Atelomycterus fasciatus n.sp., a New Catshark (Chondrichthyes: Carcharhiniformes: Scyliorhinidae) from Tropical Australia

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ABSTRACT. A new atelomycterine catshark (Scyliorhinidae: Atelomycterinae), *Atelomycterus fasciatus* n.sp., is described from the continental shelf of northern Australia (North West Shelf, Arafura Sea, Gulf of Carpentaria and Torres Strait). It differs from *Atelomycterus marmoratus* (Bennett, 1830) and *A. macleayi* Whitley, 1939 in its longer snout, smaller, posteroventrally sloping dorsal fins, smaller anal fin, fewer small dark brown spots (sometimes absent), dark bands that occasionally encircle the tail, lower vertebral counts, and smaller size.

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The genus *Atelomycterus* was proposed by Garman (1913) for *Scyllium marmoratum* Bennett, 1830, which has a wide range in the Indo-West Pacific from India and Pakistan to Malaya, Singapore, Indonesia, New Guinea, Thailand, Viet Nam, Philippines, southern China, and Taiwan (Fowler, 1941, Springer, 1979, Compagno, 1984, 1988). Whitley (1939) named a second species, *A. macleayi*, from Queensland, Western Australia and Northern Territory. *Atelomycterus macleayi* is readily separable from *A. marmoratus* (Bennett, 1830) by colouration and clasper morphology (Compagno, 1984, 1988).

McKay (1966) recorded *A. marmoratus* from Western Australia based on three specimens, but examination of his material in the Western Australian Museum (Perth) revealed two species: a hatchling *A. macleayi* and two specimens of a new species of *Atelomycterus* that differs from *A. macleayi* and *A. marmoratus* in colouration, morphometrics, clasper structure, vertebral counts, and smaller size (Compagno, 1984, 1988).

Recent offshore trawl surveys on the outer continental shelves and upper slopes of Australia (Gloerfelt-Tarp & Kailola, 1984; Davis & Ward, 1984; Sainsbury *et al.*, 1985; Gorman & Graham, 1985; Williams, 1987) produced a wealth of specimens of scyliorhinid catsharks along with many other sharks and bony fishes. Included in these collections is much additional material of the new *Atelomycterus*, which is described here as *A. fasciatus* new species.

Terminology and Abbreviations

The terminology for external structures, chondrocrania, vertebrae and dentition follows Compagno (1970, 1988). For vertebrae, an additional abbreviation PC is introduced for precaudal (monospondylous + diplospondylous precaudal) vertebral counts. The abbreviations and methods of measuring follow the FAO system of Compagno (1984), except that the measurement MOL (mouth length) was incorrectly shown in the diagram (Compagno, 1984: 12) as extending from the lower symphysis to the mouth corners; it should be from the *upper* symphysis to the mouth corners. Also, TL is used for total length and PCL for precaudal length (following general usage in ichthyology) instead of TOT and PRC. The abbreviations for measurements in this account include: TL (TOT) – total length; PCL (PRC) – precaudal length; PRN – prenarial length; POR – preoral length; POB – preorbital length; PSP – prespiracle length; PGI – pregill (prebranchial) length; HDL – head length; PP1 – prepectoral length; PP2 – prepelvic length; SVL – snout-vent length; PAL – preanal length; PD1 – pre-first dorsal length; PD2 – pre-second dorsal length; IDS – interdorsal space; DCS – dorsocaudal space; PPS – pectoral-pelvic space; PAS – preanal space; ACS – anal-caudal space; EYL – eye length; EYH – eye height; INO – interorbital width; NOW – nostril width; INW – internarial width; ANF – anterior nasal flap length; SPL – spiracle length; ESL – eye-spiracle length; MOL – mouth length; MOW – mouth width; ULA – upper labial furrow length; LLA – lower labial furrow length; GS1 – first gill opening height; GS2 – second gill opening height; GS3 – third gill opening height; GS4 – fourth gill opening height; GS5 – fifth gill opening height; HDH – head height; HDW – head width; TRH – trunk height; TRW – trunk width; CPH – caudal peduncle height; CPW – caudal peduncle width; GIR – girth; P1L – pectoral length; P1A – pectoral anterior margin; P1B – pectoral base; P1H – pectoral height; P1I – pectoral inner margin; P1P – pectoral posterior margin; P2L – pelvic length; P2A – pelvic anterior margin; P2B – pelvic base; P2H – pelvic height; P2I – pelvic inner margin; P2P – pelvic posterior margin; CLO – clasper outer length; CLI – clasper inner length; CLB – clasper base width; D1L – first dorsal length; D1A – first dorsal anterior margin; D1B – first dorsal base; D1H – first dorsal height; D1I – first dorsal inner margin; D1P – first dorsal posterior margin; D2L – second dorsal length; D2A – second dorsal anterior margin; D2B – second dorsal base; D2H – second dorsal height; D2I – second dorsal inner margin; D2P – second dorsal posterior margin; ANL – anal length; ANA – anal anterior margin; ANB – anal base; ANH – anal height; ANI – anal inner margin; ANP – anal posterior margin; CDM – dorsal caudal margin; CPV – preventral caudal margin; CPL+U – combined lower and upper postventral caudal margin; CST – subterminal caudal margin; CTR – terminal caudal margin; CTL – terminal caudal lobe; DAO – second dorsal-anal origin; DAI – second dorsal-anal insertion.

The criteria for assessing sexual maturity, and maturity stage, follow Compagno (1988). Stage 1 indicates embryos or fetuses, 2 immatures, 3 adolescents and 4 adults.

Comprehensive measurements were taken for the ten type specimens of *Atelomycterus fasciatus* and converted to proportions as percentages of total length (Table 1). Similar measurements and proportions were taken for three specimens of *A. macleayi* and nine *A. marmoratus* (Table 2) for comparison with the types of *A. fasciatus*. Selected morphometrics that suggested consistent differences between these two samples (PCL, POR, HDL, D1H, ANB, ANH, CLO, CLI, CLB) were then taken along with total length and weight for 62 additional specimens of *A. fasciatus*, for graphic and statistical comparison (Fig.14, Table 4) and analysis of differences between the three species.

Abbreviations and prefixes for field, accession and catalog numbers follow Leviton *et al.* (1986) and Compagno (1988) in part: BPBM – Bernice P. Bishop Museum, Honolulu, Hawaii; AMS – Australian Museum, Sydney, CSIRO CA and H – CSIRO Marine Laboratories, Hobart, Tasmania; CAS – California Academy of Sciences, San Francisco; LACM – Los Angeles County Museum of Natural History; LJVC – L.J.V. Compagno cataloged collection; NTM – Northern Territory Museum, Darwin; SU – Stanford University Division of Systematic Biology fish collection, now housed at CAS. USNM – United States National Museum of Natural History, Washington, D.C.; SO – CSIRO RV 'Soela' station number; WAM – Western Australian Museum, Perth. Abbreviations for statistics include: cv – coefficient of variation (100 x standard deviation/mean); n – number of specimens; sd – standard deviation.

All tables are listed in the Appendix.

Scyliorhinidae Gill, 1862

Atelomycterinae White, 1936

Comments. Compagno (1988) presented discussions and definitions of the subfamilies of Scyliorhinidae. The Atelomycterinae includes two genera: *Aulohalaelurus* Fowler, 1934, with *A. labiosus* (Waite, 1905) and *A. kanakorum* Seret, 1990, and *Atelomycterus* Garman, 1913, with *A. marmoratus* (Bennett, 1830), *A. macleayi* Whitley, 1939, and *A. fasciatus*.

Atelomycterus Garman, 1913

Atelomycterus Garman, 1913: 100. Type species *Scyllium marmoratum* Bennett, 1830, by monotypy.

Definition. Slender-bodied, narrow and short-headed cylindrical catsharks with thick, tough skin and well-calcified dermal denticles. Stomach not inflatable. Tail moderately long, length from vent to lower caudal fin origin about four-fifths of snout-vent length. Snout short, rounded-parabolic or angular in dorsoventral view; ampullal pores not greatly enlarged on snout. Nostrils enlarged but with incurrent and excurrent apertures only slightly open to exterior; anterior nasal flaps very large, broad, triangular, nearly meeting each other at midline of snout and extending posteriorly to overlap mouth; nasoral grooves connecting mouth and nostrils, covered by anterior nasal flaps. Eyes dorsolateral on head, with narrow subocular ridges below eyes. Mouth angular or semiangular, teeth only slightly exposed; very long labial furrows on both jaws, uppers extending in front of upper symphysis. Branchial region very short, gill slits lateral on head. Well-differentiated rows of posterior teeth present along distal surface of mouth. Two dorsal fins present, equal sized or with second slightly larger than first; origin of first dorsal varying from over pelvic fin midbases to over their insertions; second dorsal fin origin over the first quarter of the anal fin base. Inner margins of pelvic fins not fused over claspers in adult males. Claspers with anterior tab on cover rhipidion; pseudosiphon greatly elongated. Anal fin small, not greatly elongated, smaller than pelvic and dorsal fins; anal origin far behind pelvic bases, insertion well anterior to lower caudal fin origin. Caudal fin short and broad, less than a fifth of total length in adults, without crests of enlarged denticles. Supraorbital crests present on cranium. Vertebral centra strongly calcified, with prominent, wedge-shaped, hollow intermedialia and large diagonal calcified lamellae. Total vertebral counts 149 to 183. Colour pattern of dark and light spots and dark saddles and bands present.

For a more detailed definition of this genus see Compagno (1988).

Comparative Material

Atelomycterus macleayi. AUSTRALIA: AMS I5269, 488 mm adult male, Port Darwin, NT. HOLOTYPE of *A. macleayi* Whitley, 1939; USNM 174070, 481 mm adult male, near Darwin, East Point Reef, NT; WAM P8811, 100 mm hatchling male, Cygnet Bay, King Sound, WA; NTM 50183, 390 mm female, near Darwin, East Point Reef, NT.

Atelomycterus marmoratus. NO DATA: LJVC-0325, 443 mm immature female. SINGAPORE: LACM Applegate uncatalogued, 491 mm adult female; SU 14182, 467 mm adult male; SU 40095, 395 mm immature female (semi-albino). PHILIPPINE ISLANDS: SU 13562, 615 mm adult male, Linapucan Island; SU 13563, 570 mm adult female, Sitankai, Sibutu Island; SU 13659, 477 mm adult male, Dumaguete, Negros Island; SU 13689, 472 mm immature female, Siasi Island; LACM 37431-1, 428 mm immature female, Pangasinan, near Bolinao. BPBM 29851, 614 mm adult female, Lombok, Batu Nampar fish market, Indonesia.

Key to the Species of *Atelomycterus*

1. Dorsal fins not angled rearwards, posterior margins sloping posteroventrally from fin apices. Dark brown spots and markings sparse, colour pattern dominated by brownish-grey saddles and bands on light background .... *Atelomycterus fasciatus* n.sp.

—— Dorsal fins angled rearwards, posterior margins vertical or sloping anteroventrally from fin apices. Dark brown spots and markings dominating colour pattern 2

2. Colour pattern of brownish-grey saddles separated by light areas and outlined by numerous relatively small dark brown spots in adults; hatchlings have a simpler pattern of dusky saddles .... *Atelomycterus macleayi* Whitley, 1939

—— Saddle markings obsolete, light grey and white spots outlined by large dark brown spots, bars and lines .... *Atelomycterus marmoratus* (Bennett, 1830)

Atelomycterus fasciatus n.sp.

Banded sand catshark

Figs 1-4, 5A,B, 6-11

Atelomycterus marmoratus.–McKay, 1966, in part: 66, fig.1c,d (WAM P8629) [not fig.1a,b (WAM P8811) which is *A. macleayi*]

Atelomycterus sp.–Sainsbury *et al.*, 1985: 25 (illustration).–Compagno, 1988: 102-103, 393.

Atelomycterus (undescribed species).–Compagno, 1984: 292.–Sainsbury *et al.*, 1985: 24, illust.–Paxton *et al.*, 1989: 72.

Type material. HOLOTYPE, WAM P8629, 369 mm adult male, Onslow, WA (Fig.1).

PARATYPES, 9 (216-413 mm TL): WESTERN AUSTRALIA: CSIRO CA3289, SO2/82/57, 395 mm female, 16 Apr. 1982, 18°59'S 118°04'E, 100 m; WAM P23838, 251 mm immature male, 1973, 22°05'S 114°15'E; CSIRO H-1295-01, SO3/83/42, 400 mm adult male, 8 June 1983, 19°50'S 116°13'E, 68 m; CSIRO CA4518, SO3/83/44, 216 mm immature female, 9 June 1983, 20°23'S 116°04'E, 38 m; CSIRO CA4524, SO3/83/56, 318 mm immature female, 10 June 1983, 19°41'S 116°51'E, 66 m; CSIRO CA4523, SO3/83/61, 264 mm immature male, 11 June 1983, 20°22'S 117°22'E, 27 m; CSIRO H1297-01, SO3/83/96, 234 mm immature male, 16 June 1983, 20°00'S 117°52'E, 40 m; CSIRO H1294-01, SO3/83/111, 372 mm adult female, 17 June 1983, 19°59'S 117°51'E, 39 m; CSIRO H1296-01, SO6/86/26, 413 mm adult female, 12 Oct. 1986, 20°00'S 115°47'E, 66 m.

