

A Revision of Selected Genera of the Family Carangidae (Pisces) from Australian Waters

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ABSTRACT. An annotated list of the 63 species in 23 genera of carangid fishes known from Australian waters is presented. Included in these 63 are eight endemic species, eight new Australian records (*Alepes vari*, *Carangoides equula*, *C. plagiotaenia*, *C. talamparoides*, *Caranx lugubris*, *Decapterus kurroides*, *D. tabl* and *Seriola rivoliana*) and a new species in the genus *Alepes*. A generic key and specific keys to *Alectis*, *Alepes*, *Carangoides*, *Scomberoides*, *Selar*, *Ulua* and *Uraspis* are given. The systematics of the 32 Australian species of *Alectis*, *Alepes*, *Atule*, *Carangoides*, "*Caranx*", *Elagatis*, *Gnathanodon*, *Megalaspis*, *Pantolabus*, *Scomberoides*, *Selar*, *Selaroides*, *Seriolina*, *Ulua* and *Uraspis* are covered in detail. For each species a recommended common name, other common names, Australian secondary synonymy, diagnosis, colour notes, description, comparison with other species, maximum recorded size, ecological notes and distribution are given. Specific primary synonymies are listed when the type locality is Australia or Papua New Guinea.

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Introduction

The family Carangidae comprises fishes whose body shapes vary from elongate and fusiform to deeply ovate and strongly compressed. Their habits range from pelagic to demersal; many are semi-pelagic. Known variously as trevally, jack, scad, mackerel, kingfish, queenfish, rainbow runners, darts, amberfish and pompano, approximately 140 species of carangids have been recorded worldwide (Laroche *et al.*, 1984).

Sixty three carangid species are known to occur in Australian waters, of which eight are Australian or Australian and south Papuan endemics. Diversity is greatest in tropical regions, with 52 of these species occurring predominantly north of 23°S while only six have temperate distributions. Throughout the range occupied, habitats vary from estuarine and shallow neritic to reef, offshore continental shelf and oceanic waters.

In northern Australia, the Carangidae are an abundant and ecologically important element of a rich multispecies fish fauna. Although their economic value to the region is

restricted by limited marketing potential within Australia (Okera *et al.*, 1981), carangids are a major component of a Taiwanese demersal pair-trawl fishery in the north and north-western sectors of the Australian Fishing Zone. They are also taken in large quantities (and discarded) as trash in prawn fisheries throughout the region, and are regarded as excellent sporting fish by recreational fishermen. While statistics on total (including trash) catches in the zone are not kept, the 2,135 tonnes taken by the Taiwanese in 1979 is insignificant when compared with the 3.7 million tonnes of carangids landed throughout the world in that year (FAO, 1980).

Despite their economic value and ecological importance, the taxonomy of many carangid genera is poorly understood. Much of the early work on Indo-West Pacific carangids, including many species that occur in Australian waters, was carried out by Forsskäl (1775), Rüppell (1829–1830), Cuvier & Valenciennes (1832, 1833) and Bleeker (1852).

While there are isolated records of carangids in the Australian literature of the mid-1800s (e.g. Richardson,

1848, Castelnau, 1875), Alleyne & Macleay's (1877) report represented the first major contribution on the family's Australian fauna. Subsequently, Klunzinger (1879), Günther (1880), Macleay (1881, 1882, 1884), De Vis (1884), Kent (1893), Ogilby (1913, 1915), McCulloch (1915, 1924, 1929–1930) and Whitley (1931, 1932, 1934, 1937, 1940, 1947, 1951a, 1951b) recorded and described a large number of carangid fishes from throughout Australia's temperate and tropical waters.

Many of these works added to an already confusing array of primary and secondary synonymies for Australian carangids. McCulloch (1929–1930) and then Munro (1958, 1960a, 1960b) helped to clarify some, but by no means all, of the problems. Collectively, the works of Munro (1958, 1960a, 1960b), Marshall (1964), Taylor (1964), Grant (1978), Sainsbury *et al.* (1984) and to a lesser extent Chan *et al.* (1974) represented the state-of-the-art in Australian carangid taxonomy prior to the present study.

Since the declaration of the Australian Fishing Zone in 1979, there has been a rapid development of policies aimed at the rational utilisation and management of Australia's marine resources.

A prerequisite for successful management of fish stocks, and in particular the management of the multispecies stocks

of tropical Australian waters, is the accurate identification of component species. This study was initiated in response to recognised inadequacies in the taxonomic knowledge of Australian carangid fishes. A large-scale CSIRO fishery resource survey in north Australian waters in 1980–1981 collected specimens from habitats not previously sampled, and for many species these collections provided an excellent supplement to Australian museum material.

While 21 carangid genera are known to occur in Australian waters, seven of these were omitted from this work on the basis of inadequate collections (*Naucrates*, *Seriola*, *Trachinotus* and *Trachurus*) or because they are currently subjects of worldwide revisions (Smith-Vaniz, personal communication) that will necessitate changes in nomenclature (*Pseudocaranx*, *Caranx* and *Decapterus*). Treatment of Australian species of these genera has been postponed for inclusion in a subsequent study.

Materials and Methods

Dial calipers were used for measurements of less than 20 cm, a 1-m rule for those greater than this. Fig. 1 illustrates the

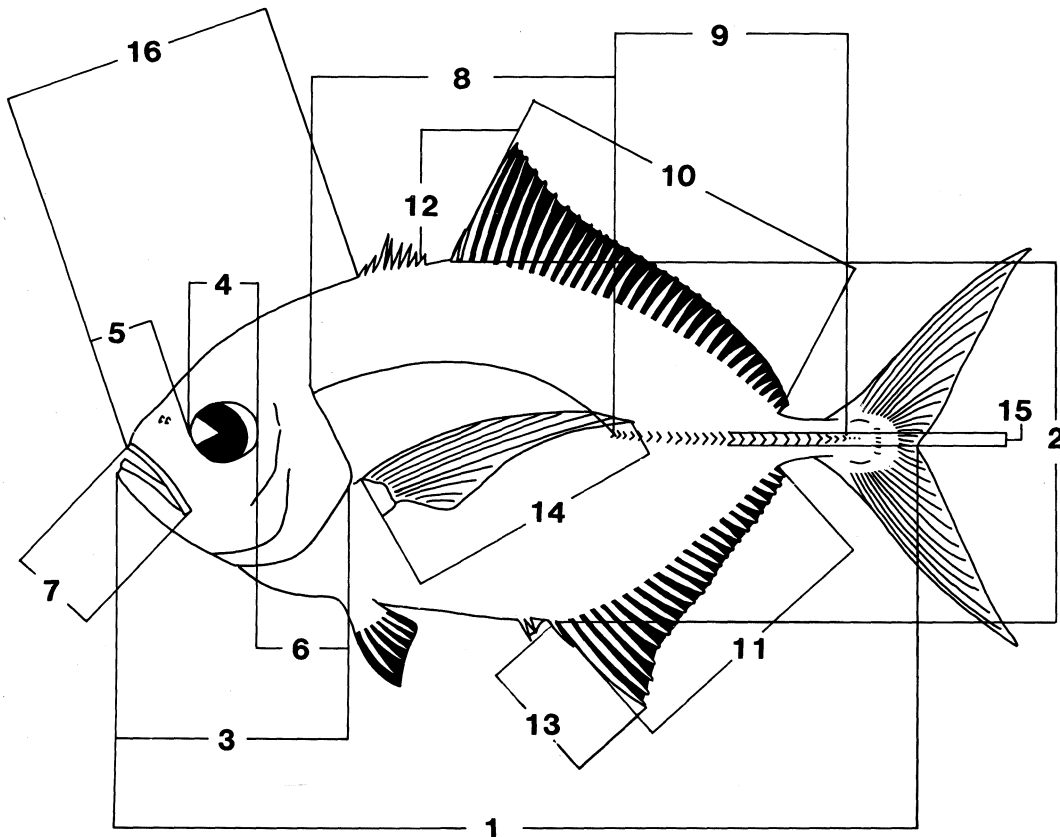


Fig.1. Measurements used in the description of specimens (unless otherwise stated, proportional measurements are expressed as a percentage of length to caudal fork). 1 – fork length (LCF); 2 – body depth (BD); 3 – head length (HL); 4 – eye diameter; 5 – snout length; 6 – postorbital length; 7 – upper jaw length; 8 – curved lateral line segment length (CLL); 9 – straight lateral line segment length (SLL); 10 – soft dorsal fin base length; 11 – soft anal fin base length; 12 – soft dorsal fin lobe height; 13 – soft anal fin lobe height; 14 – pectoral fin length; 15 – maximum scute length; 16 – snout to origin of spinous dorsal fin.

measurements taken. Following Smith-Vaniz & Staiger (1973), length to caudal fork (LCF) was used as the standard measure of fish length. All measurements are expressed as a percentage of LCF unless otherwise stated.

Gill raker counts are of rakers on the first gill arch and are expressed in the form: upper raker range + lower raker range = total range. A gill raker on the angle of the gill arch between the upper and lower limbs is counted in the lower raker range. Rudimentary rakers are included in all counts.

Unless otherwise stated scute counts are of the total number of retrorse scutes in the straight lateral line segment from one side of the body. In cases where scutes are antrorse and/or are present on both the curved and straight lateral line segments these are counted and designated as variations from the normal pattern. Following Berry (1959) and Williams & Venkataramani (1978), a scute is defined as a modified lateral line scale that is enlarged and usually thickened. Its posterior margin terminates in a spine or ends in an apex with the angle of the scute formed by this margin being less than 110°. In some carangid genera, lateral line scales immediately anterior and/or posterior to the scutes are partly modified, often showing a degree of enlargement and/or thickening. However, in these scales the posterior margins do not terminate in a spine or an apex with an angle of less than 110°.

Curved lateral line (CLL) measurements are of the chord of the arc from its origin to its junction with the straight lateral line (SLL). Relative proportions of curved and straight lateral line segments are expressed as a ratio CLL/SLL.

Unless otherwise stated, colour notes are of specimens in live or immediate post-mortem condition.

A maximum recorded size is given for species for which the literature contains reliable reports of fish larger than the material examined.

Diet was analysed by examination of stomach contents in the field and/or in the laboratory.

