revert to a monotypic species.

Birds were collected from 4,200 to 6,200 feet.

Serinus mindanensis, sp.n.

Type: ♂ ad. (Y.P.M. No. 58898), collected April 19, 1960, by R. B. Gonzales at Malaybalay, Mount Katanglad, Bukidnon Province, Mindanao Island, Philippines.

Diagnosis: Upperparts blackish-brown, the margins of the feathers indistinctly and widely edged with greenish olive; forecrown extending very nearly to the base of the bill, golden yellow, reaching below to the cheeks, throat, and breast; no white ring around the eye; greater median and lesser wing coverts, rump and upper tail coverts broadly edged with golden yellow; underparts including under tail coverts dull white, the flank feathers narrowly streaked with a central streak of blackish brown; primaries and rectrices black, a faint trace of a yellowish edging on the outer margin of the median portion of the sixth and seventh primary. Bill apparently olive horn-colored, feet dark-brown.

The bill of this species is remarkably stout and arched, far more so in proportion than in *estherae.* The maxillary tomia are angled and thickened to produce a dentate bulge midway from the angle to the tip. This gives a pronounced cutting mechanism to the mid-point of the comissural line.

Measurements: Wing, 70; tail, 49; culmen, 9 mm.

Range: Known only from Mount Katanglad, central Mindanao, southern Philippines.

REMARKS: *Serinus mindanensis,* while obviously close to *estherae,* is best kept in a superspecies. The species *estherae* divides into 3 subspecies as follows:

(a) *vanderbilti* (de Schaunensee), of which *ripleyi* (Chasen) is a synonym, Mount Löser area, Atjeh, north Sumatra, 7,000 feet above sea level;

(b) *estherae* (Finsch), west Java on Mount Pangrango and Poentjakpas near Bogor 4,300 to 6,000 feet and perhaps Mount Telemojo south of Semarang in central Java; and

(c) *orientalis* (Chasen, 1940) east Java on Mount Ajekajek, Tengger mountains over 7,000 feet.

All these races are very similar to each other, differing only in size, tone of color, and size of the white ring around the eye. These populations are roughly equivalent to each other; the sub-specific category is unequivocal. In contrast, *mindanensis* is distinctly different in pattern and color, not equivalent, and to merge it with the races of *estherae* would be decidedly ambiguous.

This specimen has prompted us to look again at the relationships of these isolated montane relict forms. The most recent note on the taxonomy of *estherae* is that of Delacour (1946) who remarked simply: "The species *estherae* is certainly not referable to the genus *Serinus,* but to *Carduelis,* its nearest relative being C. (=*Hypacanthis*) *monguilloti* from the mountains of southern Annam." *Hypacanthis* (type, *spinoïdes*) had been combined earlier with *Carduelis* by Mayr, among others, who remarked (1941): "As far as the genera *Hypacanthis* and *Spinus* are concerned, nobody has yet brought forward any valid reason why they should not be united with *Carduelis,* as Hartert proposed more than thirty years ago."

Hartert (1910) indeed proposed that the Goldfinch be united with the Siskins, Linnet, Twite, and American Goldfinches on the basis of bill shape, color pattern, similarity of wing and tail, and stout feet. This suggestion was followed in the British Handbook (1938 *et seq.*) in which the genus *Carduelis* includes, besides the Goldfinch, the Siskin, the Twite, the Linnet, and the Redpoll. These latter birds, in which the wing pattern differs, browns and pinkish reds predominate in the plumage, and in which the pale-edged forked tail appears longer in proportion to the wing, have been kept separate in *Acanthis* more recently by Vaurie (1959). All of these species have a distinctive bill, almost conical in shape with a tendency to a thickened, swollen base. In contrast *Serinus*, the Serin, the Citril, and the Gold-Fronted Finch, *S. pusillus*, all have short, stubby, thick bills, with the culmen distinctly curved, not straight.