Non-type material. 69 (166-421 mm TL): WESTERN AUSTRALIA: CSIRO H1300-02, 366 mm adult female, CSIRO H1300-03, 364 mm early adult female, CSIRO H1300-04, 347 mm adolescent female, all 3 from SO1/83, 15 Feb. 1983, about 19°15'S 118°45'E; CSIRO H1300-01, 361 mm adult male, SO1/83/01, 15 Feb. 1983, 20°02'S 117°48'E, 40 m; CSIRO H1300-05, 302 mm early adolescent male, SO1/83/06, 15 Feb. 1983, 20°22'S 116°39'E, 27 m; CSIRO CA4515, 353 mm adolescent female, CSIRO CA4514, 389 mm late adolescent female, both from SO2/83/60, 2 Apr. 1983, 19°32'S 118°45'E, 35 m; CSIRO CA4513, 254 mm immature female, SO3/83/06, 2 June 1983, 19°50'S 117°34'E, 52 m; CSIRO H1295-02, 402 mm adult male, CSIRO H1295-03, 392 mm early adult female, both from SO3/83/42, 8 June 1983, 19°50'S 116°13'E, 68 m; CSIRO H1306-01, 378 mm adult female, SO3/83/77, 15 June 1983, 20°00'S 117°51'E, 41 m; CSIRO H1308-01, 379 mm adult female, SO3/83/88, 16 June 1983, 19°59'S 117°50'E, 42 m; CSIRO H1297-02, 352 mm adult (gravid) female, CSIRO H1297-03, 353 mm adult male, both from SO3/83/96, 16 June 1983, 20°00'S 117°52'E, 40 m; CSIRO H1303-01, 329 mm adult male, SO3/83/97, 16 June 1983, 20°00'S 117°51'E, 39 m; CSIRO H1304-01, 245 mm immature female, CSIRO H1304-02, 383 mm early adult female, both from SO3/83/99, 17 June 1983, 19°59'S 117°51'E, 40 m; CSIRO H1305-01, 362 mm adult male, SO3/83/101, 27 June 1983, 20°00'S 117°52'E, 41 m; CSIRO H1307-01, 310 mm adolescent male, CSIRO H1307-02, 370 mm adult female, both from SO3/83/110, 17 June 1983, 19°59'S 117°52'E, 40 m; CSIRO H1294-02, 286 mm immature female, CSIRO H1299-10, 372 mm adult (gravid) female, both from SO3/83/111, 17 June 1983, 19°59'S 117°51'E, 39 m; CSIRO CA4522, 255 mm immature male, SO4/82/22, 11 Aug. 1982, 19°50'S 118°02'E, 44 m; CSIRO CA4520, 311 mm early adolescent male, CSIRO CA2451, 246 mm immature male, both from SO4/83/28, 6 Aug. 1983, 20°03'S 117°51'E, 35 m; CSIRO CA4519, 253 mm immature female, SO5/82/46, 10 Feb. 1983, 19°02'S 117°58'E, 104 m; CSIRO H1301-01, 387 mm adult male, SO5/82/64, 5 Oct. 1982, 19°30'S 117°48'E, 62 m; CSIRO H1299-08, 401 mm adult male, CSIRO H1299-11, 420 mm adult female, CSIRO H1302-01, 421 mm adult female, CSIRO H1302-02, 372 mm adolescent female, CSIRO H1302-03, 398 mm adult female, CSIRO H1302-04, 384 mm adult male, all 6 from SO6/82/101, 28 Nov. 1982, 20°10'S 117°20'E, 40 m; CSIRO H1095-01, 335 mm immature female, CSIRO H1095-02, 264 mm immature male, both from SO7/87/20, 3 Oct. 1987, 20°14'S 116°48'E, 41 m; CSIRO CA1290, 338 mm female, SO7/80/19, 7 Nov. 1980, 18°37'S 119°24'E, 120 m; CSIRO CA1293, 357 mm adult male, SO4/80/51, 6 June 1980, 18°37'S 119°20'E, 122 m; CSIRO CA1294, 364 mm female, SO7/80/6, 4 Nov. 1980, 20°09'S 116°07'E, 76 m; CSIRO CA1295, 270 mm female, SO4/80/56, 7 June 1980, 19°33'S 119°31'E, 34 m; CSIRO H1223-01, 271 mm immature female, Feb. 1988, Albatross Bay (skeletonised); CSIRO H1298-01, 298 mm immature male, CSIRO H1298-02, 379 mm adult (early) female, CSIRO H1298-03, 186 mm immature female, CSIRO H1298-04, 378 mm adult female, CSIRO H1298-05, 381 mm adult

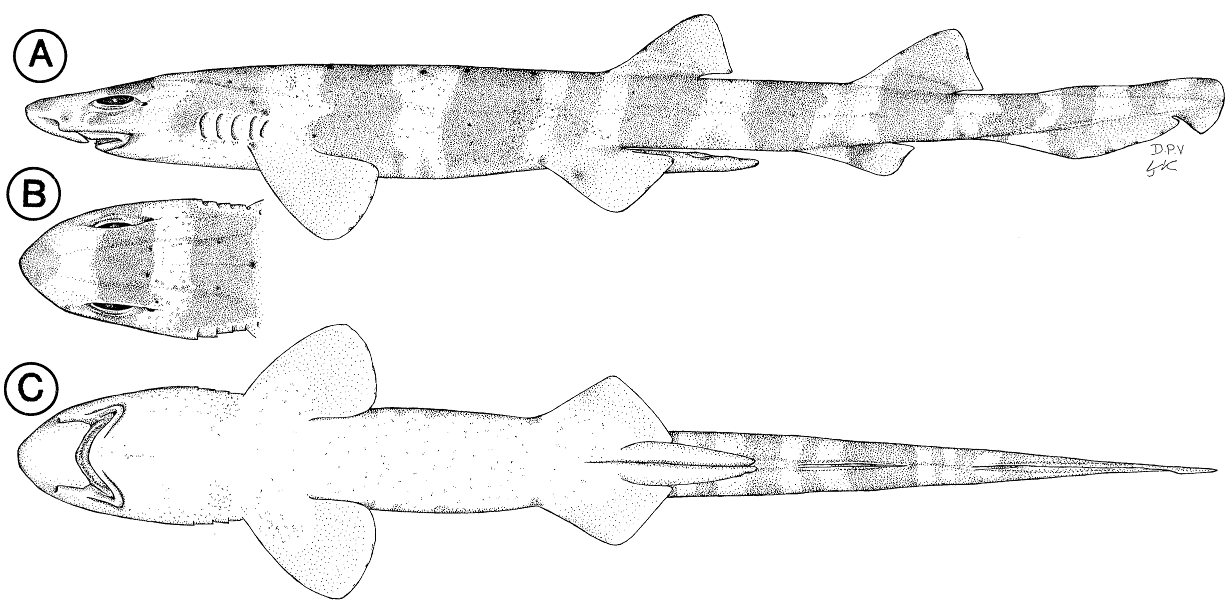

Fig.1. *Atelomycterus fasciatus* n.sp., holotype, WAM P8629, 369 mm adult male. A, lateral view; B, dorsal view of head; C, ventral view. (The majority of specimens have more numerous spots than the holotype and have incomplete saddle markings posterior to the pelvic fins rather than encircling bands.) Illustration by D. Voorfelt and L.J.V. Compagno.

(early) female, CSIRO H1298-06, 395 mm adult male, CSIRO H1298-07, 368 mm adult male, CSIRO H1298-08, 180 mm immature male, CSIRO H1298-09, 400 mm adult male, CSIRO H1298-10, 240 mm immature female, CSIRO H1298-11, 373 mm adult male, CSIRO H1298-12, 166 mm immature female, CSIRO H1299-09, 405 mm adult (gravid) female, CSIRO H1299-13, 272 mm immature female, all 14 from 'Coral Reeftel', 15 May 1983, North West Shelf; CSIRO CA4517, 359 mm adult male, CSIRO CA4516, 386 mm adult male, both dated 19 Sept. 1982, no further data; CSIRO H1299-01, 370 mm adult male, CSIRO H1299-02, 393 mm adult female, CSIRO H1299-03, 314 mm early adolescent female, CSIRO H1299-04, 380 mm adult female, CSIRO H1299-05, 413 mm adult female, CSIRO H1299-06, 252 mm immature female, CSIRO H1299-07, 241 mm immature female, CSIRO H1299-12, 394 mm adult female, CSIRO H1299-14, 400 mm adult female, CSIRO H1349-01, 180 mm immature male, all 10 from North West Shelf but with no further data. NORTHERN TERRITORY: AMS I.21842-001, 375 mm female, from SO7/80/43P, 16 Nov. 1980, Arafura Sea, 10°37'S 133°47'E, 60 m. QUEENSLAND: AMS I.15557-003, 270 mm adult male, 1964, 16°38'S 140°02'E, 32 m; CSIRO H1118-01, 300 mm immature male, 4 Nov. 1987, Torres Strait, 10°31'S 140°48'E, 43 m.

Diagnosis. *Atelomycterus* with a relatively long snout, preoral length 4.4-5.6% TL. Head length 18.4-21.3% TL, precaudal length 77.8-86.1% TL. Dorsal fins broadly triangular, not semifalcate, with posterior margins sloping posteroventrally from fin apices. Adult claspers elongated but broad, thick, tapering from base to tip, clasper outer length 9.3-11.2% TL, clasper base width 12.7-17.4% of clasper outer length. Clasper glans slightly more than half length of clasper; an enlarged tab on cover rhipidion; cover rhipidion large; rhipidion moderately large, relatively low, but mostly concealed by cover rhipidion and exorhipidion; exorhipidion large and overlapping base of cover rhipidion; pseudosiphon over half length of cover rhipidion; pseudopera large; clasper tip narrow, bluntly pointed. Clasper shaft stout, hourglass-shaped; dorsal and ventral terminal cartilages long; end-style long; accessory dorsal terminal (TD2) not greatly elongated. Anal fin smaller than in other species, height 1.6-3.3% TL and base 7.2-7.3% TL. Total vertebral counts 149-161 (N = 9), precaudal counts 100-110 (N = 18). Colour pattern of broad brownish saddles and transverse bands on tan background, with scattered small dark brown and sometimes small white spots; brownish saddles on abdomen extend ventrally to, or slightly below, line between pectoral and pelvic fin bases, brownish bands occasionally encircle precaudal tail. Size small, adult females to 451 mm TL and 258 g weight.

Etymology. Latin *fasciatus*, banded, in reference to its colour pattern.

Description. Proportions as percentages of total length for holotype and paratypes (9) are presented in Table 1.

Head short, length about equal (0.9-1.1) to pectoral-pelvic space. Head narrow and depressed, roughly trapezodial in cross-section at eyes. Outline of head in lateral view convex dorsally, with slight concavity in front of eyes; in dorsoventral view head with narrow parabolic outline anterior to gill openings. Preoral snout short, 0.7-0.9 times mouth width, broadly rounded in dorsoventral view, not indented anterior to nostrils; snout bulbous and bluntly pointed in lateral view, convex above and below.

External eye openings with prominent anterior and posterior eye notches; eyes small and spindle-shaped, eye length 5.1-7.0 in head length and 2.0-3.8 times eye height. Eyes dorsolateral on head, with lower edges well

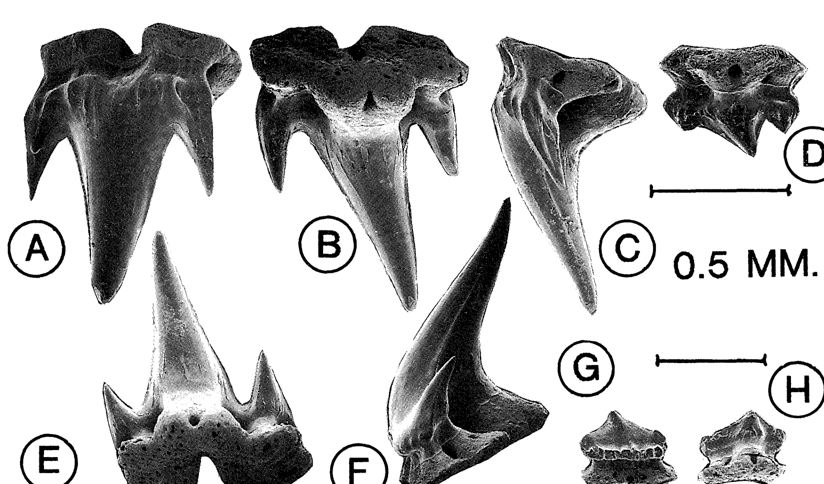

Fig.2. *Atelomycterus fasciatus*, scanning electron micrographs of representative teeth from CSIRO H1296.01, 413 mm adult female. A-D, upper teeth, enlarged to about 1.2 times the size of the lower teeth; E-G, lower teeth. A-C, upper anterolateral teeth from near symphysis in A, labial, B, lingual and C, mesodistal views; D, posterior tooth in lingual view; E-F, lower anterolateral teeth from near symphysis in E, lingual and F, mesodistal views; G-H, posterior teeth in G, labial and H, lingual views. Scale bars = 0.5 mm, differing for upper and lower teeth. Photos by A.J. Rees.

medial to horizontal head rim in dorsal view, subocular ridges strong but narrow. Nictitating lower eyelids of rudimentary type, with shallow, scaled subocular pouches and secondary lower eyelids free from upper eyelids.

Spiracles small, length 3.8-8.5 in eye length, 0.1-0.3 eye lengths behind and below posterior eye notch. First four gill openings usually higher than fifth, height of fifth 0.5-1.0 of third; height of third 7.1-15.6 in head and 0.4-0.8 of eye length. Gill openings straight, undulated, or slightly concave, gill filaments not visible from outside. Upper ends of gill openings about opposite lower edges of eyes, gill openings not elevated on dorsolateral surface of head. Gill-raker papillae absent from gill arches.

Nostrils with very small incurrent apertures lacking posterolateral keels, broadly angular nasal flaps with narrowly rounded tips, very small mesonarial flaps well lateral on anterior nasal flaps, large excurrent apertures, no posterior nasal flaps. Nostrils reaching mouth, with anterior nasal flaps partly covering upper symphysis. Anterior nasal flaps very large, meeting at midlength of mouth, covering excurrent apertures. Nostril width 0.8-1.1 in internarial space, 1.1-2.0 in eye length, and 0.6-1.6 in third gill opening height.

Mouth broadly angular, small, short, mouth width 2.7-3.4 in head length; mouth length 2.1-3.1 in mouth width. Lower symphysis nearly reaching upper symphysis, teeth exposed in ventral view. Tongue moderate-sized, flat and rounded, filling most of floor of mouth. Maxillary valve narrow, not highly papillose. No large buccal papillae in mouth, palate and floor of mouth covered with buccopharyngeal denticles, except for just in front of tongue. Upper labial furrows long, reaching upper symphysis, lower furrows 0.8-1.0 times upper furrows. Labial cartilages large.