Australian secondary synonymies are drawn primarily from the following key Australian taxonomic works: Alleyne & Macleay (1877), Kent (1893), McCulloch (1915, 1924), Ogilby (1915), Weber & de Beaufort (1931), Munro (1958, 1960a, 1960b), Marshall (1964), Taylor (1964), Grant (1978), Russell (1983) and Sainsbury *et al.* (1984). Reference to other works is made when Australian material is considered in worldwide generic revisions (e.g. Smith-Vaniz & Staiger (1973) for *Scomberoides*) or where good quality illustrations or plates provide a reliable means of determination of synonymy (e.g. Coleman, 1981).

Recommended common names are taken from an Annotated World List of Carangidae (Smith-Vaniz, in preparation). General distributional information is derived from the aforementioned list, Wakiya (1924), Roxas & Agco (1941), Suzuki (1962), Smith-Vaniz & Staiger (1973), Chan *et al.* (1974), Kailola (1975), Masuda *et al.* (1975), Fourmanoir & Laboute (1976), Kyushin *et al.* (1977), Smith (1977), Rau & Rau (1980), Gushiken (1983), and Smith-Vaniz (1984).

General distributional regions follow those delineated by Laroche *et al.* (1984), i.e. species that reach their eastern distributional limits on the western margin of the Pacific

plate (see Springer, 1982) are not considered to occur in the central Pacific; Easter Island is treated as a component of the central Pacific.

Species diagnoses are *vis a vis* only Australian congeners of the species under consideration.

Institutions from which material was examined are abbreviated as follows: AMS — Australian Museum, Sydney; ANSP — Academy of Natural Sciences of Philadelphia, Philadelphia, USA; CSIROML — Commonwealth Scientific and Industrial Research Organization Marine Laboratories, Hobart; NTMAS — Northern Territory Museum of Arts and Sciences, Darwin; QM — Queensland Museum, Brisbane; WAM — Western Australian Museum, Perth.

Distribution figures are derived from material examined and from confirmed locality records.

Appendix includes all plates referred to in the text.

Diagnosis — Family Carangidae

Medium- to large-sized fishes inhabiting marine and, in some cases, brackish waters.

Body elongate, fusiform to deeply ovate, occasionally angular to rhomboidal, usually moderately to strongly compressed, in some cases rounded.

Scales small, often embedded and inconspicuous, giving appearance of naked skin. Breast often naked.

Single lateral line well developed, composed of gently curved to strongly arched anterior segment and straight posterior segment. Scutes on lateral line present or absent. When present, scutes are feeble to strong, most often retrorse and situated on the straight lateral line segment. Scutes occasionally antrorse (*Uraspis* only) and in some cases occur on both the curved and straight lateral line segments.

2 dorsal fins: the first with 5–8 weak to moderate spines (which often become embedded with age); the second with 1 spine preceding soft fin rays and, in some cases, 1–9 detached finlets.

Anal fin preceded by 1 (*Seriolina* and *Elagatis*) or 2 moderate to strong detached spines (which often become embedded with age); anal fin with 1 spine preceding soft fin rays and, in some cases, 1–9 detached finlets.

Pectoral fins of adults most often long and falcate; in other cases ranging from short and truncate to subfalcate. Pelvic fin generally short.

Caudal fin deeply forked.

Premaxilla usually protrusible. Teeth variously on premaxillae, dentary, vomer, palatines, tongue and pharyngeals. Teeth small and villiform to large and conical, in series, bands and rows.

Generic Limits in the Family Carangidae

The limits to carangid genera are, in many cases poorly defined. This is in part a consequence of some fundamental problems in the delineation of generic and sub-generic

units within the family. A case in point is the separation of the large genus *Caranx* Lacepède into a series of smaller genera including *Carangoides* Bleeker, *Selar* Bleeker, *Alepes* Swainson, *Atule* Jordan & Jordan, *Decapterus* Bleeker, *Pseudocaranx* Bleeker, *Ulua* Jordan & Snyder, *Uraspis* Bleeker and *Caranx* (*sensu stricto*). A number of these categories include species that have the diagnostic characters of two or more genera. For example, the conical teeth and canines on both jaws of large *Carangoides oblongus* and *C. humerosus* closely approximate the dentition of *Caranx* (*sensu stricto*). While *Caranx* differs in having only a single row of enlarged dentary teeth (all *Carangoides* species having villiform teeth in bands on the lower jaw), the dentition of *Carangoides oblongus* and *C. humerosus* appears to lie somewhere between that of *Caranx* and *Carangoides*. As dentition is a primary diagnostic character in the separation of these two generic units, intermediate species pose a question as to the validity of the original generic definitions. The use of *Carangoides* over its senior generic synonym *Olistus* Cuvier remains one of convenience. Smith-Vaniz *et al.* (1979) and Williams & Venkataramani (1978) discuss these generic categories and recommend that, to avoid confusion, *Carangoides* be used until a review of carangid genera is completed.

A second problem is the lack of a valid generic name for "*Caranx*" *kleinii* (Bloch, 1793). The dentition and general morphology of this species differ markedly from that of *Caranx* (*sensu stricto*) and thus preclude the use of this name. Several authors (e.g. Munro, 1960a [as *kalla*]; Grant, 1978 [as *kalla*]; Smith-Vaniz *et al.*, 1979) have assigned the species to *Alepes*. However, the differences between the jaw dentition of *Alepes* species and "*Caranx*" *kleinii* make this grouping difficult to justify. Seaman (1972) placed "*C. kleinii*" and two *Alepes* species into *Atule*. However, he mentioned no synapomorphies that would suggest that the species he grouped under the single generic name were more closely related to each other than to any other member of the family Carangidae. In the absence of definitive works on carangid generic limits and in the interests of consistency, I am following the proposal of Smith-Vaniz (1984), who adopted a category "*Caranx*" for *C. kleinii*.

Other generic categories followed in this study are those most commonly cited in the recent literature (in particular, Smith-Vaniz *et al.*, 1979) and are used as a matter of convenience.

Australian generic synonyms are listed for the 14 genera covered in detail.

An Annotated List of Fishes of the Family Carangidae occurring in Australian Waters

Key: * — species largely confined to temperate and/or sub-tropical waters; + — species endemic to Australian or Australian and Papuan waters; # — species are new Australian records; o — species covered in this paper.

- o *Alectis ciliaris* (Bloch, 1787)
- o *Alectis indicus* (Rüppell, 1830)

- o+ *Alepes* sp.
- o# *Alepes vari* (Cuvier, 1833)
- o *Atule mate* (Cuvier, 1833)
- o *Carangoides coeruleopinnatus* (Rüppell, 1830)
- o *Carangoides chrysophrys* (Cuvier, 1833)
- o# *Carangoides equula* (Schlegel, 1844)
- o *Carangoides ferdau* (Forsskål, 1775)
- o *Carangoides fulvoguttatus* (Forsskål, 1775)
- o *Carangoides gymnostethus* (Cuvier, 1833)
- o *Carangoides hedlandensis* (Whitley, 1934)
- o *Carangoides humerosus* (McCulloch, 1915)
- o *Carangoides malabaricus* (Bloch & Schneider, 1801)
- o *Carangoides oblongus* (Cuvier, 1833)
- o *Carangoides orthogrammus* (Jordan & Gilbert, 1882)
- o# *Carangoides plagiotaenia* Bleeker, 1857
- o# *Carangoides talamparoides* Bleeker, 1852
- + *Caranx bucculentus* Alleyne & Macleay, 1877
- Caranx ignobilis* (Forsskål, 1775)
- # *Caranx lugubris* Poey, 1860
- Caranx melampygus* Cuvier, 1833
- Caranx papuensis* Alleyne & Macleay, 1877
- Caranx sexfasciatus* Quoy & Gaimard, 1825
- Caranx tille* Cuvier, 1833
- o "*Caranx*" *kleinii* (Bloch, 1793)
- # *Decapterus kurroides* Bleeker, 1855
- Decapterus macarellus* (Cuvier, 1833)
- Decapterus macrosoma* Bleeker, 1851
- * *Decapterus muroadsi* Temminck & Schlegel, 1844
- Decapterus russelli* (Rüppell, 1830)
- # *Decapterus tabl* Berry, 1968
- o *Elagatis bipinnulata* (Quoy & Gaimard, 1825)
- o *Gnathanodon speciosus* (Forsskål, 1775)
- o *Megalaspis cordyla* (Linnaeus, 1758)
- Naucrates ductor* (Linnaeus, 1758)
- o+ *Pantolabus radiatus* (Macleay, 1881)
- Parastromateus niger* (Bloch, 1795)
- * *Pseudocaranx dentex* (Bloch & Schneider, 1801)
- *+ *Pseudocaranx wrighti* (Whitley, 1931)
- o *Scomberoides commersonianus* Lacepède, 1801
- o *Scomberoides lysan* (Forsskål, 1775)
- o *Scomberoides tala* (Cuvier, 1832)
- o *Scomberoides tol* (Cuvier, 1832)
- o *Selar boops* (Cuvier, 1833)
- o *Selar crumenophthalmus* (Bloch, 1793)
- o *Selaroides leptolepis* (Cuvier, 1833)
- Seriola dumerili* (Risso, 1810)
- *+ *Seriola hippos* Günther, 1876
- Seriola lalandi* Valenciennes, 1833
- # *Seriola rivoliana* Valenciennes, 1833
- o *Seriolina nigrofasciata* (Rüppell, 1829)
- + *Trachinotus anak* Ogilby, 1909
- Trachinotus baillioni* (Lacepède, 1801)
- Trachinotus blochii* (Lacepède, 1801)
- Trachinotus botla* (Shaw, 1803)
- Trachinotus coppingeri* Günther, 1884
- * *Trachurus declivis* (Jenyns, 1841)
- * *Trachurus novaezelandiae* Richardson, 1843

- o+ *Ulua aurochs* (Ogilby, 1915)
- o *Uluamentalis* (Cuvier, 1833)
- o *Uraspis secunda* (Poey, 1860)
- o *Uraspis uraspis* (Günther, 1860)