After looking over these species of the Palearctic, it seems impossible to align the species from Java, Sumatra, and Mindanao with *Carduelis monguilloti* or its relatives, *ambigua* and *spinoïdes*. Some of the differences may be expressed below:

	Longest Primary	Wing Patch	Tail Patch	Top of Head	Bill
Carduelis superspecies	first; not always	present on primaries	present	dark, only yellow superciliary	sharp, conical
estherae, mindanensis	second and third	absent	absent	yellow	swollen, bullfinch-like

Once a careful examination of the specimens is made, the island birds with bills as tumid and curved as in the genus *Carpodacus* or *Pyrrhula*, with an entirely different wing pattern, with areas of yellow round the head and breast in a very different arrangement, with the yellow edgings of the rump feathers carried right out throughout the upper tail coverts, it can be seen that they are strikingly different. These species are as different from *Carduelis* in their own right as is *Rhynchostruthus* of the Somali arid zone of northeastern Africa and southwest Arabia.

If these birds do not fit in *Carduelis*, could they then fit in some other Cardueline genus? The first description of *estherae* (Finsch, 1902) placed it in *Crithagra*. The type of this genus is *sulphuratus* of South Africa, and the genus is now considered synonymous with *Serinus*. In the arrangement of the primaries, second and third longest, they fit in better with *Serinus* than with *Carduelis*. *Serinus*, found in the Palearctic and in Africa, is characterized as having a very short, thick, tumid bill, culmen distinctly curved, tail deeply emarginated. The wing is long, longer than the tail, the wing/tail index varying from 75-82%.

	Serinus	*estherae, mindanensis*
Bill	small, tumid	more rounded, more tumid, larger in proportion
Facial Pattern	tendency to superciliary; crown patch in two species	no eye stripe; crown patch
Back	streaked	plain
Tail	forked, wing/tail index 75-82%	barely forked 67-70%
Rump	yellow, usually not on upper tail coverts	yellow extending through upper tail coverts
Wing Covert Edgings ..	normally match color of the back	distinct from back
Outer Web of Primaries	edged with yellow	almost totally reduced or absent

The primary arrangement of *Serinus,* with the exception of *flaviventris* in which the first primary is longest, inclines us to feel that the tropical island species are nearer to *Serinus* than to *Carduelis contra* Delacour. The bill shape is far more similar, especially to some of the African members of the *Serinus* throng. All these are less strongly hooked or rounded, or indeed as swollen in the mid-section of the tomium of the maxilla. In some ways these tropical island species strongly resemble *Carpodacus.* The bill, although more bullfinch-like, resembles that of the common Asian species *erythrinus.* The plumage patterns, if yellows are substituted for reds, are not too dissimilar.

In the same way *Rhynchostruthus* bears a certain resemblance to *Rhodopechys. Callacanthis burtoni* of the Himalayas bears an even closer resemblance to *Carduelis carduelis,* and in this case it is possible to hazard a guess that *burtoni* may be a Palearctic relict which was evolved from an ancestral goldfinch. No such guess seems readily apparent or in order for *Rhynchostruthus* on the other hand.

Our opinion, then, is that these birds belong with the expanded genus *Serinus* and that the Philippine bird, though sympatric, differs as significantly from the three known closely allied races of *estherae* as do the three sympatric forms of *Carduelis, spinoïdes, ambigua,* and *monguilloti,* kept by modern workers, Mayr (*tom. cit. supra*) and Vaurie (1949), as separate species in a superspecies.

Pyrrhula leucogenys coriaria, subsp.n.

Type: ♂ ad. (Y.P.M. No. 58899), collected April 11, 1960, by R. B. Gonzales at Malaybalay, Mount Katanglad, Bukidnon Province, Mindanao Island, Philippines.

Diagnosis: From *apo* Hachisuka (1941), of which the type and one other specimen are in the Ripley collection, this form differs by being darker, more suffused with olive, "mummy brown" rather than "prouts brown" both above and below. From *steerei* Mearns this form differs by being much darker, the darker smoky brown being of the same grayish tones rather than in the more tawny tone of *apo.* All these three populations are smaller than *leucogenys* of Luzon and have all-black bills.

Measurements: Wing, ♂ ♂ 74-79, ♀ ♀ 76, 78; tail, ♂ ♂ 64-66.5, ♀ ♀ 61.5, 64; exposed culmen, ♂ ♂ 10-11, ♀ ♀ 10, 11.5.

Remarks: It is interesting that this race situated in a central position geographically should be much darker than the two populations it separates, that of Mount Malindang to the west and Mount Apo to the southeast. Taken together running from west to east or vice versa, these populations represent a sharply discontinuous geographical cline.