Teeth in 56-73/50-59 rows; 2-5/3-8 series functional, with more series functional in adults than young and in posterior tooth rows than anterolaterals. Lateroposterior teeth not arranged in diagonal files, no toothless spaces at symphysis. Teeth not strongly differentiated in upper

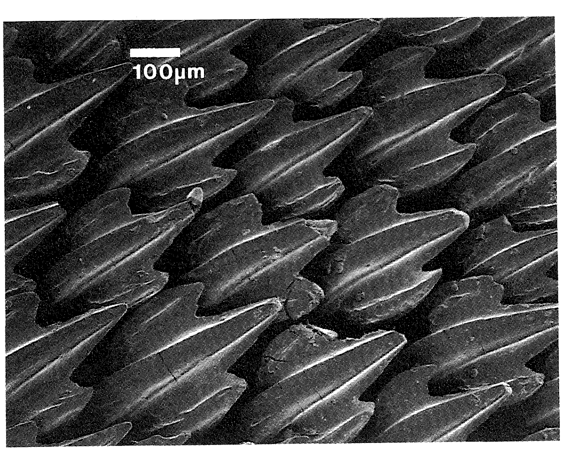

Fig.3. *Atelomycterus fasciatus*, scanning electron micrograph of lateral trunk denticles in three-quarter anteriorlateral view, from CSIRO H1296.01, 413 mm adult female. Photo by A.J. Rees.

and lower jaws but with tooth row groups along jaws, including weakly defined medials (M), anterolaterals (AL) and posteriors (P) in both jaws. Tooth formula (N = 7) is:

$$\text{Left}\quad \frac{\text{P9-13 AL18-23 M3 AL19-21 P7-14}}{\text{P9-11 AL14-16 M3 AL14-18 P8-13}}\quad \text{Right}$$

or

$$\frac{\text{28-35 3 27-35}}{\text{23-27 3 22-30}}$$

Sexual heterodonty apparently absent, teeth not enlarged or particularly modified in adult males. Upper anterolateral teeth (Fig.2A-C) smaller, with slightly broader crowns and longer cusplets than lowers (Fig.2E,F), with well-developed transverse ridges (absent in lower anteroposteriors). Weakly differentiated medials are smaller than anterolaterals, which have strong erect to semioblique cusps, usually 1 strong cusplet on either side, strong basal ledges and grooves, transverse ridges confined to the basal ledges where present, and low, thick, flat roots. Several rows of strikingly smaller posteriors with low weak cusps are present in both jaws, uppers (Fig.2D) differing from lowers (Fig.2G,H) in having stronger cusplets; posterior teeth not comblike, with cusp not strongly shifted posteriorly on crown foot. Gradient monognathic heterodonty well developed in anterolateral teeth; anteroposteriors distally smaller, with thicker and more oblique cusps and lower cusplets. Sample teeth examined either with no transverse groove (anaulacorhizous in most distal teeth) or a partially developed labial groove (hemiaulacorhizous) with prominent centrolingual foramen on linguobasal attachment surface of roots and disto- and mesolingual foramina on sides of teeth. Tooth histological type (histotype) orthodont as seen

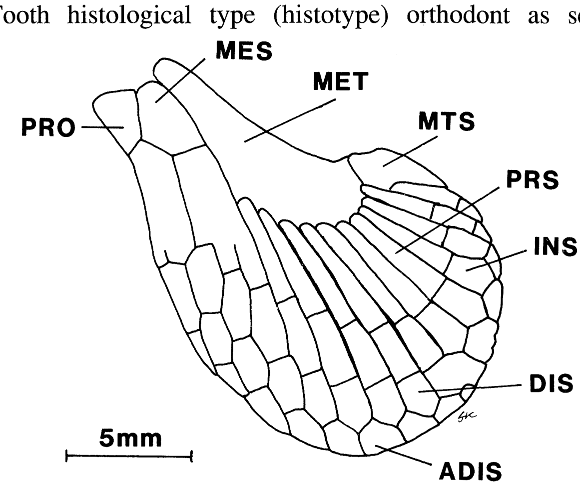

Fig.4. *Atelomycterus fasciatus*, pectoral fin skeleton, CSIRO H1223.01, 271 mm immature male. Abbreviations: ADIS – accessory distal radial segments; DIS – distal radial segments; INS – intermediate radial segments; MES – mesopterygium; MET – metapterygium; MTS – metapterygial segment (axis); PRO – propterygium; PRS – proximal radial segments. Illustration by L.J.V. Compagno.

by transmitted light through teeth in water, with a pulp cavity.

Body fairly slender, trunk virtually circular in section at first dorsal base, length of trunk from fifth gill openings to vent 0.9-1.3 times head length. No predorsal, interdorsal or postdorsal ridges on midline of back, no postanal ridge between anal fin base and lower caudal fin origin; lateral ridges absent from body. Caudal peduncle short, fairly thick, vertically oval or circular in section, without lateral keels, caudal peduncle height 1.0-1.3 of its width at second dorsal fin insertion, 1.5-2.6 in dorsal-caudal space.

Lateral trunk denticles below first dorsal fin with flat, smooth, elongated teardrop-shaped crowns about 1.5 times as long as wide (Fig.3). Crown with pair of strong medial ridges extending entire length of crown onto long, strong, narrow medial cusp; pair of low but prominent lateral ridges extending onto short, obtuse, relatively broad lateral cusps. Denticle crowns closely spaced and well-imbricated. Denticles varying little with growth; young have lateral trunk denticles with slightly narrower crowns and narrower medial cusps than adults.

Pectoral fins broad and rounded-triangular, not falcate, with broadly convex anterior margins, narrowly rounded apices, broadly rounded posterior margins, free rear tips, inner margins and narrow bases. Pectoral fin anterior margin 1.0-1.2 times pectoral fin length. Pectoral fins slightly less than twice area of first dorsal fin. Origins of pectoral fins under interspace between third and fourth gill openings. Apex of pectoral fin slightly anterior to its free rear tip when fin is elevated and appressed to body.

Pectoral fin skeleton (Fig.4) aplesodic, with longest radials extending about 0.4 of pectoral fin anterior margin length into fin. Radials mostly divided into 3 (propterygial and posteriormost metapterygial radials) or 4 (mesopterygial and anterior 5 metapterygial radials) segments, longest distal segment 0.6 times length of its proximal segment. Pectoral skeleton tribasal, propterygium with single radial; mesopterygium with 4 radials, proximal segment of anteriormost fused anteriorly to propterygial radial, proximal segments of posterior 3 fused together; metapterygium with 10

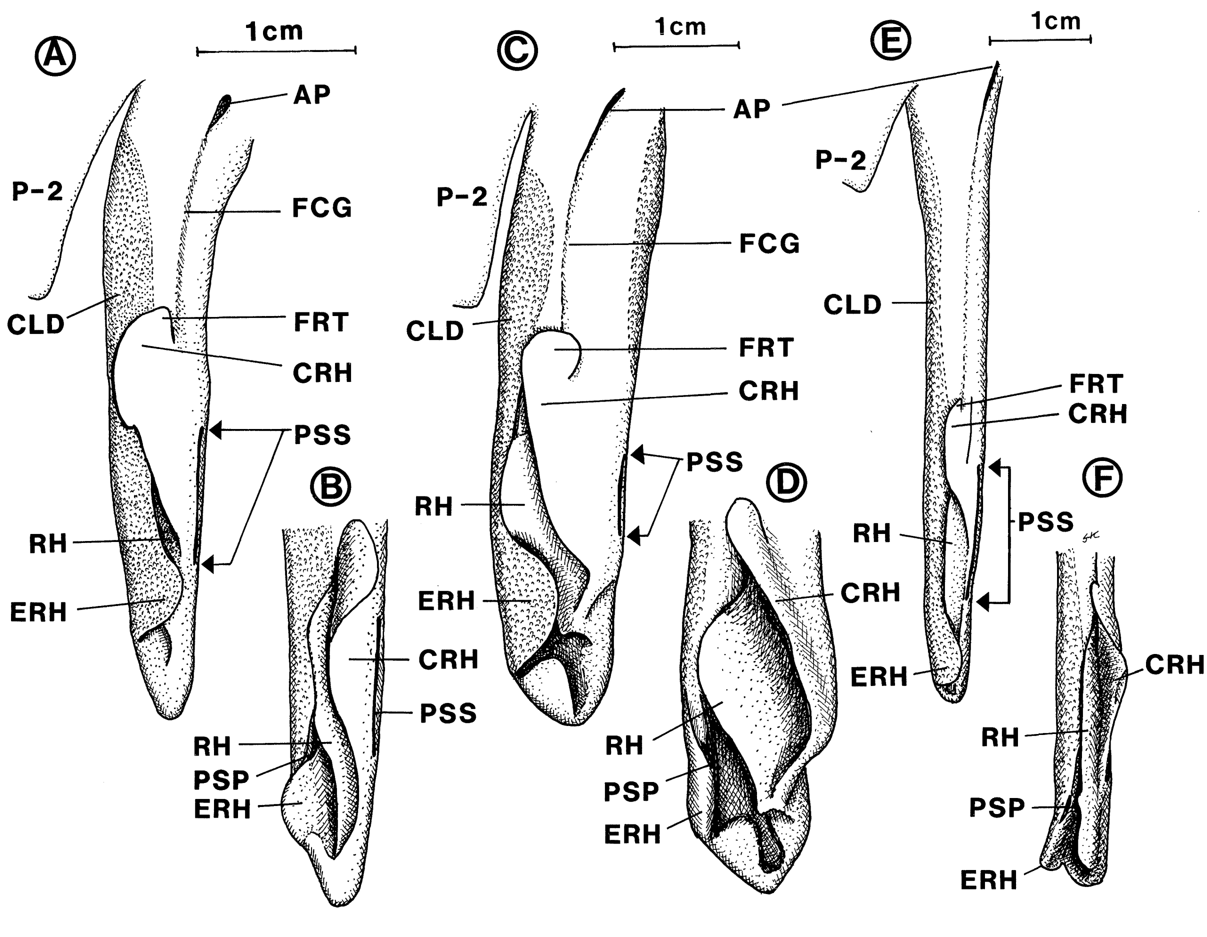

Fig.5. Claspers of *Atelomycterus* species, all from adult males. A-B, *Atelomycterus fasciatus*, WAM P8629, 369 mm holotype; C-D, *Atelomycterus macleayi*, USNM 174070, 481 mm; E-F, *Atelomycterus marmoratus*, SU 14182, 467 mm. A,C,E – glans not dilated; B,D,F – glans spread. Abbreviations: AP – apopyle; CLD – clasper denticles; CRH – cover rhipidion; ERH – exorhipidion; FCG – fused clasper groove; FRT – free tab on cover rhipidion; P-2 – pelvic fin; PSP – pseudopera; PSS – pseudosiphon; RH – rhipidion. Illustration by L.J.V. Compagno.

unfused radials on basal segment and 1 on metapterygial axis; total radial count 16. Propterygium short and wedge-shaped, broad basally and distally narrow. Mesopterygium and metapterygium not separated by a fenestra; mesopterygium short, irregularly pentagonal, only slightly elongated mesodistally. Metapterygial basal segment triangular, elongated diagonal to axes of its radials. Metapterygial axis short, without a segment, with length about 0.4 of metapterygial basal segment.

Pelvic fins broadly triangular; pelvic anterior margins 0.6-0.8 of pectoral-fin anterior margins; pelvic area 2-3 times anal fin area. Pelvic-fin anterior margins nearly straight, apices narrowly rounded, posterior margins convex or nearly straight, free rear tips narrowly rounded and not attenuated, inner margins straight or slightly convex and not fused together over claspers of adult males.

Claspers (Fig.5A,B) relatively long and basally stout, convex and strongly tapering on lateral edge, with a slightly undulated, blunt-tipped clasper glans. Claspers of adult males extending well behind pelvic-fin free rear tips by distance about 1.7 of pelvic-fin inner margin, but falling in front of anal fin origin by about 0.4 of anal fin base. Most of clasper except dorsomedial and posteromedial surface of glans (including rhipidion) and a lateral strip adjacent to clasper groove covered with small clasper denticles with anteriorly directed cusps. Exorhipidion strongly differentiated, originating opposite last third of cover rhipidion, with a blunt apex and long base but without specialised clasper hooks. Pseudopera present below anterior end of exorhipidion and about opposite posterior end of cover rhipidion, relatively broad and shallow. No envelope present anterior to hypopyle. Rhipidion present and very large, extending over most of length of clasper glans formed as a flat, convex-edged blade with posterior end below apex of exorhipidion. Cover rhipidion very large, formed as distally tapering wedge with large, lobate anterior tab, extending from apopyle to apex of exorhipidion. Pseudosiphon very long, narrow, slitlike, extending opposite most of base of cover rhipidion.

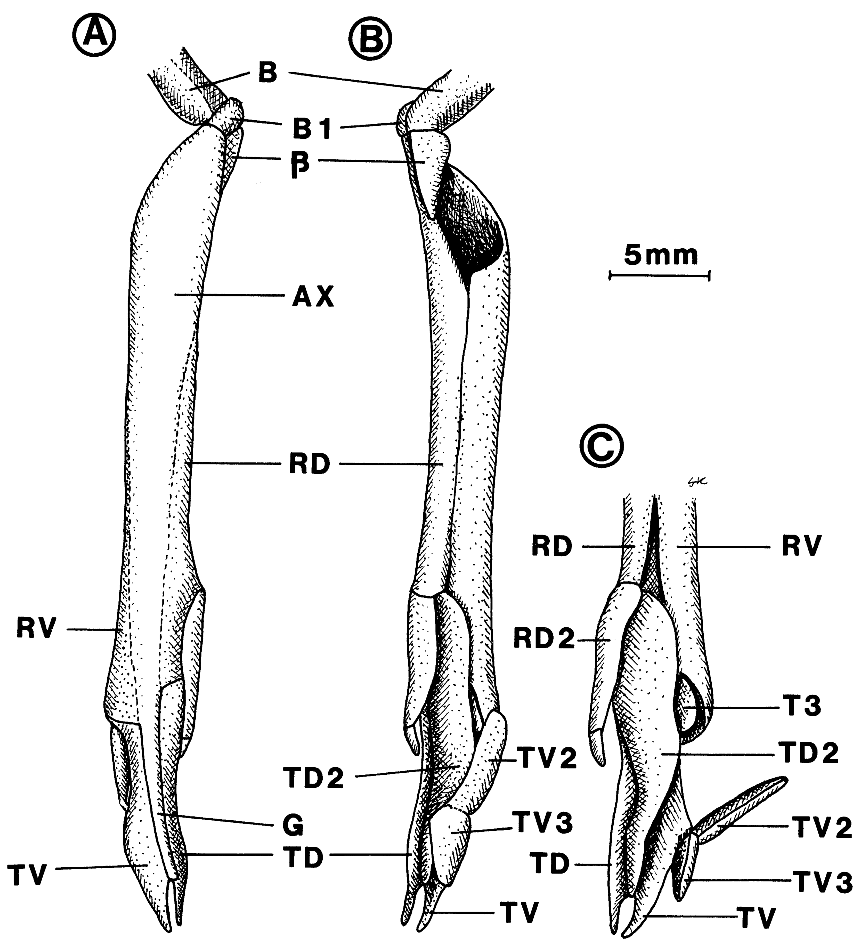

Fig.6. *Atelomycterus fasciatus*, clasper skeleton, CSIRO CA4517, 359 mm adult male, right side. A, ventral view; B, dorsal view, terminal cartilages not dilated; C, dorsal view of glans, terminal cartilages spread. Abbreviations: AX – axial cartilage; ß – beta cartilage; B – basipterygium; B1 – intermediate segment; G – end-style; RD – dorsal marginal cartilage; RD2 – accessory dorsal marginal cartilage; RV – ventral marginal cartilage; T3 – accessory terminal cartilage; TD – dorsal terminal cartilage; TD2 – dorsal terminal 2 cartilage; TV – ventral terminal cartilage; TV2 – ventral terminal 2 cartilage; TV3 – ventral terminal 3 cartilage. Illustration by L.J.V. Compagno.