Key to Australian Genera of Carangidae

- 1. Lateral line with scutes; pectoral fins in adults long and falcate, (except in some *Decapterus* spp.) fins longer than or equal to head; soft dorsal and soft anal fin bases approximately equal 2
- Lateral line without scutes; pectoral fins shorter than head, not falcate; soft dorsal base significantly longer than anal fin base or approximately equal 17
- 2. Scutes present along entire length of curved and straight lateral line segments *Trachurus* Rafinesque, 1810
- Scutes present only on straight lateral line segment 3
- 3. Scales on body small but conspicuous, not embedded; dorsal spines 7–8, connected by membrane 4
- Scales on body small, inconspicuous and embedded giving the impression of naked skin; 6 short dorsal spines not connected by membrane (spines often embedded in large specimens) *Alectis* Rafinesque, 1815
- 4. Soft dorsal and soft anal fins with 1 or more detached finlets posteriorly 5
- Soft dorsal and soft anal fins without detached finlets posteriorly 6
- 5. Soft dorsal and soft anal fins with 1 detached, 2-rayed finlet posteriorly *Decapterus* Bleeker, 1851
- Soft dorsal and soft anal fins with 6–9 detached finlets posteriorly *Megalaspis* Linnaeus, 1758
- 6. One or both jaws with teeth; lips not papillose (except in *Pseudocaranx*) 7
- Jaws edentulate except in very small juveniles (which have few villiform teeth); lips papillose in large specimens *Gnathanodon* Bleeker, 1851
- 7. Teeth present on both jaws 8
- Teeth present on lower jaw only (upper jaw edentulate) *Selaroides* Bleeker, 1851

8. Villiform teeth present on vomer and palatines; roof and floor of mouth never white, sides of mouth never black 9
- No teeth on vomer or palatines; roof and floor of mouth and tongue white, sides of mouth black (Pl.20a,b) *Uraspis* Bleeker, 1855
9. Anterior and posterior adipose eyelids well developed, adipose tissue covering all but central slit over pupil *Atule* Jordan & Jordan, 1922
- Anterior adipose eyelid not well developed; most of anterior half of eye exposed (in many species posterior adipose eyelid also poorly developed; all of eye exposed) 10
10. Lower margin of gill opening with well defined, deep furrow (Pl.16a) *Selar* Bleeker, 1851
- Lower margin of gill opening without furrow or with shallow groove 11
11. Teeth on both jaws in single row (upper jaw in *Pseudocaranx* occasionally with inner row or band of teeth anteriorly) 12
- Teeth on upper or both jaws pluriserial or in bands 13
12. Jaw teeth numerous, fine and pointed, forming a comb-like serrated edge *Alepes* Swainson, 1839
- Jaw teeth conical and blunt *Pseudocaranx* Bleeker, 1863
13. Teeth on dentary enlarged, conical; in single row 14
- Teeth on dentary usually fine to villiform, rarely enlarged and conical; triserial or in bands 15
14. Body generally deep, with dorsal profile more convex than ventral; total gill rakers 20–31; soft dorsal and soft anal fin rays never produced as filaments; up to 4 canines anteriorly in each jaw *Caranx* Lacepède, 1801
- Body shallow with dorsal and ventral profiles equally convex; total gill rakers 34–39; soft dorsal and soft anal fin rays produced as filaments in mature males; no canines on either jaw *Pantolabus* Whitley, 1931
15. Jaw teeth villiform, in bands; ventral profile less convex than dorsal; scutes generally weak (less than 10% body depth); breast often naked 16
- Jaw teeth fine, not villiform; premaxillary dentition pluriserial anteriorly; dentary dentition triserial; ventral profile more convex than dorsal; scutes strong (16.2–20.0% body depth); breast fully scaled "*Caranx*" *kleinii* (Bloch, 1793)

16. Total gill rakers 54–80; rakers long, featherlike, extending into mouth beside tongue; tongue with or without central villiform tooth band; CLL/SLL less than 1.0 *Ulua* Jordan & Snyder, 1908
- Total gill rakers 21–36; rakers not extending into mouth beside tongue; tongue with central villiform tooth band; CLL/SLL usually equal to or greater than 1.0 *Carangoides* Bleeker, 1851
17. Soft dorsal and soft anal fin bases approximately equal in length 18
- Soft dorsal fin base significantly longer than soft anal fin base 19
18. Body oval to oblong; soft dorsal and soft anal fins without semi-detached finlets posteriorly; anterior lobes of soft dorsal and soft anal fins strongly falcate; scales circular *Trachinotus* Lacepède, 1801
- Body elongate; soft dorsal and soft anal fins with semi-detached finlets posteriorly; anterior lobes of soft dorsal and soft anal fins only moderately to weakly falcate, if at all; scales needle-like to lanceolate *Scomberoides* Lacepède, 1801
19. Soft dorsal and soft anal fins without detached finlets posteriorly 20
- Soft dorsal and soft anal fins with 1 detached, 2-rayed finlet posteriorly *Elagatis* Bennett, 1840
20. First dorsal fin with 4–5 spines not connected by membrane *Naucrates* Rafinesque, 1810
- First dorsal fin with 6–7 spines connected by membrane 21
21. Gill rakers on first gill arch normal; eye diameter usually twice or more in snout length *Seriola* Cuvier, 1816
- Gill rakers on first gill arch reduced, knoblike; eye diameter less than twice in snout length *Seriolina* Wakiya, 1924

***Alectis* Rafinesque**

Gallus Lacepède, 1802: 583 (type species *Gallus virescens* Lacepède, 1802 [= *Zeus ciliaris* Bloch, 1788] by monotypy; preoccupied by *Gallus* Moehring, 1758, not

binomial, and *Gallus* Brisson, 1760, Aves). *Alectis* Rafinesque, 1815: 84 (type species *Gallus virescens* Lacepède, 1802 [= *Zeus ciliaris* Bloch, 1788] by monotypy). *Scyris* Cuvier, 1829: 209 (type species *Gallus alexandrinus* Geoffroy Saint-Hillaire, 1817, by monotypy).

Key to Australian Species of *Alectis*

- 1. Body deeply ovate to slightly angular; head profile only moderately steep, with distinct interorbital notch; snout short, less than eye (snout/eye = 0.83–0.95); gill rakers 5–6 + 15 = 20–21 *A. ciliaris* (Bloch, 1787)
- Body angular, rhomboidal; head profile very steep, greatly elevated above eye with concavity at eye level; snout long, much greater than eye (snout/eye = 1.85–2.32); gill rakers 7–8 + 22–23 = 29–31 *A. indicus* (Rüppell, 1830)

Alectis ciliaris (Bloch)

Fig. 2, Pl. 1a

Zeus ciliaris Bloch, 1787: 36, pl.191 (type locality Indonesia).

Caranx ciliaris.—Macleay, 1881: 537.

Alectis ciliaris.—Ogilby, 1915: 88.—Weber & de Beaufort, 1931: 269.—Munro, 1960b: 19, No. 843.—Munro, 1967: 225, No. 364.—Russell, 1983: 53.—Sainsbury *et al.*, 1984: 158.

(1:138), I 5102 (1:95), I 5222 (1:180), I 5225 (1:208), I 5606 (1:89), I 5607 (1:112), I 7631 (1:205), I 7891 (1:183), I 7905 (1:266), I 8104 (1:200), I 8106 (1:230), I 10185 (1:212), I 11952 (1:258), I 11953 (1:111), I 11954 (1:189), I 11955 (1:181), I 13777 (1:76), I 14061 (1:216), I 17481 (1:188). NEW SOUTH WALES: AMS I 15382-001 (1:220). CSIROML A 1849 (1:80), A 1850 (1:91).

Recommended common name. African pompano.

Other common name. Pennant fish.

Material examined. (28:75–266) – WESTERN AUSTRALIA: CSIROML CA 301 (1:145), CA 1112 (1:118). WAM P 5913 (1:257), P 26186-010 (1:75). GULF OF CARPENTARIA: CSIROML CA 2471 (1:157). QUEENSLAND East Coast: QM I 3053 (1:174), I 3715

Diagnosis. Body deeply ovate to slightly angular; head profile only moderately steep, with distinct interorbital notch; snout short, less than eye (snout/eye = 0.83–0.95); gill rakers 5–6 + 15 = 20–21.

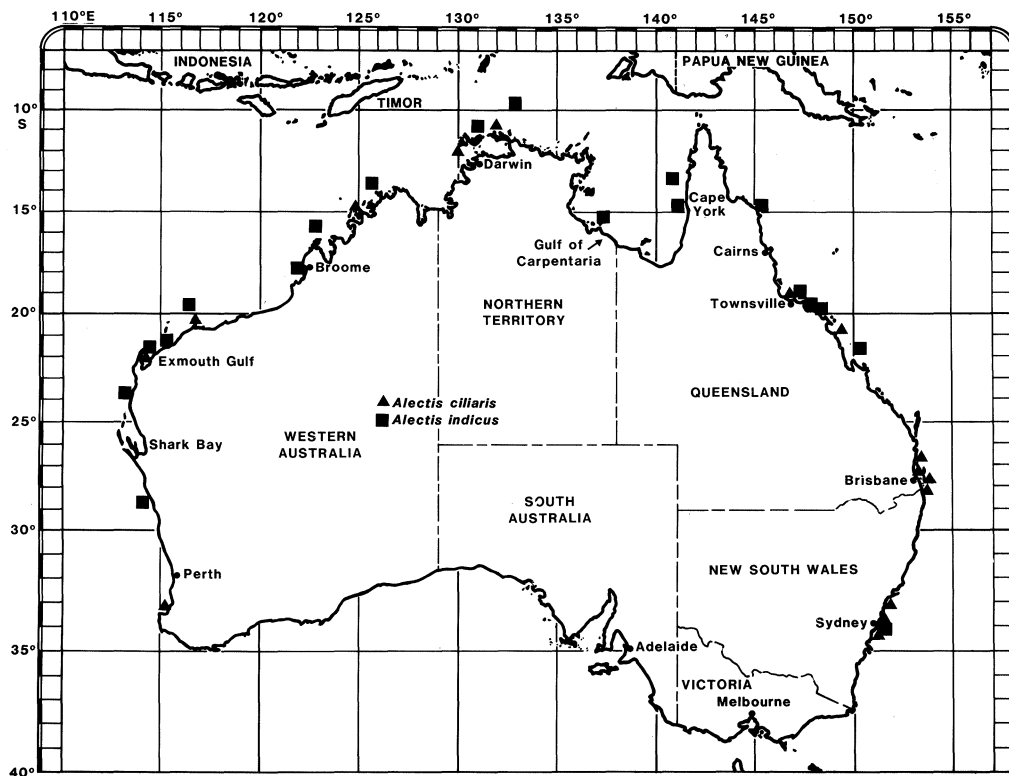


Fig.2. Australian distribution of *Alectis ciliaris* and *A. indicus*.