Lonchura malacca jagori (Martens)

As Parkes (1958) has pointed out, this variable black-headed population had best be left under the catch-all *jagori* rather than further split as Salomonsen (1953) has suggested.

Erythrura coloria, sp.n.

Type: ♂ ad. (Y.P.M. No. 58897), collected March 26, 1960, by R. B. Gonzales on Mount Katanglad, Malaybalay, Bukidnon Province, Mindanao Island, Philippines.

Diagnosis: This species resembles *Erythrura trichroa* of the Moluccas and Melanesian areas, thus differing completely from *hyperythra* and *viridifacies*, the other known parrot finches of the Philippines. From *trichroa* it differs in its richer, more intense emerald-green coloration and in the presence of a bright scarlet patch lying behind the blue cheeks and extending from the postocular area down to the sides of the throat. The blue patch covers the forehead and forecrown, the cheeks, and an area immediately behind the eyes.

Measurements: 4 ♂♂ wing, 51-56, ♀ 54.5; tail, 35-38, ♂ 33; culmen (from skull), 11-13, ♀ 11 mm.

Range: Known only from Mount Katanglad, Bukidnon Province, central Mindanao, Philippines.

Remarks: This species was found in small clearings or openings in the forest from 4,200-4,500 feet, often perching on grass close to the ground. The birds were quiet and moved singly or in pairs; when disturbed, flying to the nearest dense growth, often near small streams, perching on branches close to the ground.

Additional Species Taken on Mount Katanglad

Pernis philorhynchus philippensis Mayr
Butastur indicus (Gmelin)
Accipiter virgatus confusus Hartert
Hieraaëtus kieneri formosus Stresemann
Spilornis cheela holospilus (Vigors)
Falco severus Horsfield
Gallus gallus Linnaeus
Ptilinopus leucotis brevirostris (Tweeddale)
Ptilinopus amethystina mindanensis (Manuel)

Ptilinopus occipitalis Gray
Ducula carola mindanensis (Ogilvie-Grant)
Columba vitiensis griseogularis Walden and Layard
Macropygia phasianella tenuirostris Bonaparte
Loriculus philippensis apicalis Souancé
Cuculus fugax pectoralis Cabanis and Heine
Cacomantis variolosus sepulcralis (Müller)
Surniculus lugubris velutinus Sharpe
Centropus viridis viridis (Scopoli)
Eurostopodus macrotis macrotis (Vigors)
Hemiprocne comata comata (Temminck)
Harpactes ardens ardens (Temminck)
Halcyon smyrnensis gularis (Kuhl)
Merops viridis americanus Müller
Eurystomus orientalis cyanicollis Vieillot
Penelopides panini affinis Tweeddale
Aceros leucocephalus leucocephalus (Vieillot)
Megalaima haemacephala haemacephala (Müller)
Dryocopus javensis multilunatus (McGregor)
Dendrocopus maculatus fulvifasciatus (Hargitt)
Chrysocolaptes lucidus lucidus (Scopoli)
Lanius cristatus lucionensis Linnaeus
Lanius schach nasutus Scopoli
Oriolus chinensis suluensis Sharpe
Oriolus xanthonotus samarensis Steere
Dicrurus hottentottus striatus Tweeddale
Artamus leucorhynchus leucorhynchus (Linnaeus)
Aplonis minor todayensis (Mearns)
Sarcops calvus melanonotus Ogilvie-Grant
Basilorns miranda (Hartert)
Corvus macrorhynchus philippinus Bonaparte
Coracina striata kochii (Kutter)
Pycnonotus goiavier suluensis Mearns
Hypsipetes philippinus saturatior (Hartert)
Muscicapa griseisticta griseisticta (Swinhoe)
Muscicapa westermanni westermanni (Sharpe)
Muscicapa panayensis nigriloris (Hartert)
Culicicapa helianthea panayensis (Sharpe)

Monarcha azurea azurea (Boddaert)
Pachycephala philippensis apoensis (Mearns)
Orthotomus atrogularis frontalis Sharpe
Turdus obscurus Gmelin
Dicaeum hypoleucum hypoleucum Sharpe
Dicaeum nigrilore nigrilore Hartert
Dicaeum bicolor bicolor (Bourns and Worcester)
Dicaeum pygmaeum davao Mearns
Lonchura leucogastra manueli Parkes

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