Apopyle and hypopyle connected by long clasper groove, with its dorsal margins usually fused over clasper canal (open in one adult male examined). Clasper siphons moderately long and narrow, extending anterior to level of pectoral-fin free rear tips.

Clasper skeleton with all elements present (Fig.6). Axial cartilage or appendix-stem connected proximally by single very short intermediate segment (B1) and long, posteriorly tapering, wedge-shaped dorsal beta cartilage (ß) to pelvic basipterygium. Clasper shaft, formed from axial cartilage and tightly rolled dorsal and ventral marginal cartilages slender, tapering, then expanding posteriorly in elongated hourglass shape. Clasper glans skeleton with large, narrow, curved, pick-shaped dorsal terminal and more distally expanded, spear-shaped ventral terminal, articulating with and separated along their proximomesial three-fourths from narrow, cylindrical end-style (terminal extension of axial cartilage); short free posterior ends of terminal cartilages separated by a narrow gap, nearly straight. Accessory dorsal marginal cartilage (RD2) long, wedge-shaped, distally tapering, with separate short distal segment (RD3?) that supports cover rhipidion. Dorsal terminal 2 cartilage (TD2) large, elongated, bladelike, distally tapering, extending inside rhipidion along almost entire clasper glans from dorsal marginal to end-style tip. Ventral terminal 2 and 3 cartilages (TV2 and TV3) of exorhipidion include posteriorly tapering, wedge-shaped TV3 articulating anteriorly with lateral projection of TV, and elongated, rectangular TV2 articulating with anterolateral end of TV3 and extending anteriorly to partly cover distal end of ventral marginal. Short, broad accessory terminal cartilage (T3) present under anterior third of TD2 cartilage, partially sheathed by terminal extension of ventral marginal and well anterior to TV3-TV articulation.

First dorsal fin high, apically narrow and not falcate, with nearly straight or undulated anterior margin, narrowly rounded apex, nearly straight posterior margin, angular free rear tip, straight inner margin. First dorsal-fin origin over last third of pelvic-fin bases, midpoint of base well anterior to pelvic-fin free rear tips, insertion closer to pelvic-fin insertions than anal-fin origin, free rear tip 2-3 times length of inner margin anterior to anal-fin origin. Posterior margin slanting posteroventrally from fin apex, insertion varying from slightly in front to slightly behind dorsal-fin apex. First dorsal-fin base 1.4-2.1 in interdorsal space, 1.8-2.8 in dorsal caudal-fin margin; first dorsal-fin height 1.2-1.7 in first dorsal-fin base; first dorsal-fin inner margin 1.3-2.1 in first dorsal-fin height, 1.9-3.7 in first dorsal-fin base.

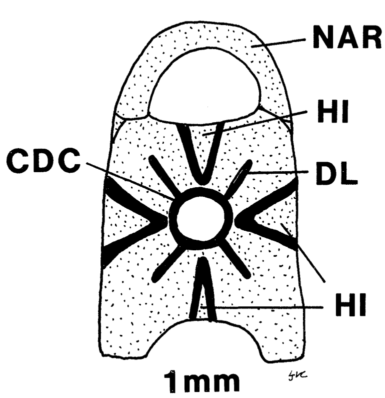

Fig.7. *Atelomycterus fasciatus*, vertebral calcification pattern, CSIRO H1223-01, 271 mm immature male. Abbreviations: CDC – calcified double cone; DL – diagonal calcified lamella; HI – hollow intermedialia; NAR – neural arch. Illustration by L.J.V. Compagno.

Second dorsal fin high, apically narrow, not falcate, subequal to first dorsal-fin area, second dorsal-fin height 0.8-1.1 of first dorsal-fin height, base 1.0-1.3 of first dorsal-fin base. Second dorsal fin with slightly convex anterior margin, narrowly rounded apex, nearly straight posterior margin, bluntly pointed free rear tip, and concave or straight inner margin. Second dorsal-fin origin opposite or slightly in front of anal-fin midbase, insertion well behind anal-fin free rear tip, and free rear tip in front of upper caudal-fin origin by 1-2 times its inner margin. Posterior margin slanting posteroventrally from apex, insertion below or slightly in front of dorsal apex. Second dorsal-fin base 0.6-0.9 in dorsocaudal space, second dorsal-fin height 1.5-2.0 in second dorsal-fin base, second dorsal-fin inner margin 1.5-2.2 in second dorsal-fin height and 2.6-3.8 in second dorsal-fin base.

Anal fin low, apically broad, not falcate, much smaller than second dorsal fin, anal-fin height 0.5-0.6 in second dorsal-fin height and base 0.7-1.0 times second dorsal-fin base. Anal-fin anterior margin slightly concave, nearly straight, or convex, apex broadly rounded, posterior margin slightly undulated, free rear tip bluntly pointed, and inner margin nearly straight. Anal-fin base without preanal ridges, anal-fin origin about 2.0-2.5 times anal-fin base length behind pelvic-fin insertions, free rear tip about 2.5-5.0 times anal-fin inner margin length anterior to lower caudal-fin origin. Anal-fin posterior margin slanting posterodorsally, anal-fin insertion posterior to apex. Anal-fin base 0.9-1.8 in anal-caudal space, anal-fin height 2.4-3.3 in anal-fin base, anal-fin inner margin 1.2-1.7 in anal-fin height and 3.1-4.7 in anal-fin base.

Caudal fin narrow and asymmetrical, with large terminal lobe and ventral lobe not developed. Caudal fin short, dorsal margin 4.3-5.1 in precaudal length. Preventral caudal-fin margin 1.8-2.5 in dorsal caudal-fin margin, terminal lobe 3.2-4.4 in dorsal caudal-fin margin, subterminal margin 1.1-1.8 in terminal margin. Dorsal caudal-fin margin without lateral undulations but proximally and distally convex with shallow concavity between the convexities. Preventral caudal-fin margin basally concave and apically straight, tip of ventral caudal fin lobe bluntly rounded. Postventral margin not differentiated into upper and lower parts, margin straight to convex. Subterminal notch a narrow, deep slot, subterminal margin straight to concave and terminal margin convex and sometimes notched, lobe formed by these margins angular, tip of tail broadly rounded.

Vertebral counts, ratios and statistics given in Table 3. Transition between MP and DP centra about 4-8 centra behind front of pelvic girdle. Last few MP centra before MP-DP transition hardly enlarged, not forming 'stutter zone' of alternating long and short centra.

Vertebral calcification pattern (Fig.7) as in other atelomycterines (Compagno, 1988), with well-calcified hollow intermedialia, long diagonal calcified lamellae, and a well-calcified double cone.

Intestinal valve of conicospiral type, with 11-13 turns. Of 18 specimens counted 2 had 11, 10 had 12, 6 had 13 turns (mean = 12.2, sd = 0.6, cv = 5.3).

Chondrocranium (Fig.8) with short rostral cartilages, these slender, cylindrical, not hypercalcified. In one specimen examined these were free at their distal tips and did not form a discrete rostral node. Medial rostral cartilage approximately 27% of NBL, distance between bases of lateral rostral cartilages 1.8 in medial rostral cartilage. Medial rostral with distal spearlike expanded tip and ventral low prominence; lateral rostrals evenly tapering to their narrow tips. Nasal capsules large, high, transversely oval, and slightly wider than long, width across them 71% of NBL, length of capsule 1.1 in its width. Anterior margins of nasal capsules broadly convex. Nasal apertures nearly vertical, on anterolateral faces of capsules, separated from large nasal fontanelles by a broad channel. Ectethmoid chambers inside nasal cavities, at posterior edges of nasal fontanelles and not visible

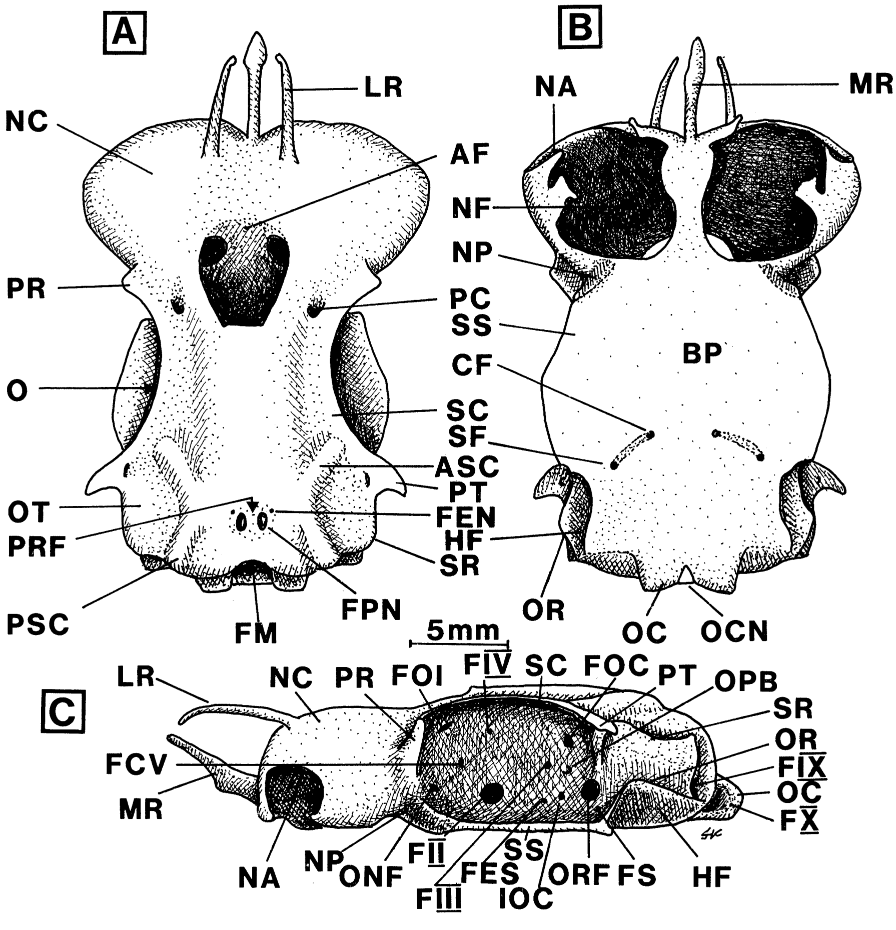

Fig.8. *Atelomycterus fasciatus*, chondrocranium, CSIRO H1223-01, 271 mm immature male. A, dorsal; B, ventral; C, lateral views. Abbreviations: AF – anterior fontanelle; ASC – anterior semicircular canal; BP – basal plate; CF – internal carotid foramen; FCV – foramen for anterior cerebral vein; FEN – endolymphatic foramen; FES – foramen for efferent spiracular artery; FM – foramen magnum; FOC – foramen for superficial opthalmic nerve; FOE and FOI – external and orbital foramina of preorbital canal; FPN – perilymphatic foramen; FII – optic nerve foramen; FIII – oculomotor nerve foramen; FIV – trochlear nerve foramen; FIX – glossopharyngeal nerve foramen; FX – vagus nerve foramen; HF – hyomandibular facet; IOC – interorbital canal; LR – lateral rostral cartilage; MR – medial rostral cartilage; NA – nasal aperture; NF – nasal fontanelle; NC – nasal capsule; NP – orbital notch; O – orbit; OPB – optic pedicel base; OC – occipital condyle; OCN – occipital centrum; ONF – orbitonasal foramen; OR – opisthotic ridge; ORF – orbital fissure; OT – otic capsule; PR – preorbital process; PRF – parietal fossa; PSC – posterior semicircular canal; PT – postorbital process; SC – supraorbital crest; SF – stapedial foramen; SR – sphenopterotic ridge; SS – suborbital shelf. Illustration by L.J.V. Compagno.

ventrally. Subnasal plate in form of short irregular medial extensions of lateral capsule wall, lateral extensions of narrow, high internasal septum bordering wide nasal fontanelles. Anterior fontanelle horizontally oval but with posterior edge transverse, width about 1.2 times in its length and about 20% of NBL. Dorsal lip of fontanelle slightly flared, without epiphysial foramen. Cranial roof flat between orbits, slightly elevated above supraorbital crests but not greatly arched or domelike. Parietal fossa shallow. Orbital notches relatively deep. Basal plate flat from orbital notches to occipital centrum, without keels. Internal carotid foramina slightly further from each other than from stapedial foramina. Edge of supraorbital crests arcuate in dorsal view, with short, prominent bluntly triangular preorbital processes and retroflexed, posteriorly hooked postorbital processes with basal foramina. Width across preorbital processes 59% of NBL, width across postorbital processes 71% of NBL, least width across supraorbital crests 1.8 in width across postorbital processes. Orbits horizontally subrectangular in lateral view, with contents indicated in Figure 8C. A weak ledge between suborbital shelves and nasal capsules. Suborbital shelves arcuate-angular in shape, extending well lateral to supraorbital crests in dorsal view. Width across suborbital shelves 63% of NBL. Otic capsules not greatly expanded or inflated, lengths about 27% of NBL, and greatest width across them 59% of NBL. Sphenopterotic ridges broadly arcuate in dorsal view, with slight pterotic horn in lateral view. Opisthotic ridges high, extending laterally to edges of sphenopterotic ridges. Hyomandibular facets very large, wedge-shaped, extending across entire length of otic capsules but not exserted posteriorly. Occipital condyles broad and prominently exserted from occiput, with a single occipital centrum between them.