Colour notes. Body silvery blue to blue green above, darkest on top of head and upper shoulder, silver below; juveniles with 5–6 broad, dark vertical crossbands through body; operculum with small, diffuse dark spot. Base of filamentous soft dorsal and soft anal fin rays dark blue to black; other rays pale to silvery white; caudal and pectoral fins pale to hyaline.

Description. D IV–VI + I, 18–19; A II + I, 15–16; snout 9.4–9.9%; eye 10.4–11.3%; head length 30.1–32.8%; body depth 59.9–73.8%; scutes weak, 8–10.

Body strongly compressed; occipital gibbosity slight to absent; dorsal and ventral profiles equally convex; body depth greatest between soft dorsal and soft anal fin origins, decreases proportionally with age. Body apparently naked but with minute, deeply embedded scales. Dorsal and anal spines become embedded with age; anterior rays of soft dorsal and soft anal fins produced to filaments in small specimens, progressively reduced to falcate lobes with age; pectoral fins long, falcate, extending to beyond junction of straight and curved lateral line segments. Curved lateral line strongly arched, equal to or slightly longer than straight (CLL/SLL = 1.00–1.20). Maxilla extends to below middle to posterior third of eye; cleft of mouth slightly below eye level. Villiform teeth in both jaws, vomer, palatines and on central band on tongue.

Comparison with other species. *Alectis ciliaris* may be distinguished from *A. indicus* on the basis of characters given in the key to the genus *Alectis*.

Remarks. Munro (1960b) reports a maximum size of 10 inches (25 cm) for *A. ciliaris* in Australian waters.

Smith-Vaniz (1983) notes that the dorsal and anal spines of this species become embedded and are not apparent in specimens greater than 17 cm fork length. The largest specimen observed during this study with dorsal or anal spines conspicuous above the skin was 196 mm.

Ecological notes. Although it occurs throughout northern Australia, *A. ciliaris* is most abundant in waters of the North West Shelf and Great Barrier Reef. On the North West Shelf the species occurs in depths ranging from less than 20 to 100 m. Limited information on diet suggests it feeds on a wide range of small crustaceans.

Distribution. General — Circumtropical. Australia — *Alectis ciliaris* occurs in inshore and reef habitats from Exmouth Gulf in Western Australia to Brisbane on the Queensland east coast (Fig.2). Juveniles of the species also occur in estuaries on the southern New South Wales coast during summer, presumably the result of southern transport of larvae by the East Australian Current. As no adults have been recorded from these southern limits to the species' distribution, it appears likely that the juveniles do not survive the winter period. On the Western Australian coast, a single record of *A. ciliaris* from south of Perth suggests that the Leeuwin Current may also act as a transport mechanism for tropical species.

Alectis indicus (Rüppell)

Fig. 2, Pl. 1b

Scyris indicus Rüppell, 1830: 128, pl.33, fig.1 (type locality Red Sea).

Caranx gallus.—Klunzinger, 1879: 377.—Macleay, 1881: 537.—Kent, 1893: 68, pl.16, fig.2.

Alectis indica.—Ogilby, 1915: 83, pl.26.—McCulloch, 1915: 140.—Weber & de Beaufort, 1931: 270, fig.53.—Munro, 1960b: 19, No. 844.—Marshall, 1964: 226, No. 238.—Taylor, 1964: 178.—Munro, 1967: 225, No. 365.—Grant, 1978: 225.

Alectis indicus.—Sainsbury *et al.*, 1984: 158.

Material examined. (40:52–297) — WESTERN AUSTRALIA: CSIROML C 2395 (1:175), C 2782 (1:98), CA 1051 (1:156), CA 2463 (1:199). WAM P 4269 (2:96–116), P 4504 (2:99–115), P 4923 (2:101–156), P 8875 (1:88), P 8876 (1:110), P 13342 (1:111), P 15485 (1:82), P 23461 (1:76), P 23462 (1:71). GULF OF CARPENTARIA: CSIROML A 3186 (1:74), A 3216 (1:92), B 2161 (5:125–145), C 3578 (1:224), C 3579 (1:237), CA 2458 (1:142), CA 2476(1:150). QUEENSLAND East Coast: QM I 1914 (1:169), I 2347 (1:143), I 2348 (1:117), I 2349 (1:119), I 2350 (1:128), I 5127 (1:130), I 5645 (1:54), I 5646 (1:68), I 5720 (1:223), I 6905 (1:68), I 11951 (1:297). NEW SOUTH WALES: QM I 12169 (1:268).

PAPUA NEW GUINEA: CSIROML A 3100 (1:52).

Recommended common name. Indian threadfin.

Other common names. Diamond trevally, diamond fish, mirror fish, plumed trevally, threadfin trevally.

Diagnosis. Body angular, rhomboidal; head profile very steep, greatly elevated above eye with concavity at eye level; snout long, much greater than eye (snout/eye = 1.85–2.32); gillrakers 7–8+22–23=29–31.

Colour notes. Body silvery blue green above, darkest on top of head; silver below; juveniles with 5–7 broad, dark, vertical crossbands through body; upper operculum with small, diffuse dark spot. Filamentous, soft dorsal, soft anal and pelvic fin rays dark blue to black; other fins pale green to hyaline.

Description. D V–VI + I, 18–19; A II + I, 15–16; snout 14.6–17.0%; eye 6.5–9.0%; head length 28.2–35.5%; body depth 58.3–82.1%; scutes weak, 9–10.

Body distinctly angular, strongly compressed; head profile with occipital gibbosity; dorsal profile more convex than ventral; body depth greatest between soft dorsal and soft anal fin origins, decreases proportionally with age. Body apparently naked but with minute, deeply embedded scales. Dorsal and anal spines become embedded with age; anterior rays of soft dorsal, soft anal and pelvic fins produced to filaments in small specimens, progressively reduced to falcate lobes with age; pectoral fins falcate, extending beyond junction of straight and curved lateral line segments. Curved lateral line strongly arched, shorter

than straight (CLL/SLL = 0.62–0.95). Maxilla does not extend beyond anterior margin of eye; cleft of mouth well below eye level. Villiform teeth on both jaws, vomer, palatines and on central band on tongue.

Remarks. Munro (1960b) reports a maximum size of 5 feet (150 cm) or 28 lbs for *A. indicus* in Australian waters.

Smith-Vaniz (1983) notes that the dorsal and anal fin spines of this species became embedded and are not apparent in specimens greater than 17 cm fork length. The largest specimen observed during this study with dorsal or anal spines conspicuous above the skin was 183 mm.

Ecological notes. *Alectis indicus* has a patchy distribution in north Australian waters. It is common on the North West Shelf and in waters of the Great Barrier Reef Lagoon but is reef-associated and comparatively rare in the

Timor and Arafura Seas and Gulf of Carpentaria. Limited information on diet suggests that it feeds on a wide range of fish and crustaceans.

Distribution. General — tropical Indo-West Pacific. Australia — *Alectis indicus* occurs in inshore and reef habitats from Geraldton in Western Australia to Brisbane on the east Queensland coast (Fig.2). Small juveniles also occur in estuaries around Sydney in summer. As is the case for *A. ciliaris*, the small juveniles do not appear to survive the winter.

***Alepes* Swainson**

Alepes Swainson, 1839: 176, 248 (type species: *Alepes melanoptera* Swainson, 1839, by monotypy).

Key to Australian Species of *Alepes*

- 1. Gill rakers 8–10+18–21 = 27–30; supramaxilla without spinelike anterior projection*Alepes* sp.
- Gill rakers 10 + 27 = 37 (for the one Australian specimen examined; Smith-Vaniz personal communication Mar. 1983 gives 9–12 + 23–27 = 32–38 for material collected throughout the Indo-West Pacific); supramaxilla with spinelike anterior projection*A. vari* (Cuvier, 1833)

Alepes sp.
Fig. 3, Pl. 2a

supramaxilla relatively small, rounded anteriorly, without anterior spinelike projection.

Caranx malam.—McCulloch, 1915: 131, pl.22.—Weber & de Beaufort, 1931: 213.
Alepes djedaba.—Munro, 1960a: 17, No. 817.
Alepes sp.—Sainsbury *et al.*, 1984: 158.

Material examined. (52:66–233) – WESTERN AUSTRALIA: CSIROML C 3839 (1:146), C 3845 (1:164), C 3862 (1:176), CA 420 (1:207), CA 435 (1:203), CA 436 (1:155). WAM P 8895 (1:164), P 25396-020 (5:89–164), P 26263-005 (1:232), P 26257-001 (1:190), P 26259 (1:171). GULF OF CARPENTARIA: AMS I 15557-100 (1:166). ANSP 147708 (5:107–202). CSIROML B 2166 (5:174–206). QUEENSLAND East Coast: QM I 9252 (1:160), I 9253 (1:153), I 10761 (2:66–90), I 10762 (1:101), I 11092 (2:122–153), I 11381 (1:172), I 11508 (1:222), I 14196 (10:140–161), I 14321 (1:168), I 15961 (1:85).

MATERIAL NOT RETAINED (5:185–233) – Northern Territory, 11°10'S, 136°00'E, Nov. 1980.

Recommended common name. Smallmouth scad.

Other common name. Banded scad.

Diagnosis. Gill rakers 8–10 + 18–21 = 27–30;

Colour notes. Body green to blue green above, silver below; in small specimens body with dark vertical cross bars; operculum with dark, diffuse blotch. Spinous and soft dorsal, soft anal and caudal fins dusky yellow green; anterior rays of soft dorsal and soft anal fins often with white tips; pelvic fins white; pectoral fins hyaline; caudal fin lobes often with dark tips.

Description. D VIII + I, 24–26; AII + I, 20–22; snout 5.5–5.7%; eye 5.5–7.8%; head length 23.8–28.7%; body depth 32.1–38.7%; scutes moderate, 51–70; maximum scute height 5.5–6.2% body depth.