Colour. In alcohol, colour light brownish grey above, lighter below on head, trunk, precaudal tail and fins, bands and saddles darker brownish grey. Broad dark

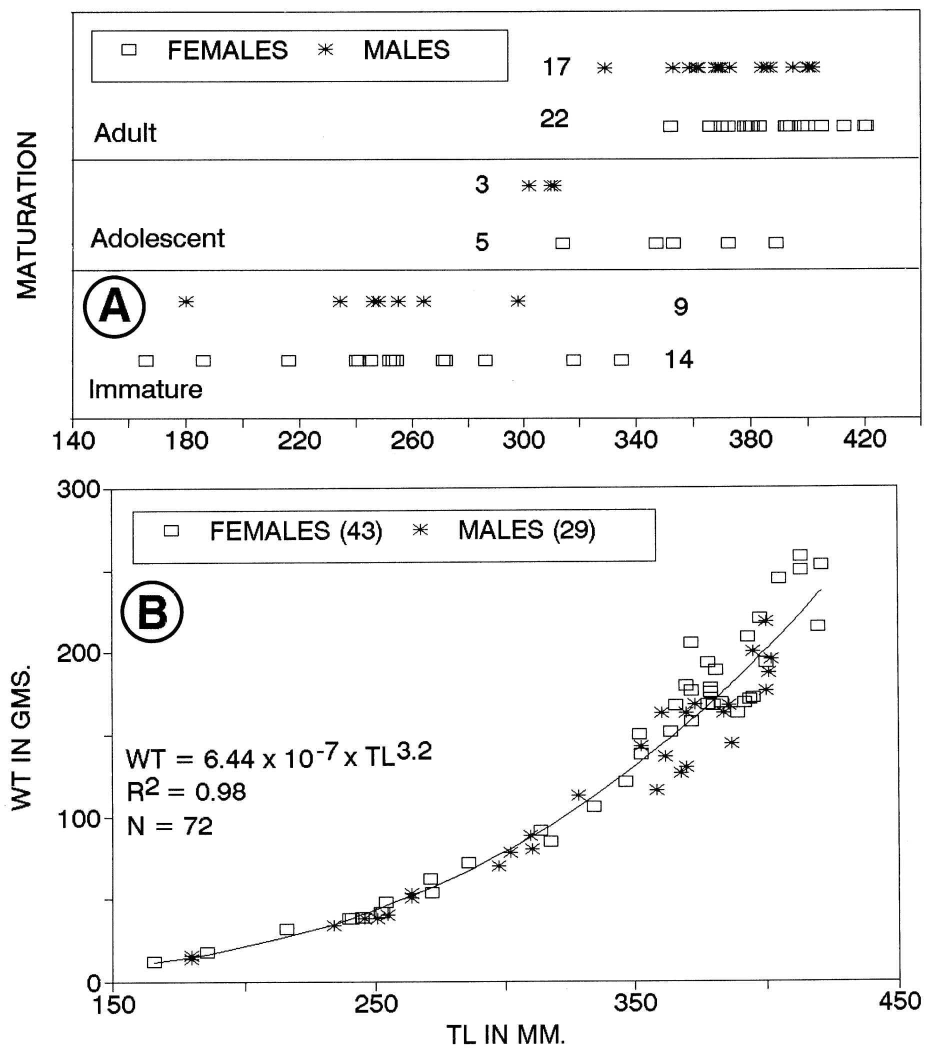

Fig.9. *Atelomycterus fasciatus* size plots. Females indicated by hollow squares, males by hollow diamonds. A, scatterplots of total lengths of immature, adolescent and adult specimens in the sample, separated by sex; B, length-weight plot of 72 individuals. Line indicates exponential regression curve combining both sexes, WT = 6.44 x 10^{-7} x $TL^{3.26}$, R^2 = 0.98.

brownish grey saddle-marks on snout tip, head above eyes, over and just in front of gills, over pectoral-fin inner margins, over abdomen just anterior to pelvic-fin bases, occasionally changing to encircling bands over pelvic-fin inner margins, between dorsal-fin bases, under second dorsal-fin base, at origins of caudal fins, continuing as 2 bands on caudal-fin web and 1 on caudal-fin terminal lobe. Secondary narrow dark bands variably developed over pectoral-fin bases, between broad bands on abdomen, over pelvic-fin bases, and between broad bands under first dorsal-fin free rear tip, under second dorsal-fin origin, below second dorsal-fin inner margin, and between bands on caudal fin; secondary bands usually lighter than primary dark bands. Small dark brown spots size of eye pupil or greater variably developed, scattered on head, body, dorsal-fin surfaces and precaudal tail. No prominent white tips or edges to fins. Small white spots either absent or variably developed, when present few to numerous, size of eye pupil or larger, and scattered over dorsal surface and sides of head, body, tail and dorsal surface of pectoral and pelvic fins, between and inside dark saddle marks and most other dark areas.

Size. Female *Atelomycterus fasciatus* probably mature at a greater size and attain a larger maximum size than males. A size-frequency scattergram comparing juveniles, adolescents and adults of both sexes of *A. fasciatus* is presented as Figure 9A. Nine immature males are 180 to 298 mm long, while three adolescent males are 302 to 311 mm long, and 17 adult males are 329 to 402 mm long (mean for adults 376 mm TL, sd = 19.9, cv = 5.3). Fourteen immature females are 166 to 335 mm long, while five adolescent females are 314 to 389 mm long and 22 adult females (including 3 with egg cases) are 352 to 451 mm long (mean for adults 388.1 mm TL, sd = 18.0, cv = 4.6). There is considerable overlap between juvenile and adolescent females, and between adolescent and adult males in the sample.

Average weight of adult males in our sample was about 82% of that of adult females, with considerable overlap between large males and small females. Adult males weighed 113 to 218 g (mean = 159.2, sd = 29.4, cv = 18.4) while adult females weighed 150 to 258 g (mean = 195.3, sd = 31.4, cv = 16.1). A length-weight scattergram for 72 *Atelomycterus fasciatus* with fitted exponential regression curve is presented as Figure 9B.

Fig.10. *Atelomycterus fasciatus*, two egg cases (67 mm long, 20 mm wide) removed from CSIRO H1299.10, 372 mm female. Vestibular end up, terminal end with horns and filaments down. Scale markings in mm. Photo by T. Carter.

Reproduction. *Atelomycterus fasciatus* is probably oviparous. Three adult females 352, 372 and 405 mm long in our sample were gravid and had a thick-walled egg case in each oviduct. These egg cases are similar to those of other oviparous scyliorhinids with single oviparity (Compagno, 1988), in which one egg case at a time is formed in the oviduct, and deposited on the substrate well before the embryo is ready to hatch.

The egg cases (Fig.10, removed from the uterus) are bright yellow in colour and measure 67 mm long from the center of the anterior or vestibular end to the bases of the horns at the terminal or posterior end, are 20 mm wide and 11 mm thick. In dorsoventral profile these egg cases have a truncated vestibular end, a pair of anterior convexities posterior to the vestibular end, a distinct waist or neck, a central convex body for the egg proper, a second posterior waist or neck, and a tapering terminal end that has two horns with twisted bases and curled, fine filaments. There are no vestibular horns on the cases, but these may form before the egg cases are laid.

Distribution and habitat. *Atelomycterus fasciatus* is a common offshore benthic shark on the continental shelf of Western Australia where it has been captured between Exmouth Gulf (22°S 114°15'E) and off the southern end of Eighty Miles Beach (20°S 120°E) (Fig.11). There are also single specimens of this species from the Arafura Sea (10°37'S 133°47'E), Northern Territory, and from the Gulf of Carpentaria (16°38'S 140°02'E) and Torres Strait (10°31'S 140°48'E) Queensland (Fig.11, inset map). Western Australian specimens were caught on sand and shelly sand bottoms with Frank & Bryce demersal trawls with a 30.5 m headline. Depths of capture were from 27 to 122 m, with most records shallower than 60 m.

Atelomycterus macleayi currently has a more extensive geographic range than *A. fasciatus*, with scattered records from Western Australia and the Northern Territory as well as Queensland (Whitley, 1940; Springer, 1979; Compagno, 1988; Paxton *et al.* 1989). The Indo-

West Pacific *A. marmoratus* is apparently absent from Australian waters but is nominally recorded from New Guinea (Springer, 1979; Compagno, 1988).

Atelomycterus macleayi is rarer in collections than *A. fasciatus*, which may reflect a habitat difference between these species. *Atelomycterus macleayi* may prefer reefs and other hard bottom habitats that are difficult to sample with demersal trawls, while *A. fasciatus* may prefer a soft mud and sand bottom. Only *A. fasciatus* was caught in the extensive series of soft-bottom trawl stations listed above.

Comparison with other species. *Atelomycterus macleayi* (Fig.12) and *A. marmoratus* (Fig.13) are readily distinguishable from *A. fasciatus* in external morphology and morphometrics, clasper structure, colouration, and vertebral counts (Table 3), and possibly differ in intestinal valve counts and cranial morphology. A summary of major morphometric differences with statistics are presented in Table 4 for 72 *A. fasciatus*, three *A. macleayi*, and nine *A. marmoratus*.

Atelomycterus macleayi and *A. marmoratus* have relatively shorter preoral snouts (POR) than *A. fasciatus*, with only a slight overlap (Fig.15A, Table 4). There may be negative allometry with POR in all three species, with smaller *A. macleayi* and *A. marmoratus* overlapping large *A. fasciatus*. Head length (HDL) is slightly greater in *A. fasciatus* than in the other two species, but with negative allometry in this species and *A. macleayi* and slight overlap between larger individuals of *A. fasciatus* and small *A. macleayi*.

Precaudal length (PCL) is slightly shorter in *Atelomycterus macleayi* and *A. marmoratus* than in *A. fasciatus* (Table 4). However, PCL is apparently positively allometric in *A. macleayi* and *A. fasciatus*, with small *A. fasciatus* overlapping large *A. macleayi* and *A. marmoratus* in this dimension.

Atelomycterus macleayi and *A. marmoratus* differ from *A. fasciatus* in their higher, rear-swept dorsal fins (Figs 12, 13, 14B), with the posterior margins vertical or slanting anteroventrally from the fin apices and the apices themselves usually more broadly rounded. The few *A. macleayi* examined have their dorsal fins more swept than in *A. marmoratus*. *Atelomycterus fasciatus* have the posterior margins of their dorsal fins slanting posteroventrally from their apices and the apices more narrowly rounded.

The anal fin is slightly larger in *Atelomycterus*

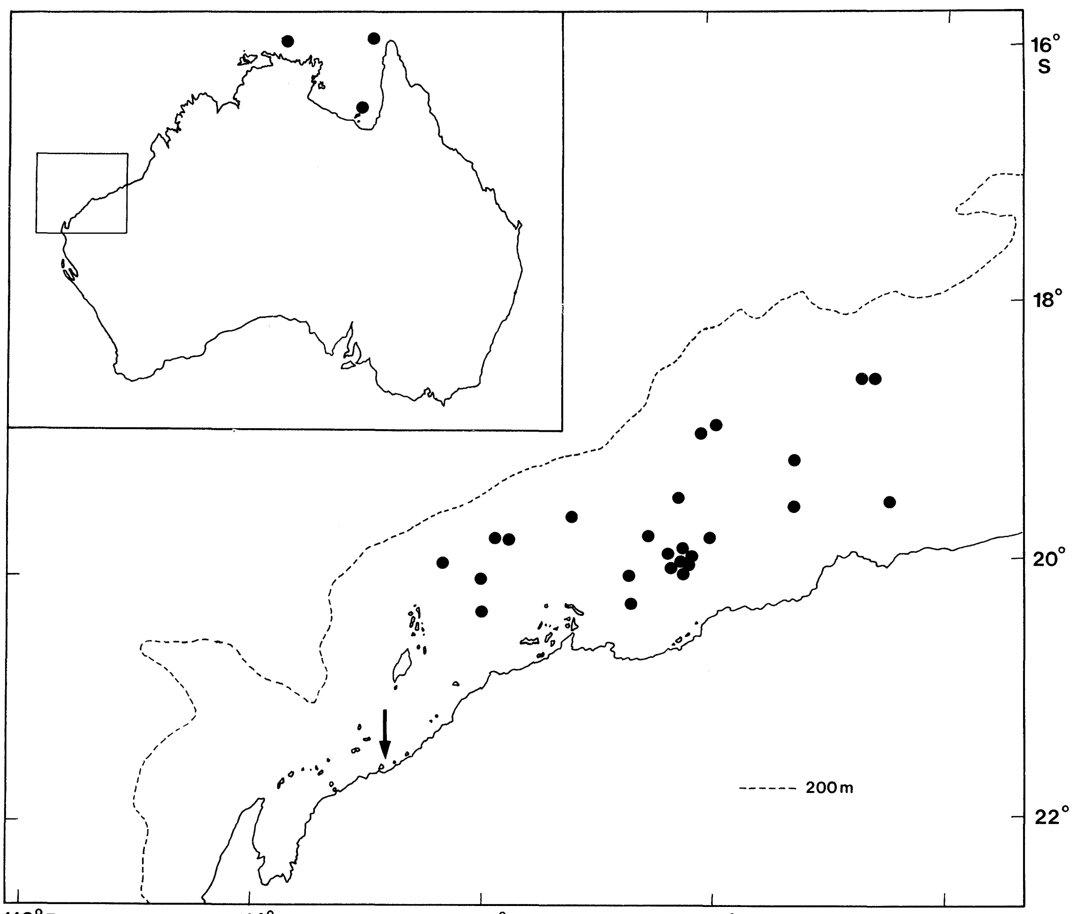

Fig.11. *Atelomycterus fasciatus*, distribution map. Inset: Continent with Western Australian range circumscribed by square, black dots show the records from the Arafura Sea, Gulf of Carpentaria and Torres Strait. Main map: enlargement of inset square with records (black dots) of specimens off the North West Shelf of Western Australia. Arrow points to area in which holotype was found. Map by P. White.

macleayi and *A. marmoratus* than in *A. fasciatus* (Table 4), with some overlap in height (ANH) and base length (ANB).

The three *Atelomycterus* species are sharply distinguished by the dimensions, external morphology and skeletal structure of their claspers. Adult males of *A. macleayi* have short, very stout claspers (Figs 12, 5C,D), *Atelomycterus marmoratus* has very long, attenuated claspers (Figs 13, 5E,F), while *A. fasciatus* is intermediate in having moderately stout and elongated claspers (Figs 1, 5A,B). Clasper dimensions do not overlap between the three species in our limited sample of adult males, including 17 *A. fasciatus*, two *A. macleayi* and three *A. marmoratus* (Table 4, Fig.14C). CLB as % CLO is diagnostic and reflects the different clasper shapes in the three species (Table 4).

The claspers of *Atelomycterus marmoratus* additionally differ from those of *A. fasciatus* and *A. macleayi* (Fig.5) in having the glans less than half the length of the clasper outer margin; a small, narrow anterior tab on the cover rhipidion; a small, narrow cover rhipidion, with its posterior end well anterior to the pseudopera and exorhipidion and far ahead of the rear end of the rhipidion; a low, subquadrate, striplike rhipidion; a much smaller exorhipidion and pseudopera that are well behind the cover rhipidion; a pseudosiphon aperture that is slightly longer than the cover rhipidion. The claspers of *A. marmoratus* additionally differ from those of *A. fasciatus* in being less tapered from apopyle to hypopyle and in having an exposed rhipidion (largely covered by the exorhipidion and cover rhipidion in *A. fasciatus*. The claspers of *A. macleayi* additionally differ from those of *A. fasciatus* in having a broader clasper glans with broad, blunt tip (narrower and tapering in *A. fasciatus*); a broader, more arcuate, exposed rhipidion; a shorter pseudosiphon less than half the length of the cover rhipidion.

The clasper skeleton of *A. macleayi* could not be studied, but that of *A. marmoratus* (Fig.15) differs of that of *A. fasciatus* (Fig.6) in numerous features, including

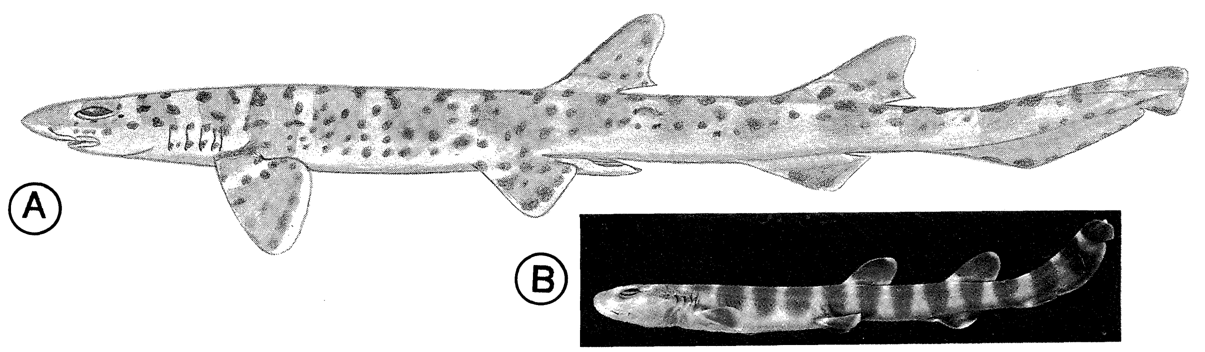

Fig.12. *Atelomycterus macleayi*. A, USNM 174070, 481 mm adult male, lateral view; B, WAM P8811, 100 mm hatchling male, lateral view, not to scale. Illustration and photograph by L.J.V. Compagno.

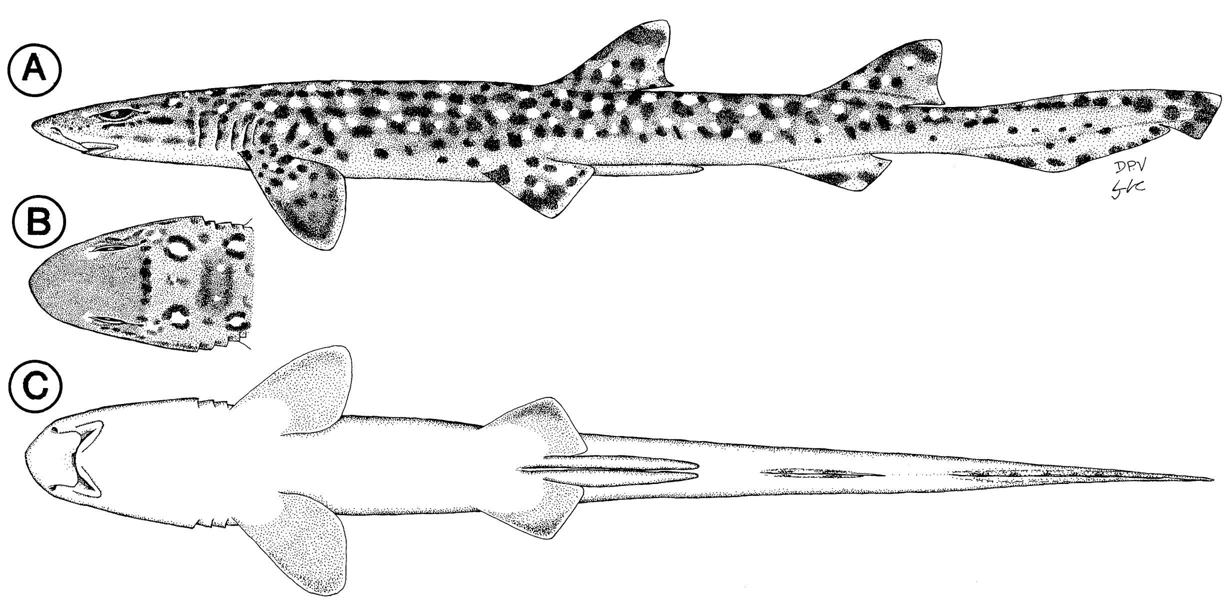

Fig.13. *Atelomycterus marmoratus*, SU 14182, 467 mm adult male. A, lateral view; B, dorsal view of head; C, ventral view. Illustration by D. Voorfelt and L.J.V. Compagno.

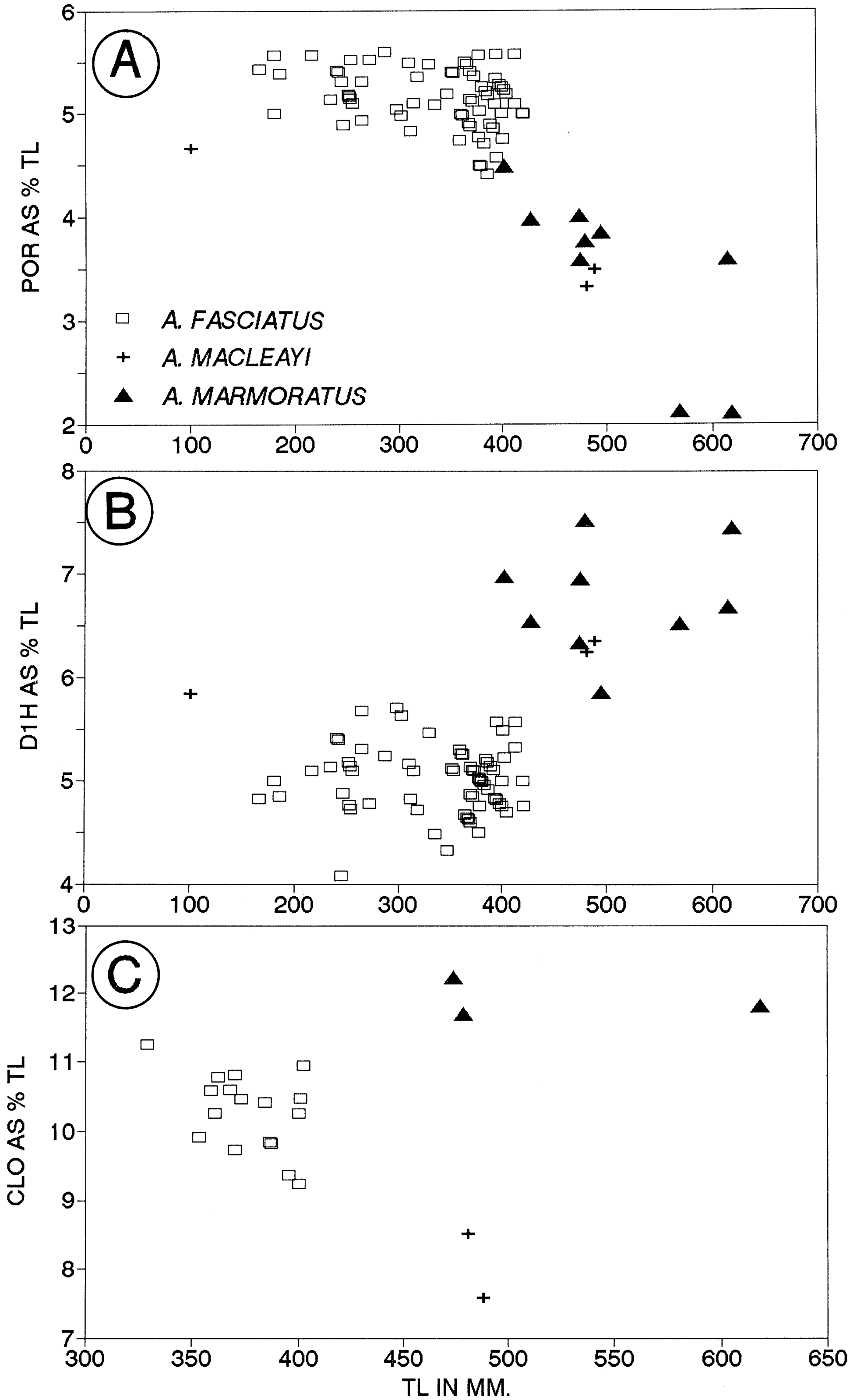

Fig.14. *Atelomycterus* species. Head proportions as percentages of total length versus total length (TL) in mm. *Atelomycterus fasciatus* – hollow squares; *Atelomycterus macleayi* – crosses; *Atelomycterus marmoratus* – filled triangles. A, preoral length (POR) as % TL versus TL; B, head length (HDL) as % TL versus TL; B, first dorsal height (D1H) as % TL versus TL; C, clasper outer length (CLO) as % TL versus TL.

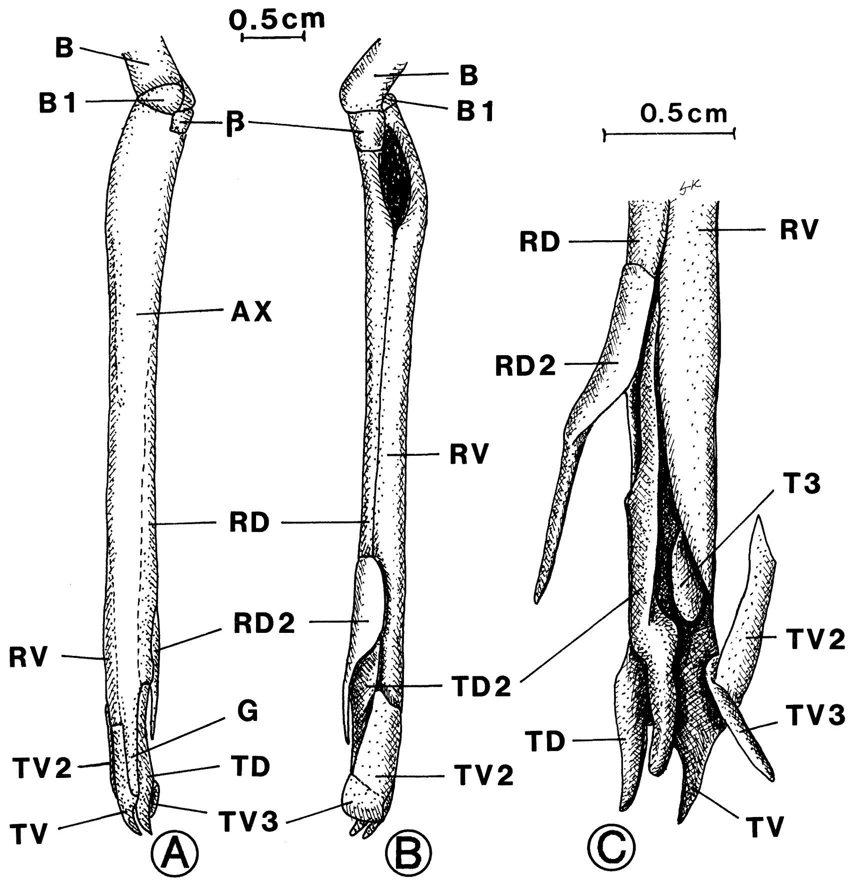

Fig.15. *Atelomycterus marmoratus*, clasper skeleton, SU 13659, 477 mm adult male, right side. A, ventral view; B, dorsal view, terminal cartilages not dilated; C, dorsal view of glans (twice size of B), terminal cartilages spread. Abbreviations as in Figure 6. Illustration by L.J.V. Compagno.

its more slender, parallel-sided clasper shaft (dorsal and ventral marginal cartilages distally splayed in *A. fasciatus*, giving the clasper shaft an elongated hourglass-shape), shorter appendix-stem, shorter dorsal and ventral terminal (TD and TV) cartilages, greatly elongated, attenuated accessory terminal dorsal (TD2) cartilage, and more distally attenuated accessory dorsal marginal (RD2) cartilage.

Intestinal valve counts may average slightly higher in *Atelomycterus macleayi* and *A. marmoratus* than in *A. fasciatus*, with some overlap between the latter two species. One *A. macleayi* counted had 15 turns, eight *A. marmoratus* had 13 to 14 turns (mean = 13.6, sd = 1.1, cv = 7.1), while 18 *A. fasciatus* had 11 to 13 turns (mean 12.2, sd = 0.6, cv = 5.3).

Adults and subadults of the *Atelomycterus* species are readily distinguished by colouration and colour pattern (Figs 1, 12, 13). *Atelomycterus macleayi* and *A. marmoratus* differ from *A. fasciatus* in having bolder colour patterns as adults, with numerous large and small dark brown or black spots on their bodies and fins, white tips on their dorsal and caudal fins, light-edged paired fins, and with saddles, where present, not extending onto the ventral surface of the tail or the abdomen. *Atelomycterus macleayi* additionally differs from *A. fasciatus* in having its saddles less well defined in adults, and of equal width (Fig.12A). *Atelomycterus fasciatus* alternates broad and narrow banding from the branchial region to the caudal base (Fig.1). *Atelomycterus marmoratus* is much darker than *A. fasciatus*, with the saddles obsolete and the dark brown to black spots enlarged and often merging to form dash and bar marks that bridge the saddle areas, and with the light ground colour reduced to large white spots on the sides and back.

Hatchling *A. fasciatus* and *A. marmoratus* have not been seen, but hatchling *A. macleayi* apparently differ from adults in having equal width, bold, simple, solid dark saddles without dark spots, but also having prominent white fin edges and tips (Fig.12B).

Atelomycterus marmoratus and *A. macleayi* have higher TC, PC and DP vertebral counts than *A. fasciatus*. In turn *A. macleayi* apparently has higher DP, PC and TC than *A. marmoratus*, and higher DP as % TC and DP/MP ratios than either *A. marmoratus* or *A. fasciatus* (Table 3).