Body elongate oval to oblong, strongly compressed; snout blunt; dorsal and ventral profiles equally convex. Dorsal and anal fins low, not falcate; pectoral fins subfalcate, extending to beyond junction of straight and curved lateral line segments. Curved lateral line short, strongly arched, rising from origin at upper operculum before falling to junction with straight lateral line (CLL/SLL = 0.40–0.59). Maxilla extends to below anterior third of eye; posterior adipose eyelid well developed, reaching almost to centre of eye. Jaw teeth fine, generally uniserial, larger specimens occasionally with multiple series on anterior

premaxillary; fine teeth also on vomer, palatines and on central band on tongue.

Comparison with other species. *Alepes* sp. and *A. vari* are superficially similar to a number of Australian species within other genera (e.g. *Atule mate*, *Selar* spp. and *Decapterus* spp.). They may be easily distinguished from *Atule mate* in that they lack the well-developed anterior and posterior adipose eyelids characteristic of this species. The well defined, deep furrow characteristic of *Selar* spp. is absent in *Alepes*, as are the dorsal and anal finlets that distinguish species of the genus *Decapterus*. *Alepes* sp. may be distinguished from *A. vari* on the basis of characters given in the key to the genus *Alepes*.

Alepes melanoptera, a species that occurs throughout the Indo-West Pacific (including Java and Bali) but not in Australian waters, is very similar to *Alepes* sp. Meristic values for the two species broadly overlap and the size and shape of the supramaxilla is similar (Smith-Vaniz personal communication, 1982). The primary distinguishing character for the two species is the spinous dorsal fin colouration: the interradial membranes of this fin are black in *A. melanoptera*, dusky to hyaline in *Alepes* sp.

Remarks. The maximum recorded size of the species is 295 mm (CSIRO unpublished data).

The systematic status of *Alepes* sp. is uncertain. The species differs significantly from *A. vari*, *A. djedaba* and *A. melanoptera*, the other recognised members of the

genus. However, as a comparative analysis of all *Alepes* type material was beyond the scope of this study, a definitive statement of the species' nomenclature can not be given here.

Grant (1987) assigned the name *Alepes aperena* to a photograph of a specimen he had identified as a juvenile *Alepes* (p. 173, specimen #400). While it is impossible to identify accurately the specimen he photographed (no mention is made of a voucher specimen), the photograph and accompanying description may provide a valid name for the *Alepes* sp. of this paper. However, as the genus *Alepes* is currently the focus of a revision by W.F. Smith-Vaniz (personal communication) and the validity of Grant's (1987) citation is still in doubt, the name *Alepes* sp. has been used here.

Ecological notes. *Alepes* sp. is abundant throughout north Australian continental shelf waters. The species occurs in depths of from less than 10 to 150 m. Preliminary analysis of diet suggests the species feeds predominantly on microscopic benthic crustaceans and molluscs. It was the only carangid species examined during the present study in which algal material was regularly present in stomach contents.

Distribution. General — endemic to Australian waters. Australia — *Alepes* sp. occurs in inshore and continental shelf waters from Exmouth Gulf in Western Australia to Sydney on the New South Wales coast.

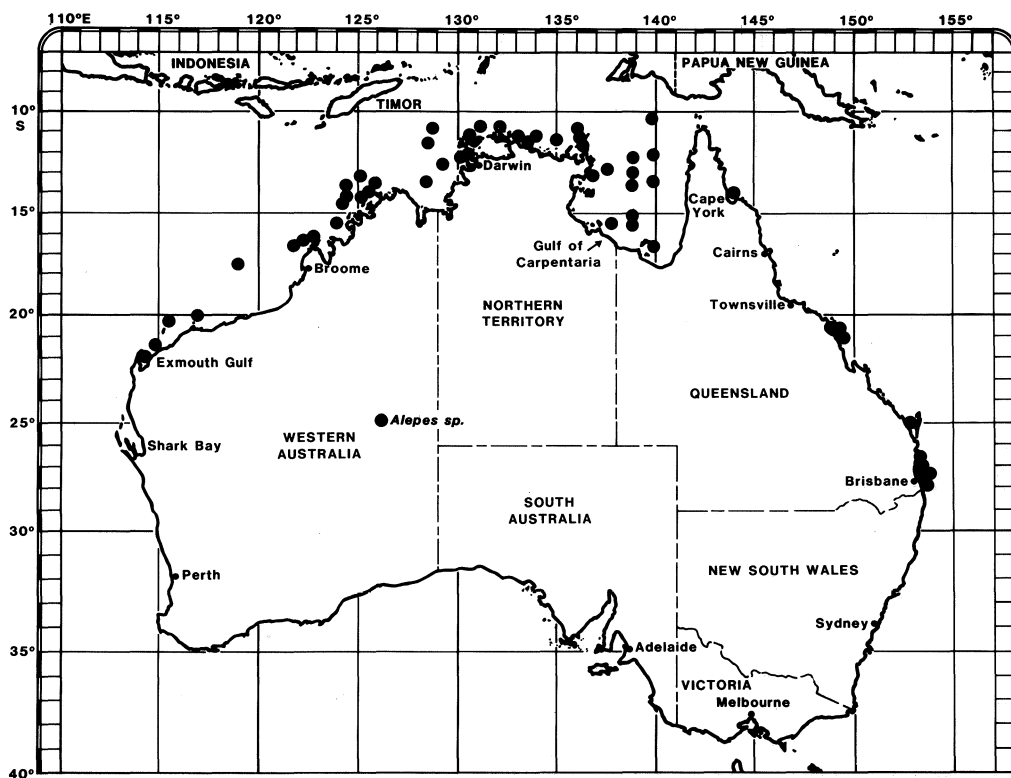


Fig.3. Australian distribution of *Alepes* sp.

Alepes vari (Cuvier)

Caranx vari Cuvier, 1833: 48 (type locality Pondichery).

Material examined. (1:538) – WESTERN AUSTRALIA: WAM P23232 (1:538).

Recommended common name. Herring scad.

Diagnosis. Gill rakers 10 + 27 = 37; supramaxilla relatively elongate, with anterior spinelike projection.

Colour notes. A single specimen, WAM P 23232, is the only record of *Alepes vari* from Australian waters. The specimen, which is preserved in alcohol, is a light brown colour.

Gushiken (1983:199) describes the live colouration of *A. vari* from Japanese waters as "...bluish green above, silvery below; opercular spot indistinctive; dorsals pale yellow and anal white, but in adults second dorsal and anal edged with black except anterior part of anal; other fins pale but caudal yellowish or blackish".

Description. D V III + I, 26 ; A II + I, 22 ; Snout 5.7%; eye 4.6%; head length 20.5%; body depth 30.8%; scutes moderate to strong, 52; maximum scute height 11.9% body depth.

Body elongate oval, strongly compressed; snout blunt; dorsal and ventral profiles equally convex. Dorsal and anal

fins low, not falcate; pectoral fins subfalcate, extending to beyond junction of straight and curved lateral line segments. Curved lateral line short, strongly arched (CLL/SLL=0.58). Maxilla extends to below anterior third of eye; posterior adipose eyelid well developed, reaching almost to centre of pupil. Jaw teeth fine, generally uniseriate; fine teeth also on vomer, palatines and on central band on tongue.

Distribution. General — tropical Indo-West Pacific. Australia — *Alepes vari* has been recorded only once from Australian waters. The single specimen was speared at Tryal Rocks, Western Australia (20°17'S, 115°23'E).

Atule Jordan & Jordan

Atule Jordan & Jordan, 1922: 38 (type species *Caranx affinis* Rüppell, 1836 [= *Caranx mate* Cuvier in Cuvier & Valenciennes, 1833] by original designation).

Atule mate (Cuvier)

Fig. 4, Pl. 3a.

Caranx mate Cuvier in Cuvier & Valenciennes, 1833: 54 (type locality Pondichery).

Caranx affinis.—McCulloch, 1915: 130.

Alepes mate.—Munro, 1960a: 17, No. 815.—Munro, 1967:

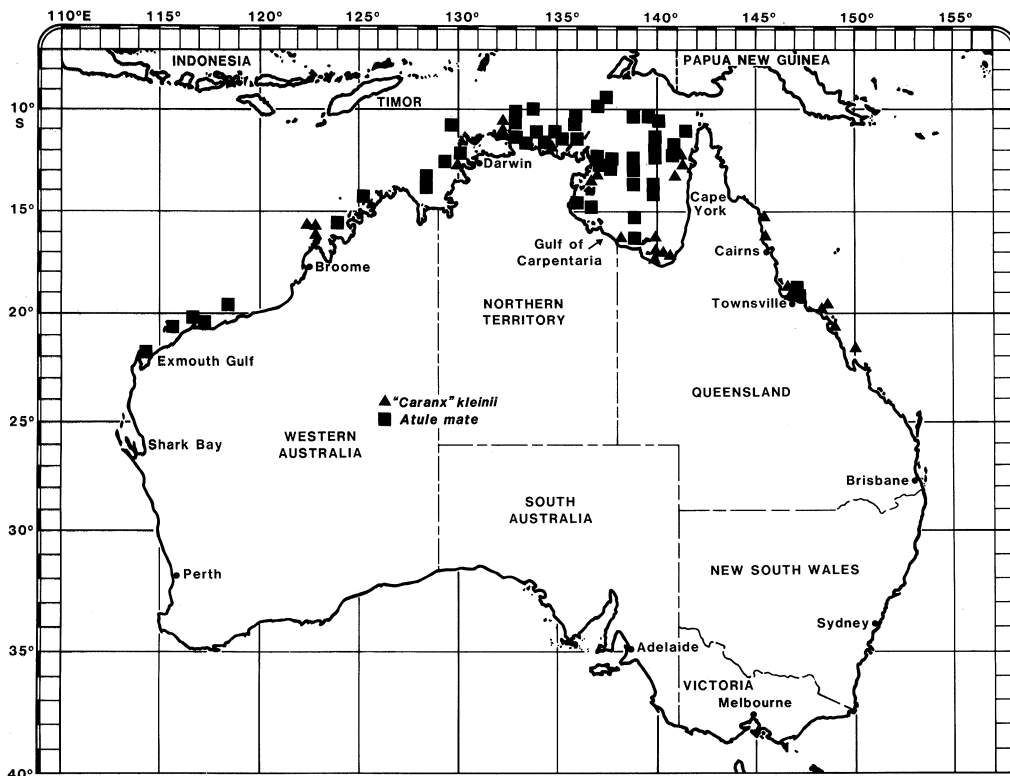


Fig.4. Australian distribution of "*Caranx*" *kleinii* and *Atule mate*.

227, No. 371.

Caranx (Selar) mate.—Weber & de Beaufort, 1931: 207.

Atule mate.—Sainsbury *et al.*, 1984: 160.

Material examined. (30:108–267) – WESTERN AUSTRALIA: AMS I 13179 (1:203). CSIROML B 2155 (11:124–133), C 2325/26/27/28 (4:138–153), C 2389 (1:143), C 2596/97 (2:108–117), CA 1052 (1:197), CA 2436/37/38 (3:250–267). NORTHERN TERRITORY: CSIROML CA 1053 (1:218). QUEENSLAND East Coast: QM I 4084 (1:229), I 7060 (1:248), I 11505 (1:249).

MATERIAL NOT RETAINED (3:115–138) – Gulf of Carpentaria, 14°00'S, 140°00'E, July 1981.

Recommended common name. Yellowtail scad.

Diagnosis. Anterior and posterior adipose eyelids well developed, leaving only narrow slit over centre of pupil exposed (adipose eyelids not fully developed in specimens less than 100 mm); premaxillary dentition in adults biseriata, dentary dentition uniseriate; last soft dorsal and soft anal fin rays finlet-like but not detached; curved lateral line gently arched (CLL/SLL = 0.70–0.79); scutes moderate, 44–48; maximum scute height 11.7–12.6% body depth.

Colour notes. Body blue green above, grading through green to yellow green mid-laterally to silver below; body usually with 13–16 dark vertical crossbars; operculum with distinct black spot. Spinous and soft dorsal, soft anal and caudal fins dusky yellow; pelvic fins white; pectoral fins hyaline.

Description. D VIII + I, 22–23; A II + I, 18–20; gill rakers 11–13 + 24–30 = 34–43; snout 6.2–6.9%; eye 5.9–6.3%; head length 23.6–25.2%; body depth 26.4–31.4%.

Body elongate oval, moderately compressed; dorsal and ventral profiles equally convex; snout pointed. Soft dorsal and soft anal fins low, not falcate; pectoral fins subfalcate to falcate, extending to junction of straight and curved lateral line segments. Maxilla extends to below anterior third of eye. Jaw teeth fine; villiform teeth on

vomer, palatines and on central band on tongue.

Comparison with other species. *Atule mate* is distinguished from two similar species, *Alepes* sp. and “*Caranx*” *kleinii*, by well-developed anterior adipose eyelids (poorly developed in *Alepes* sp. and “*C.*” *kleinii*), biseriata premaxillary dentition (uniseriate in *Alepes* sp.; pluriseriate in “*C.*” *kleinii*), finlet-like last dorsal and anal rays (normal in *Alepes* sp. and “*C.*” *kleinii*) and a proportionally longer curved lateral line segment (CLL/SLL = 0.70–0.79 in *A. mate*; 0.40–0.59 in *Alepes* sp.; 0.51–0.62 in “*C.*” *kleinii*).

Ecological notes. *Atule mate* is common in depths of less than 80 m throughout north Australian waters. Cephalopods and crustaceans are the most important components in its diet.

Distribution. General — tropical Indo-West and Central Pacific. Australia — *Atule mate* occurs in tropical continental shelf waters from Exmouth Gulf in Western Australia to Townsville on the Queensland east coast (Fig.4).

Carangoides Bleeker

Olistus Cuvier, 1829: 209 (type species *Olistus malabaricus* Cuvier in Cuvier & Valenciennes, 1833, by subsequent designation of Jordan, 1917: 129, preoccupied by *Scomber malabaricus* Bloch & Schneider, 1801 = *Olistus hedlandensis* Whitley, 1934, first valid name).

Carangoides Bleeker, 1851: 343,352 (type species *Caranx praeustus* Bennett, 1830, by subsequent designation of Jordan, 1919: 248).

Ferdauia Jordan, Evermann & Tanaka, 1927: 662 (type species *Carangoides jordani* Nichols, 1922, by monotypy).

Turum Whitley, 1932: 337 (type species *Turum emburyi* Whitley, 1932, by monotypy).

Key to Australian Species of *Carangoides*

1. Breast completely scaled 2
- Breast partly or wholly naked 3
2. Preoperculum with black posterior margin; vomer triangular, without medial posterior projection (Fig. 10e); soft dorsal and soft anal fins with slightly falcate anterior lobes *C. plagiotaenia* Bleeker, 1857
- Preoperculum uniformly silver, without black posterior margin; vomer arrowhead shaped with long posterior projection (Fig. 8c); soft dorsal and soft anal fins low without falcate anterior lobes *C. equula* (Schlegel, 1844)

3. Naked area on breast extending dorsally up to or above pectoral base..... 7
- Naked area on breast triangular, highest part anteriorly, not extending dorsally as far up as pectoral base 4
4. Naked area on breast generally extends half or less than half distance to pectoral base; scutes weak, 14–30; D VIII + I, 25–34; A II + I, 22–27; second dorsal fin ray not produced into a long filament 5
- Naked area on breast triangular, highest anteriorly, extends approximately two thirds of the distance to pectoral base (Fig.7g); posteriorly, naked area ends in a distinct angled edge above pelvic origin; scutes strong, 35–45; D VIII + I, 20–22; A II + I, 18–19; second dorsal fin ray produced into a long filament which extends to or past caudal peduncle *C. oblongus* (Cuvier, 1833)
5. Naked area on breast generally extends approximately half way to pectoral base (Fig.7f) (while specimens from the western Indian Ocean frequently have a narrow, scaleless isthmus joining the naked pectoral base with the naked breast (Smith-Vaniz, 1984), this squamation pattern has not been observed in Australian material); scutes weak, 14–20; D VIII + I, 25–29; A II + I, 22–24; gill rakers 6–7 + 17–18 = 24–25; curved lateral line gently to moderately arched; adults and juveniles with many small golden spots on upper two thirds of body *C. fulvoguttatus* (Forsskäl, 1775)
- Naked area inconspicuous from lateral view, restricted to ventral surface of breast; scutes weak, 21–30; D VIII + I, 28–34; A II + I, 23–27; gill rakers 8–10 + 17–22 = 26–31; curved lateral line very weakly arched; body with or without broad vertical dark banding and occasionally small, inconspicuous yellow or orange spots or with 2–7 relatively large yellow and brown elliptical spots 6
6. In life and immediately post-mortem, 2–7 relatively large, elliptical yellow spots with brown borders present on sides; banding usually absent on sides in adults; lips relatively thick and papillose especially in large adults; snout 8.4–9.9% LCF; eye 5.1–6.3% LCF; upper jaw length to snout ratio 1.1–1.2; snout to eye ratio 1.44–1.87 *C. orthogrammus* (Jordan & Gilbert, 1882)
- In life and immediately post-mortem, yellow or orange spots usually absent on sides, but if present are small, numerous and inconspicuous; adults typically with 5–7 broad, vertical dusky bands on sides; lips never papillose; snout 6.9–8.1% LCF; eye 6.2–8.1% LCF; upper jaw length to snout ratio 1.2–1.4; snout to eye ratio 0.95–1.22 *C. ferdau* (Forsskäl, 1775)
7. Naked area on breast extends to above pectoral base 8
- Naked area on breast extends up to and includes pectoral base, but does not extend above it 9

8. Gill rakers 7–11 + 22–26 = 32–36; soft dorsal and soft anal fins only slightly falcate, if at all; tongue brown to grey-brown *C. malabaricus* (Bloch & Schneider, 1801)
- Gill rakers 6–9 + 18–21 = 26–30; soft dorsal and soft anal fins falcate; tongue usually white, infrequently with sparse grey spots *C. talamparoides* Bleeker, 1852
9. D VIII + I, 18–23; A II + I, 15–19; total gill rakers less than or equal to 28 10
- D VIII + I, 28–33; A II + I, 24–27; gill rakers 8–9 + 19–22 = 28–31 *C. gymnostethus* (Cuvier, 1833)
10. Head profile steep with distinct bulge in interorbital region in larger juveniles and adults; central soft dorsal and soft anal fin rays produced as long filaments in adult males, weakly developed in females, absent in juveniles *C. hedlandensis* (Whitley, 1934)
- Head profile gently sloping to moderately convex generally without bulge (except adult male *C. humerosus* which have distinct bulge); central soft dorsal and soft anal fin rays never produced as filaments 11
11. Soft dorsal fin rays with distinct black basal spots *C. humerosus* (McCulloch, 1915)
- Soft dorsal fin rays without black basal spots 12
12. D VIII + I, 22–23; A II + I, 18–19 *C. coeruleopinnatus* (Rüppell, 1830)
- D VIII + I, 18–20; A II + I, 15–17 *C. chrysophrys* (Cuvier, 1833)

***Carangoides coeruleopinnatus* (Rüppell)**

Figs 5, 6e, 8a, 11, Pl. 4a

- Caranx caeruleopinnatus* Rüppell, 1830: 100 (type locality Red Sea).
- Citula diversa* Whitley, 1940: 421 (type locality southern Queensland).
- Caranx altissimus* (non Jordan & Seale).—McCulloch, 1915: 134, pl. 24.
- Carangoides diversa*.—Munro, 1960a: 19, No. 826.—Munro, 1967: 231, No. 384.
- Carangoides malabaricus* (non Bloch & Schneider).—Munro, 1960a: 20, No. 830.—Munro, 1967: 231, No. 385.
- Carangoides chrysophrys* (non Cuvier).—Grant, 1978: 240, pl. 92 (plate only).
- Carangoides caeruleopinnatus*.—Sainsbury *et al.*, 1984: 160.

Material examined. (30:79–379) – AMS I 13941 (1:129) HOLOTYPE *Citula diversa* Whitley, 1940. Type

locality – Southern Queensland. WESTERN AUSTRALIA: CSIRO ML CA 2434 (1:229), CA 2488 (1:123), CA 2489 (1:116), WAM P 8899 (1:106), P 25095-002 (3:108–126), P 25354-040 (1:201), P 26194-006 (2:202–212), P 26250-002 (1:111). NORTHERN TERRITORY: NTM S 10031-129 (1:143). QUEENSLAND East Coast: QM I 7009 (1:301).