Chondrocrania were not available for *Atelomycterus macleayi*, but comparison of the chondrocranium of a specimen of *A. marmoratus* (see Compagno, 1988:fig.13.2) with that of *A. fasciatus* (Fig.8) reveals a few differences. *Atelomycterus marmoratus* has a complete rostral node, nasal apertures on the ventral surfaces of the nasal capsules (anterolateral in *A. fasciatus*), a rounded anterior fontanelle (subtrapezoidal in *A. fasciatus*), and laterally directed postorbital processes (posterolateral in *A. fasciatus*).

Atelomycterus macleayi and *A. marmoratus* apparently attain a larger size than *A. fasciatus*. Two adult males of *A. macleayi* are 481 and 488 mm long while three adult male *A. marmoratus* are 474, 479 and 615 mm long. A 428 mm female *A. marmoratus* is immature while a 475 mm female is adolescent and two females of 568 and 614 mm are gravid. A 614 mm adult female *A. marmoratus* weighed 750 g, approximately 2.9 times our heaviest adult female *A. fasciatus* (258 g).

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Table 1. *Atelomycterus fasciatus*. Proportional dimensions as percentages of total length for holotype and nine paratypes.

	Holotype	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype
Coll.	WAM	CSIRO	CSIRO	WAM P	CSIRO	CSIRO	CSIRO	CSIRO	CSIRO	CSIRO
No.	P8629	CA4518	H1297-01	23838	CA4523	CA4524	H1294-01	CA3289	H1295-01	H1296-01
Sex/M	M 4	F 2	M 2	M 2	M 2	F ?	F 4	F ?	M 4	F 4
WT gm	163	32	34	38	53	85	205	172	218	258
TL mm.	370	216	234	251	264	318	372	395	400	413
PCL %	82.7	83.3	81.2	82.1	81.8	83.3	85.2	81.3	82.5	83.8
PRN	3.0	2.8	3.0	3.2	3.0	3.1	3.0	2.8	3.0	3.4
POR	5.1	5.6	5.1	5.2	4.9	5.3	5.1	4.6	5.3	5.6
POB	5.4	6.9	6.4	4.8	5.7	6.6	5.9	5.1	6.3	6.5
PSP	8.9	10.2	9.8	9.2	10.2	10.1	9.4	9.1	9.5	9.9
PGI	14.9	15.3	14.1	14.3	15.2	15.4	15.1	14.2	14.3	15.7
HDL	20.8	20.8	19.2	18.7	19.7	20.4	20.7	19.2	19.5	23.0
PP1	18.6	19.4	17.9	18.3	17.0	19.2	19.1	18.2	18.0	19.4
PP2	44.9	43.1	41.0	39.8	40.9	41.5	43.8	41.8	41.8	42.4
SVL	45.7	44.4	42.7	42.6	43.6	43.4	47.0	43.3	45.0	44.8
PAL	63.8	64.4	62.8	64.1	67.8	63.2	65.9	65.1	62.8	64.2
PD1	47.8	46.3	44.4	44.2	44.7	45.3	47.0	45.8	46.0	46.7
PD2	68.4	67.1	65.8	66.5	66.3	67.3	68.8	67.1	66.0	67.8
IDS	12.2	13.4	13.7	12.7	14.4	15.1	14.2	12.9	13.0	13.1
DCS	5.9	7.9	5.1	8.0	6.4	7.2	6.5	5.6	7.3	7.7
PPS	20.8	20.4	21.4	17.1	19.7	18.9	21.0	19.5	19.8	20.6
PAS	15.4	16.2	17.1	15.5	17.0	16.0	18.3	18.2	15.5	16.2
ACS	6.8	9.3	10.3	7.2	7.6	8.8	8.1	6.8	7.3	8.0
EYL	3.0	3.7	3.4	3.2	3.4	3.5	4.0	2.8	3.5	3.4
EYH	1.4	1.4	1.3	0.9	1.1	1.3	1.1	1.3	1.3	1.7
INO	6.5	6.9	6.0	6.0	6.8	6.6	7.0	6.1	6.3	6.1
NOW	2.7	2.3	2.1	2.0	1.9	2.2	2.4	2.3	1.8	2.9
INW	2.4	1.9	2.1	2.0	1.9	2.2	2.2	2.0	2.0	2.4
ANF	3.0	3.2	3.0	3.2	3.0	3.5	5.1	2.5	3.0	3.1
SPL	0.8	0.5	0.4	0.6	0.6	0.6	0.8	0.6	0.8	0.8
ESL	0.4	0.9	0.5	0.4	0.5	0.3	0.3	0.5	0.7	0.5
MOL	3.0	2.3	2.1	2.8	2.7	2.2	2.4	2.3	2.8	2.4
MOW	7.3	6.5	6.0	6.0	6.1	6.0	7.0	5.8	7.3	7.5
ULA	3.0	2.3	3.0	2.8	2.7	3.1	2.7	2.8	3.0	3.1
LLA	3.5	2.8	3.4	2.8	3.0	3.5	3.5	3.0	3.8	3.6
GS1	1.6	1.9	1.7	1.0	1.9	2.5	2.4	1.5	2.0	2.4
GS2	1.9	1.9	2.1	1.2	1.9	2.5	2.4	1.8	2.5	2.7
GS3	1.9	2.3	2.1	1.2	1.9	2.2	2.4	1.8	2.8	2.4
GS4	1.9	2.3	1.7	1.2	1.9	2.2	2.4	1.8	2.5	2.4
GS5	1.4	1.9	1.3	0.9	1.1	1.6	2.2	1.3	1.5	1.9
HDH	5.7	5.6	5.6	5.6	5.7	5.7	5.6	5.1	5.5	5.8
HDW	10.0	10.2	9.4	9.6	9.5	9.4	10.2	9.1	10.0	10.4
TRH	8.9	7.9	7.3	6.4	7.6	7.2	9.9	7.6	8.5	9.2
TRW	8.6	8.8	8.1	7.6	8.0	8.2	10.8	8.4	9.0	9.9
CPH	3.5	3.7	3.4	3.6	3.4	3.1	3.2	3.3	2.8	3.4
CPW	3.0	2.8	3.0	2.8	2.7	2.5	3.0	3.0	2.8	3.1
GIR	27.0	28.7	26.5	21.9	25.4	26.1	33.9	25.8	27.8	32.7
P1L	10.0	9.7	9.8	9.6	9.5	10.4	10.5	10.1	8.8	10.9
P1A	11.1	10.2	10.3	10.4	10.2	11.0	11.6	11.4	10.5	12.1
P1B	4.9	4.6	4.3	4.8	4.5	4.7	4.8	4.8	4.8	4.8
P1H	7.8	8.3	6.8	8.4	8.0	8.2	8.9	8.4	9.0	10.2
P1I	5.7	5.6	6.0	8.8	5.3	6.3	5.6	5.8	5.3	6.8
P1P	7.6	7.9	6.4	6.0	6.8	7.2	7.0	7.3	7.8	9.0
P2L	10.8	9.7	9.8	10.0	9.8	9.7	9.4	9.9	10.8	10.2
P2A	7.6	7.4	7.7	8.0	7.6	7.5	6.7	6.8	8.0	8.0
P2B	5.4	5.6	6.0	6.0	6.1	6.0	5.1	5.6	6.0	6.1
P2H	6.5	6.0	5.1	5.2	9.5	6.0	4.6	2.3	5.5	5.1
P2I	5.1	4.6	3.0	3.6	3.4	3.8	4.0	4.8	3.5	4.4
P2P	6.2	6.0	5.1	5.2	5.3	6.3	5.9	6.1	5.3	6.5
CLO	10.8	–	2.1	2.0	2.7	–	–	–	10.3	–

Table 1 (cont'd).

	Holotype	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype	Paratype
Coll.	WAM	CSIRO	CSIRO	WAM P	CSIRO	CSIRO	CSIRO	CSIRO	CSIRO	CSIRO
No.	P8629	CA4518	H1297-01	23838	CA4523	CA4524	H1294-01	CA3289	H1295-01	H1296-01
CLI	14.6	–	5.1	4.4	5.7	–	–	–	13.5	–
CLB	1.6	–	0.9	0.8	0.8	–	–	–	1.5	–
D1L	11.4	10.2	10.7	11.2	9.8	10.7	10.2	10.4	9.8	10.9
D1A	10.5	9.7	10.3	10.8	8.7	8.5	9.9	10.4	8.5	10.9
D1B	8.9	6.9	6.8	7.6	6.8	8.2	7.3	7.1	6.8	8.2
D1H	5.1	5.1	5.1	5.2	5.7	4.7	4.8	4.8	4.8	5.6
D1I	2.4	3.7	3.0	2.8	2.7	3.1	3.2	2.8	3.0	3.4
D1P	4.9	4.6	3.8	4.4	4.9	5.0	4.8	4.6	5.3	5.6
D2L	11.1	11.6	10.3	11.6	10.2	10.1	11.0	11.6	11.0	12.1
D2A	10.3	11.1	10.3	10.8	9.5	10.1	10.5	10.9	9.3	11.9
D2B	8.6	8.3	8.1	8.8	8.0	8.2	8.1	9.1	8.0	9.0
D2H	4.9	5.6	4.7	4.4	5.3	4.7	4.8	4.8	4.3	4.8
D2I	2.4	3.2	2.1	2.4	2.7	2.5	2.7	2.5	2.8	2.9
D2P	5.4	4.6	4.3	4.0	4.5	4.4	4.6	4.6	4.0	4.8
ANL	9.2	9.7	8.5	9.6	8.7	8.5	8.3	9.6	10.0	9.0
ANA	7.6	8.3	6.8	8.4	7.2	6.9	7.5	8.4	7.8	7.5
ANB	7.3	7.9	5.6	7.2	7.2	6.9	6.5	7.3	8.3	6.8
ANH	2.7	2.8	2.1	2.4	3.0	2.5	2.7	2.5	2.5	2.7
ANI	1.6	1.9	1.7	2.0	2.3	1.6	1.9	2.0	1.8	2.2
ANP	3.2	2.8	2.1	2.4	3.0	2.5	2.7	2.3	2.8	2.7
CDM	16.2	18.5	18.8	17.1	17.8	17.9	17.5	18.0	17.0	16.5
CPV	8.9	8.8	7.3	9.2	8.0	9.4	8.1	9.4	8.5	8.5
CPL+U	8.6	8.8	9.0	8.8	8.7	8.2	8.3	9.1	9.5	8.2
CST	2.7	2.8	3.4	3.6	3.0	2.8	3.2	3.0	2.3	2.7
CTR	4.9	4.6	4.3	4.0	4.5	3.5	3.8	4.6	4.0	4.4
CTL	4.6	4.6	4.7	4.8	4.9	4.1	4.3	4.8	4.0	5.1
DAO	3.5	3.2	3.8	3.2	3.4	4.4	2.7	2.5	4.0	2.2
DAI	4.6	3.7	6.0	4.8	3.8	5.0	4.3	4.3	3.8	4.8

Table 2. *Atelomycterus* species. Proportional dimensions as percentages of total length for three specimens of *A. macleayi* (including the holotype) and nine *A. marmoratus*.