MATERIAL NOT RETAINED (1:443) – Western Australia, 19°40'S, 117°55'E, May 1980. (4:132–579) – Western Australia, 20°45'S, 115°30'E, May 1980. (4:79–124) – Western Australia, 14°50'S, 124°55'E, July 1980. (1:87) – Western Australia, 12°35'S, 127°45'E, July 1980. (5:127–149) – Western Australia, 13°00'S, 125°05'E, July 1980. (1:74) – Gulf of Carpentaria, 16°20'S, 140°00'E, Nov. 1980.

Recommended common name. Coastal trevally.

Other common name. Malabar trevally.

Diagnosis. D VIII + I, 22–23; A II + I, 18–19; naked area on breast extends from middle of pelvic vent up to pectoral base but not above it (Fig. 6e); gill rakers 5–8 + 15–19 = 23–27,

proximal rakers on lower arch reduced to tubercles (particularly in large adults); lower gill rakers barely visible in open mouth; soft dorsal and soft anal fins with filamentous first rays in small juveniles, filaments progressively reduced to falcate anterior lobes in adults (Fig.5); tongue white with broad central band of villiform teeth (Fig.8a); scutes weak, 16–23; scales in curved lateral line 77–97.

Colour notes. Body silver blue green above, silver white below; black spot on upper operculum. In specimens over 200 mm, head and upper body often with black pigment blotches. Soft dorsal, soft anal and caudal fins dusky, anal with faint white spots on base of membrane between rays. Juveniles with 5–7 vertical dark bands through body.

Description. Snout 10.4–11.1%; eye 8.9–10.4%; snout to spinous dorsal fin 40.8–43.0%; height of soft dorsal fin 14.3–129.3%; height of soft dorsal fin in head length 0.52–4.48.

Body oval, strongly compressed; head profile relatively steep. Pectoral fins strongly falcate, extending to junction of straight and curved lateral line segments. Curved lateral line segment moderately arched, significantly longer than straight (CLL/SLL = 1.14–2.07). Maxilla extends to below front third of eye. Villiform teeth on both jaws, vomer, palatines and on central band on tongue (Fig.8a).

Comparison with other species. Three Australian *Carangoides* species, *C. malabaricus*, *C. talamparoides* and *C. chrysophrys*, are similar to *C. coeruleopinnatus* in general body shape and colouration.

Carangoides malabaricus and *C. talamparoides* may be distinguished from *C. coeruleopinnatus* on the basis of breast squamation (naked area on breast extends above

pectoral base in *C. malabaricus* and *C. talamparoides*; does not in *C. coeruleopinnatus*), gill raker counts (7–11 + 22–26 = 32–36 for *C. malabaricus*; 6–9 + 18–21 = 26–30 for *C. talamparoides*; 5–8 + 15–19 = 23–27 for *C. coeruleopinnatus*), tongue colour (brown to grey brown in *C. malabaricus*; pale grey to white in *C. talamparoides*; white in *C. coeruleopinnatus*) and tongue dentition (in the form of a narrow, round-ended villiform band in *C. malabaricus* (Fig.10a) and *C. talamparoides* (Fig.10d); a broad, square ended villiform band in *C. coeruleopinnatus* (Fig.8a).

Carangoides chrysophrys may be distinguished from *C. coeruleopinnatus* on the basis of fin ray counts (D 18–20, A 15–17 in *C. chrysophrys*; D 22–23, A 18–19 in *C. coeruleopinnatus*) and, in specimens greater than 250 mm LCF, on snout length to eye diameter ratio (between 1:1 and 2:1 in *C. chrysophrys*; approximately 1:1 in *C. coeruleopinnatus*).

Remarks. Despite the species' abundance throughout Indo-West Pacific tropical waters, there are few records of *C. coeruleopinnatus* or *Citula diversa* (= junior synonym) in the Australian literature. A major factor contributing to the lack of records is the confusion surrounding the identity of a similar species, *Carangoides malabaricus* (Bloch & Schneider). The name *C. malabaricus* has been incorrectly used for a number of Indo-West Pacific *Carangoides* species including *C. coeruleopinnatus* and *C. talamparoides* Bleeker.

The first major attempt to correct problems in the nomenclature of *C. malabaricus* was made by Smith (1967) who, following an examination of type material and a thorough discussion of the literature, concluded that two species, *C. malabaricus* and *C. coeruleopinnatus*, had been confused under the first name. Smith (p.146) also noted that while a third species, *C. talamparoides* Bleeker, may be a

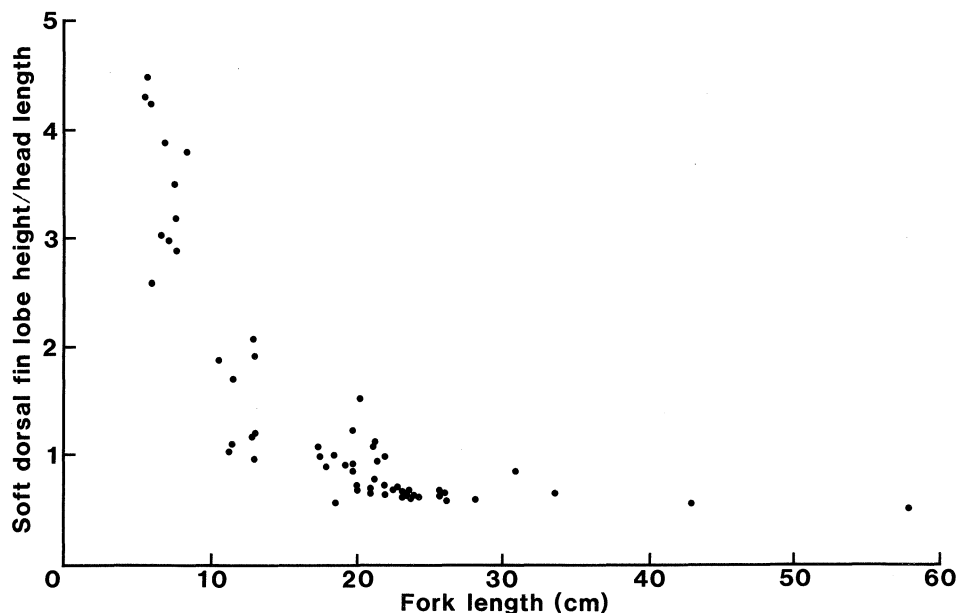


Fig.5. Soft dorsal fin anterior lobe height over head length versus fork length in *Carangoides coeruleopinnatus* from north Australian waters.

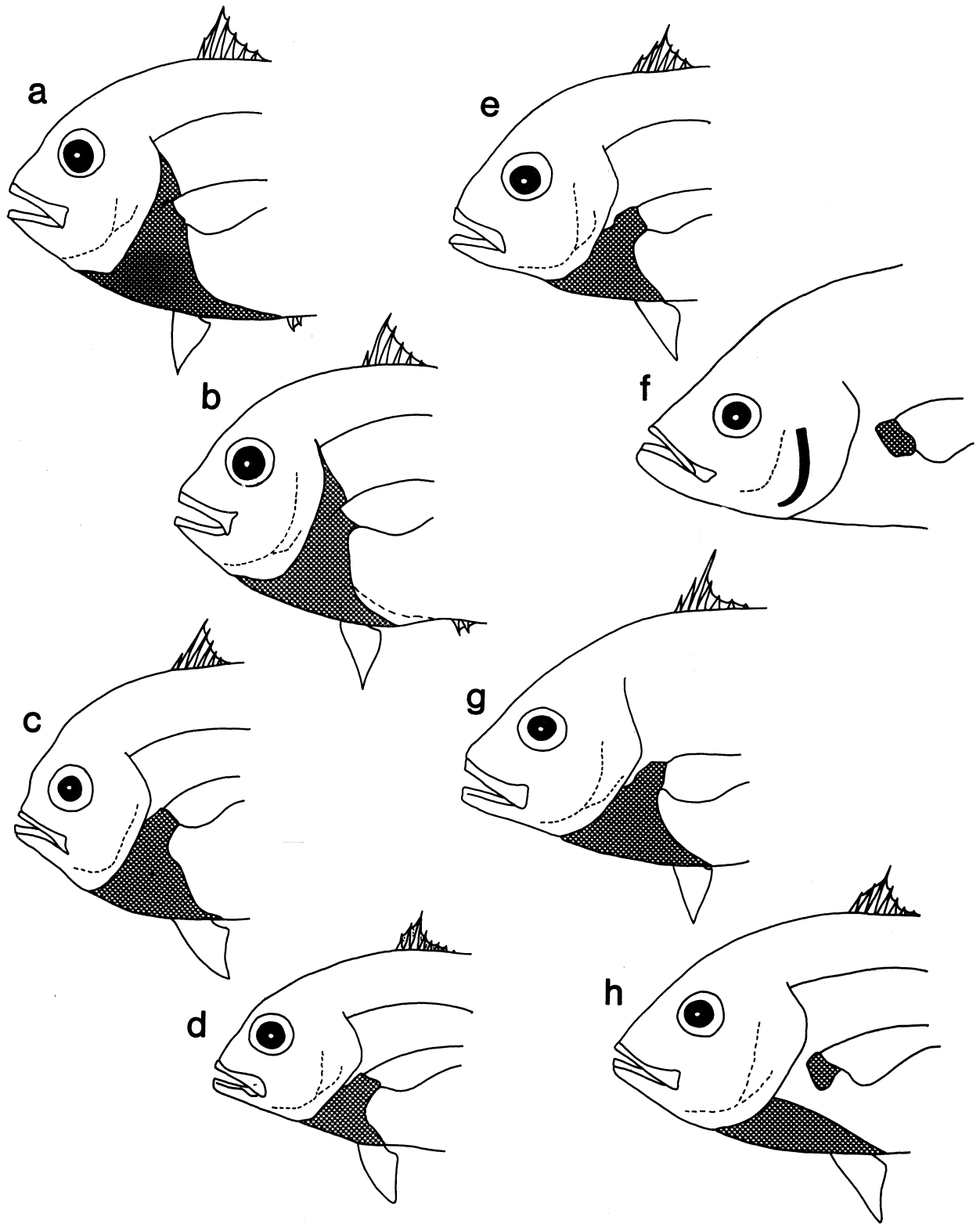


Fig.6. Breast squamation of north Australian carangid fishes (naked area of breast shaded) — Part 1.
 a: *Carangoides malabaricus*; b: *C. talamparoides*; c: *C. hedlandensis*; d: *C. humerosus*;
 e: *C. coeruleopinnatus*; f: *C. plagiotaenia*; g: *C. chrysophrys*; h: *C. gymnostethus*.

valid taxon, the poor condition of its type meant that the validity of the species could be pronounced "...only when specimens in good condition became available".