	A. macleayi			*A. marmoratus*								
Coll.	AMS	WAM	USNM	SU	LACM	SU	SU	SU	SPA	SU	BPBM	SU
No.	I5269 (HOLO)	P8811	174070	40095	37431	14182	13689	13659	UNC.	13563	29851	13562
Sex/M	M 4	M 2	M 4	F 2	F 2	M 4	F 3	M 4	F ?	F 4	F 4	M 4
TL mm	488	101	481	402	428	474	475	479	495	568	614	618
PCL %	79.3	75.2	79.0	78.6	79.4	79.3	80.0	77.7	80.8	80.1	80.0	77.8
PRN	2.0	2.7	1.9	2.2	2.3	2.1	1.7	2.1	1.8	3.9	1.8	3.6
POR	3.5	4.7	3.3	4.5	4.0	4.0	3.6	3.8	3.8	2.1	3.6	2.1
POB	4.3	5.6	4.0	5.5	4.4	5.5	5.1	5.2	4.2	4.8	3.9	4.9
PSP	6.8	8.8	7.5	8.7	7.7	8.6	8.0	8.1	7.7	8.1	8.0	7.9
PGI	12.1	15.4	12.5	12.9	12.1	13.3	13.3	12.9	12.5	13.9	12.7	12.3
HDL	17.0	19.6	17.7	18.2	17.8	18.1	17.9	17.5	18.0	19.2	17.6	18.0
PP1	16.4	17.4	16.6	16.9	16.1	15.8	16.8	15.9	16.6	18.5	16.4	16.2
PP2	–	39.5	–	37.1	36.4	36.9	37.5	36.3	40.4	38.7	37.9	37.5
SVL	41.0	41.6	40.7	39.8	40.4	40.1	38.1	38.8	42.6	40.5	40.1	39.8
PAL	–	58.4	–	57.7	60.0	61.2	60.4	58.5	62.6	62.0	58.8	59.2
PD1	43.0	44.6	43.7	41.3	40.2	43.9	41.3	40.9	46.7	40.7	43.8	40.5
PD2	–	62.4	–	62.7	62.4	63.7	62.1	62.0	67.1	63.2	63.7	60.7
IDS	12.7	10.3	13.5	11.9	12.4	14.8	15.6	14.6	14.1	13.2	14.0	12.3
DCS	6.6	5.0	6.4	5.7	6.5	6.8	7.8	7.1	6.3	4.9	7.7	5.5
PPS	18.4	17.6	18.5	16.7	16.6	16.0	18.3	14.6	17.2	17.3	19.2	16.7
PAS	15.4	12.6	17.9	14.2	15.7	19.0	18.1	17.1	16.6	19.7	17.3	16.5
ACS	7.8	7.3	7.3	5.7	7.9	6.8	7.2	7.5	7.9	4.9	7.8	6.1
EYL	2.5	2.4	2.5	3.2	2.8	3.0	3.2	3.1	2.4	3.0	2.8	3.1
EYH	0.6	0.2	0.8	1.2	0.7	1.7	1.3	1.3	1.2	1.2	0.8	1.1
INO	4.9	7.6	5.6	5.2	6.1	5.3	5.3	5.6	6.1	5.8	5.0	5.5
NOW	1.8	1.8	1.5	1.7	1.9	2.3	2.1	1.9	2.8	2.1	2.0	1.9
INW	1.4	1.8	1.9	1.2	1.6	1.7	1.3	1.3	4.2	1.6	1.8	1.3
ANF	2.5	2.6	2.5	3.0	2.8	2.7	2.7	2.7	2.0	3.0	2.6	2.8
SPL	0.4	0.3	0.4	0.5	0.7	1.1	0.8	1.0	0.6	1.1	0.8	1.0
ESL	–	0.3	0.4	0.5	–	0.6	0.8	0.6	0.4	0.7	0.5	0.6
MOL	1.8	2.0	2.9	2.2	2.6	2.5	2.1	2.7	2.8	2.3	2.3	2.4
MOW	5.7	7.7	5.6	6.2	5.4	5.9	6.1	6.3	5.9	6.2	5.9	6.1
ULA	2.5	2.2	2.5	3.2	2.8	2.7	2.7	3.3	2.4	3.0	2.9	2.9
LLA	2.9	3.1	3.3	3.5	2.8	3.4	3.4	3.8	3.2	3.3	3.1	3.4
GS1	1.8	1.1	2.1	2.0	2.6	2.5	1.7	2.1	2.2	2.3	2.4	2.1
GS2	1.8	1.1	2.1	2.2	2.6	2.5	2.1	2.1	2.2	2.6	2.9	2.3
GS3	2.5	1.1	2.1	2.2	2.6	2.5	2.1	2.1	2.0	2.6	2.8	2.4
GS4	1.6	0.8	1.9	2.0	2.1	2.1	2.1	1.9	1.8	2.6	2.4	2.3
GS5	1.4	0.7	1.5	1.5	1.6	1.5	1.7	1.5	1.2	2.1	1.8	1.8
HDH	4.9	6.5	–	5.2	6.8	4.9	5.9	5.2	4.6	5.6	5.0	5.5
HDW	6.8	10.3	–	9.0	10.3	8.6	9.3	9.4	8.5	8.6	8.5	9.1
TRH	–	8.4	6.9	7.7	–	7.6	6.3	8.4	7.7	9.3	7.3	7.8
TRW	–	4.6	8.1	7.0	–	7.6	8.6	6.9	8.9	8.3	7.3	7.6
CPH	3.5	4.8	4.2	4.0	4.2	3.6	3.6	3.3	3.4	3.7	3.7	3.7
CPW	2.7	3.0	2.7	2.7	2.8	3.0	3.2	2.9	3.0	2.8	3.1	3.2
GIR	–	24.8	–	–	–	25.3	24.2	25.1	28.1	29.6	26.1	24.3
P1L	9.2	8.9	8.5	9.5	9.8	9.5	8.2	9.6	10.7	9.3	12.2	9.1
P1A	11.3	10.8	9.8	11.4	11.7	11.0	10.5	10.6	10.7	11.3	11.4	10.8
P1B	4.1	3.7	3.7	4.0	4.9	4.4	3.8	4.4	3.6	4.6	3.9	4.4
P1H	6.8	7.0	7.3	9.7	9.1	8.9	9.5	7.3	7.3	8.6	9.3	10.0
P1I	4.7	4.7	4.8	5.0	4.9	4.9	4.2	5.6	6.1	3.7	5.2	4.5
P1P	–	6.5	8.5	7.2	–	6.3	7.4	7.7	8.1	6.3	8.6	7.8
P2L	9.0	7.9	9.6	10.0	9.8	9.5	9.3	10.2	7.9	5.3	9.6	9.9
P2A	7.4	6.5	7.1	8.7	8.2	7.6	7.8	8.1	7.5	10.0	7.7	8.6
P2B	5.5	5.2	6.0	6.5	6.1	6.1	5.5	6.1	5.7	6.7	6.0	7.0
P2H	5.7	5.2	5.4	5.2	6.3	4.6	5.5	5.6	6.1	5.5	5.4	5.7
P2I	3.7	3.7	2.5	4.0	4.0	3.8	3.6	4.4	3.2	4.0	3.9	3.7
P2P	–	5.6	5.4	5.0	–	5.5	5.1	5.2	6.5	5.8	5.7	5.8

Table 2 (cont'd).

	A. macleayi			*A. marmoratus*								
Coll.	AMS	WAM	USNM	SU	LACM	SU	SU	SU	SPA	SU	BPBM	SU
No.	I5269 (HOLO)	P8811	174070	40095	37431	14182	13689	13659	UNC.	13563	29851	13562
CLO	7.6	1.2	8.5	–	–	12.2	–	11.7	–	–	–	13.8
CLI	11.5	3.0	11.6	–	–	15.8	–	15.2	–	–	–	16.2
CLB	–	0.6	1.9	–	–	1.3	–	1.3	–	–	–	1.1
D1L	11.3	9.7	9.8	11.4	11.0	9.7	11.8	9.8	10.7	11.4	8.5	11.8
D1A	12.9	12.0	11.4	13.4	12.9	11.0	12.8	11.5	11.5	12.7	9.6	12.6
D1B	9.0	6.6	6.7	8.7	7.7	7.0	9.3	7.3	7.5	8.6	6.2	8.3
D1H	6.4	5.8	6.2	7.0	6.5	6.3	6.9	7.5	5.9	6.5	6.7	7.4
D1I	2.3	2.4	3.1	3.0	3.3	3.4	2.7	2.9	4.0	3.5	3.1	3.1
D1P	–	5.7	–	5.2	–	5.3	5.7	6.3	6.1	5.6	6.4	6.3
D2L	11.7	10.4	11.4	12.4	11.9	11.4	10.9	11.5	10.7	12.3	11.2	13.4
D2A	12.9	12.2	12.7	13.7	12.4	12.9	11.6	12.1	11.1	13.4	10.6	14.4
D2B	9.2	7.5	8.3	9.7	8.9	8.9	8.8	9.2	7.3	10.4	8.1	11.0
D2H	5.7	6.3	6.2	5.5	5.6	5.5	5.9	6.3	6.3	5.8	6.0	6.6
D2I	2.5	2.3	3.1	3.0	3.0	2.7	2.3	2.7	2.6	2.6	2.4	2.6
D2P	–	5.3	–	4.2	–	4.4	4.6	5.4	5.3	4.6	5.4	5.5
ANL	12.7	12.3	11.0	11.4	11.4	11.2	10.3	11.3	9.1	11.3	11.4	12.0
ANA	9.4	9.4	8.5	10.0	9.3	8.9	8.2	9.2	7.9	9.2	8.6	10.5
ANB	10.5	9.2	8.5	9.5	9.1	8.6	8.8	9.0	7.9	9.3	9.1	9.9
ANH	3.1	3.2	3.1	3.5	3.3	3.4	3.2	3.5	3.2	3.0	3.4	3.7
ANI	2.3	1.8	2.5	2.2	2.3	2.3	1.9	3.3	2.0	1.9	2.4	2.4
ANP	–	4.6	4.2	3.5	–	3.8	3.6	3.8	3.4	3.9	4.2	4.2
CDM	20.1	21.2	19.8	20.6	21.0	19.6	19.6	22.3	19.8	17.6	19.5	21.7
CPV	8.8	8.3	8.5	11.2	8.6	9.7	8.6	10.0	7.1	10.0	8.5	9.9
CPL+U	11.3	13.6	12.5	10.7	10.5	11.0	10.7	11.1	11.9	10.7	11.2	12.1
CST	3.1	3.0	2.9	3.5	4.0	3.4	3.2	4.2	3.2	3.5	3.4	4.0
CTR	4.1	4.3	4.4	4.0	4.7	3.4	3.6	3.8	4.6	4.2	4.4	4.5
CTL	4.3	4.4	4.6	5.2	5.8	4.9	5.1	5.6	5.5	5.1	5.5	6.0
DAO	4.5	4.7	2.1	3.7	4.2	2.5	3.4	3.3	3.4	2.1	4.4	3.2
DAI	3.1	2.5	1.9	3.5	4.2	2.7	3.6	4.4	3.4	2.6	3.7	3.4

Table 3. *Atelomycterus* species. Vertebral counts and ratios for specimens of *A. fasciatus*, *A. macleayi* and *A. marmoratus*.

A. fasciatus	T L	MP	DP	DC	PC	TC	%MP	%DP	%DC	DP/MP	DC/MP	A	B
WAM-P8629	370	43	60	54	103	157	27.3	38.2	34.3	1.4	1.3	123	68
WAM-P23838	251	42	60	47	102	149	28.1	40.2	31.5	1.4	1.1	167	83
CSIRO CA3289	395	41	62	47	103	150	27.3	41.3	31.3	1.5	1.1	115	78
CSIRO H1295-01	400	42	61	53	103	156	26.9	39.1	33.9	1.5	1.3	143	68
CSIRO H1294-01	372	42	62	52	104	156	26.9	39.7	33.3	1.5	1.2	133	60
CSIRO CA4524	318	41	61	–	102	–	–	–	–	1.5	–	130	81
CSIRO H1296-01	413	39	62	50	101	151	25.8	41.0	33.1	1.6	1.3	114	67
CSIRO H1297-01	234	41	66	–	107	–	–	–	–	1.6	–	139	90
CSIRO CA4523	264	40	61	–	101	–	–	–	–	1.5	–	140	75
CSIRO CA4518	216	41	69	–	110	–	–	–	–	1.7	–	163	62
CSIRO H1294-02	286	42	62	–	104	–	–	–	–	1.5	–	139	67
CSIRO CA4514	389	46	61	54	107	161	28.5	37.8	33.5	1.3	1.2	133	56
CSIRO H1297-03	353	44	60	50	104	154	28.5	38.9	32.4	1.4	1.1	125	78
CSIRO H1300-02	366	42	60	–	102	–	–	–	–	1.4	–	132	69
CSIRO H1307-01	310	43	62	–	105	–	–	–	–	1.4	–	119	66
CSIRO H1095-01	335	45	55	–	100	–	–	–	–	1.2	–	124	68
CSIRO CA4519	253	44	65	–	109	–	–	–	–	1.5	–	115	65
CSIRO CA4517	359	45	59	50	104	154	29.2	38.3	32.4	1.3	1.1	126	65
	range	39	55	47	100	149	25.8	37.8	31.3	1.2	1.1	114	56
		46	69	54	110	161	29.2	41.3	34.3	1.7	1.3	167	90
	mean	42.4	61.6	50.8	103.9	154.2	27.7	39.4	32.9	1.5	1.2	132.1	70.2
	SD	1.8	2.9	2.5	2.7	3.6	1.0	1.2	1.0	0.1	0.1	14.3	8.6
	CV	4.2	4.7	5.0	2.6	2.3	3.6	3.0	3.0	7.4	5.3	10.8	12.2
	N	18	18	9	18	9	9	9	9	18	9	18	18

A. macleayi	T L	MP	DP	DC	PC	TC	%MP	%DP	%DC	DP/MP	DC/MP	A	B
USNM 174070	481	47	85	51	132	183	25.6	46.4	27.8	1.8	1.1	119	71

A. marmoratus	T L	MP	DP	DC	PC	TC	%MP	%DP	%DC	DP/MP	DC/MP	A	B
GVF NO NO.	443	47	70	61	117	178	26.4	39.3	34.2	1.5	1.3	140	78
LACM NO NO.	491	46	72	57	118	175	26.2	41.1	32.5	1.6	1.2	131	77
SU 13689	475	44	72	49	116	165	26.6	43.6	29.6	1.6	1.1	122	68
SU 13659	479	46	67	54	113	167	27.5	40.1	32.3	1.5	1.2	121	69
SU 13563	568	45	73	46	118	164	27.4	44.5	28.0	1.6	1.0	115	68
SU 14182	474	46	70	52	116	168	27.3	41.6	30.9	1.5	1.1	132	81
SU 40095	402	44	73	55	117	172	25.5	42.4	31.9	1.7	1.3	132	78
	range	44	67	46	113	164	25.5	39.3	28.0	1.5	1.0	115	68
		47	73	61	118	178	27.5	44.5	34.2	1.7	1.3	140	81
	mean	45.4	71.0	53.4	116.4	169.9	26.8	41.8	31.4	1.6	1.2	127.4	74.1
	SD	1.0	2.0	4.6	1.6	4.9	0.7	1.7	1.9	0.1	0.1	7.9	5.1
	CV	2.3	2.8	8.7	1.4	2.9	2.5	4.1	6.0	4.6	7.5	6.2	6.8
	N	7	7	7	7	7	7	7	7	7	7	7	7

Table 4. Statistical summary for certain morphometrics of *Atelomycterus* species. Clasper proportions are from adult males. Note that samples of each species are not exactly equivalent and that mean, standard deviation and coefficient of variation of allometric proportions are sensitive to growth-related variation and hence to differing size composition of individuals in the three samples.

	Range	Mean	SD	CV	N
PCL % TL					
A. fasciatus	77.8-86.1	83.1	1.5	1.8	71
A. macleayi	75.2-79.3	77.9			3
A. marmoratus	77.7-80.8	79.3	1.0	1.3	9
POR % TL					
A. fasciatus	4.4-5.6	5.1	0.3	5.5	71
A. macleayi	3.3-4.7	3.8			3
A. marmoratus	2.1-4.5	3.5	0.8	22.4	9
HDL % TL					
A. fasciatus	18.4-21.3	20.0	0.7	3.4	71
A. macleayi	17.0-19.6	18.1			3
A. marmoratus	17.5-19.2	18.0	0.5	2.6	9
D1H % TL					
A. fasciatus	4.1-5.7	5.0	0.3	6.2	70
A. macleayi	5.8-6.4	6.1			3
A. marmoratus	5.9-7.5	6.8	0.5	7.4	9
ANB % TL					
A. fasciatus	4.5-10.1	7.0	0.7	10.6	71
A. macleayi	8.5-10.5	9.4			3
A. marmoratus	7.9-9.9	9.0	0.5	5.8	9
ANH % TL					
A. fasciatus	1.6-3.3	2.6	0.3	11.3	71
A. macleayi	3.1-3.2	3.1			3
A. marmoratus	3.0-3.7	3.4	0.2	6.2	9
CLO % TL					
A. fasciatus	9.3-11.2	10.3	0.5	5.2	17
A. macleayi	7.6-8.5				2
A. marmoratus	11.7-12.2	11.9			3
CLI % TL					
A. fasciatus	12.7-14.7	13.7	0.6	4.1	17
A. macleayi	11.5-11.6				2
A. marmoratus	13.8-20.9	16.8			3
CLB % TL					
A. fasciatus	1.4-1.8	1.6	0.1	6.7	17
A. macleayi	1.9				1
A. marmoratus	1.1-1.3	1.2	0.1	4.9	3
CLB/CLO x 100					
A. fasciatus	12.7-17.4	15.2	1.2	7.6	17
A. macleayi	22.0				1
A. marmoratus	9.6-10.7	10.2			3