As a follow-up to Smith's work, Williams & Venkataramani (1978) studied the systematic status of *C. malabaricus* and *C. talamparoides*. These two species were found to be easily distinguished on the basis of gill raker counts. They also differed significantly in breast squamation and gill raker counts from Smith's (1967) reinstated *C. coeruleopinnatus*.

Recent studies by F. Williams (personal communication July, 1981), Gushiken (1983) and Smith-Vaniz (1984) have revealed further confusion over the systematic status of *Carangoides coeruleopinnatus* and *C. uii* Wakiya. Williams suggested that both were valid taxa, which could be separated on the basis of soft dorsal fin lobe height and the number of scales on the curved lateral line. He found that in *C. coeruleopinnatus* the height of the second dorsal lobe was greater than or equal to 0.85 (and usually greater than 1.0 in head length), while the CLL scales were 62–81 (and usually 66–78). In *C. uii*, the height of the second dorsal lobe was less than 0.83 in head length and the CLL scales ranged from 75–89 (usually 78–88).

Gushiken (1983), in his coverage of six *C. coeruleopinnatus* specimens (132–260 mm) and four *C. uii* specimens (133–204 mm SL), did not give CLL scale counts. His basis for separation of the species was the height and relative development of the soft dorsal and soft anal fin lobes.

Apparently without examining material (the minimum size of specimens examined was 132 mm) Gushiken stated that in fish smaller than 100 mm SL of both species, the first rays of the second dorsal and anal fins are equal in length.

It is between 100 mm and 200 mm SL that the two "species" can be separated. At these lengths, Gushiken (p.246) contended that the first anal ray in *C. coeruleopinnatus* is "...more prolonged and sometimes longer than the basal length of the anal fin while the first dorsal ray is less prolonged." In *C. uii*, however (p.248), "the first ray of the second dorsal fin becomes longer than that of the anal fin and sometimes extends beyond the tip of the caudal fin lobe in contrast with *C. coeruleopinnatus*." In fish larger than 200 mm SL, Gushiken found that the soft dorsal and anal fins of both species did not exhibit filamentous ray development and as a result were distinctly shorter than at smaller sizes. He noted, however, that the anal fin in the large *C. coeruleopinnatus* was slightly longer than the dorsal.

Smith-Vaniz (1984) largely followed the arguments of Gushiken (1983) and used fin heights as the characters distinguishing *C. coeruleopinnatus* from *C. uii*.

Throughout the works discussed above Williams, Gushiken and Smith-Vaniz did not have available to them the full size range of the two proposed species, which precluded any comment on the confounding effects of allometric development of fin lobes. In a number of other *Carangoides* species (e.g. *C. chrysophrys* and *C. talamparoides*) anterior anal and/or dorsal fin rays are produced as filaments in juveniles. As these species approach sexual maturity, the filaments decrease in size

until, at maturity, they are lost altogether.

The results of the present study strongly suggest that *C. coeruleopinnatus* and *C. uii* are synonymous. There is conclusive evidence that soft dorsal fin lobe height in *C. coeruleopinnatus* (Fig.5) undergoes an allometric change and that the CLL scale differences outlined by Williams (personal communication July, 1981) do not hold for Australian material.

Life history studies in progress by the author indicate that maturity in *C. coeruleopinnatus* is attained late in the second, or early in the third, year of life and is determined by both fish size and seasonal cycles. The result of this interplay of endogenous and exogenous factors in the progression of gonads toward maturity is the attainment of the same over a relatively large size range, i.e. 120–200 mm LCF. It is between these sizes that the dorsal and anal filaments are progressively reduced and finally lost.

In Gushiken's (1983) study, all eight specimens examined (except for two large ones) were in this transition stage of maturity and fin lobe development. Thus, on the basis of Australian data, it is suggested that the differences listed by Gushiken are due to the state of sexual development of a single species, *C. coeruleopinnatus*, and are not valid grounds for the separation of two taxa.

Ecological notes. *Carangoides coeruleopinnatus*, *C. malabaricus* and *C. talamparoides* commonly co-occur in the continental shelf waters of northern Australia. Throughout these waters, *C. coeruleopinnatus* feeds predominantly on small demersal fish and in particular those of the families Bregmacerotidae and Champsodontidae.

Distribution. General — tropical Indo-West Pacific. Australia — *Carangoides coeruleopinnatus* is common in tropical continental shelf waters from Exmouth Gulf in Western Australia to Townsville on the east coast of Queensland (Fig.11).

Carangoides chrysophrys (Cuvier, 1833)

Figs 6g, 8b, 12, Pl.4b

Caranx chrysophrys Cuvier in Cuvier & Valenciennes, 1833: 77, pl.247 (type locality Seychelles).

Citula chrysophrys.—Ogilby, 1915: 77, pl.34.

Caranx chrysophrys.—McCulloch, 1915: 136.

Caranx (Carangoides) chrysophrys.—Weber & de Beaufort, 1931: 239.

Carangoides chrysophrys.—Munro, 1960a:20, No. 831.—Munro, 1967: 231, No. 386.—Grant, 1978: 241.—Sainsbury *et al.*, 1984: 162.

Material examined. (42:65–640) — WESTERN AUSTRALIA: CSIROML B 2153, (9:118–127), C 2329, (1:137), C 2330 (1:136), C 3079 (1:117), CA 210 (1:243), CA 2495 (1:595). WAM P 26194-005 (1:270). NORTHERN TERRITORY: CSIROML CA 1048 (1:198). GULF OF CARPENTARIA: CSIROML A 2916 (1:68),

B 2167 (9:146–194). QUEENSLAND East Coast: QM I 2090 (1:135), I 6204 (1:285), I 10329, (1:345), I 17734 (1:152). NEW SOUTH WALES: AMS I 19389-001 (1:640), I 20324-001 (1:65), I 21566-004 (1:523).

MATERIAL NOT RETAINED. (9:146–198) — Gulf of Carpentaria, 13°00'S, 141°00'E, Nov. 1981.

Recommended common name. Longnose trevally.

Other common name. Grunting trevally.

Diagnosis. D VIII + 1, 18–20; A II + 1, 15–17; gill rakers 6–7 + 15–18 = 21–24; eye relatively small, up to twice in snout in large adults; naked area on breast extends up to and includes pectoral base but does not extend above it (Fig.6g).

Colour notes. Body silver to silvery green above, darkest on head; silver below; black spot on upper operculum. Dorsal and anal fins ranging from white to pale yellow green to hyaline; pectoral and caudal fins dusky yellow to green.

Description. Snout 10.1–12.2%; eye 6.7–9.9; snout/eye ratio 1.09 (in 146 mm specimen)–1.97 (600 mm specimen); head length 29.3–31.3%; body depth 40.0–42.6%; snout to spinous dorsal fin 41.1–44.7%; upper jaw length 12.0–13.0%; pectoral fin 35.3–36.8%; scutes feeble, 21–27.

Body oval to elongate oval, strongly compressed; dorsal profile more convex than ventral; head profile smoothly and mildly convex before nape, straightens from nape to mouth cleft. Soft dorsal and soft anal fins falcate, in juveniles anterior rays of both fins produced as filaments. Pectoral fins long and falcate, not reaching junction of straight and curved lateral line segments. Curved lateral line moderately arched, up to twice length of straight (CLL/SLL = 1.62–1.99). Maxilla extends to below middle of eye. Villiform teeth in bands on both jaws, vomer, palatines and tongue (Fig.8b).

Comparison with other species. *Carangoides chrysophrys* may be distinguished from two similar species, *C. malabaricus* and *C. talamparoides*, on the basis of breast squamation (in *C. chrysophrys* the naked area on the breast does not extend above the pectoral base; in the other two it does), gill raker counts (total gill rakers in *C. chrysophrys* 21–24; *C. malabaricus* 32–36; *C. talamparoides* 26–30), and fin ray counts (*C. chrysophrys* D 19–20, A 15–16; *C. malabaricus* D 20–23, A 17–19; *C. talamparoides* D 20–23, A 17–19).

Carangoides coeruleopinnatus has similar breast squamation to *C. chrysophrys* and gill raker counts for the two species broadly overlap. The most consistent distinguishing characters for the species are fin ray counts (D 22–23, A 18–19 in *C. coeruleopinnatus*; D 19–20, A 15–16 in *C. chrysophrys*), snout profile (snout bluntly rounded in *C. coeruleopinnatus*; snout profile straight and vertical to the longitudinal axis of the body in *C. chrysophrys*) and snout length to eye diameter ratio (eye diameter approximates snout length at all sizes in *C. coeruleopinnatus*, snout/eye = 1.01–1.14; eye diameter approximates snout length in small specimens but

decreases proportionally with age, snout/eye 1.09 (146 mm LCF)–1.97 (600 mm LCF) in *C. chrysophrys*).

Ecological notes. Although present throughout north Australian waters, *C. chrysophrys* is most common on the North West Shelf. The species occurs in depths of up to 90 m and is most abundant at 30 to 60 m. Small demersal fish and epibenthic crustaceans are its most common food items.

Distribution. General — tropical Indo-West Pacific. Australia — *Carangoides chrysophrys* is largely confined to tropical waters from Exmouth Gulf to central Queensland (Fig.12). Large individuals are occasionally recorded from northern New South Wales and small juveniles, presumably transported south by the East Australian Current, occur in inshore waters as far south as Sydney during the summer months.

Carangoides equula (Schlegel)

Figs 7c,8c,12,Pl.5a

Caranx equula Schlegel in Temminck & Schlegel, 1844: 111, pl.60, fig.1 (type locality Japan).

Carangoides equula.—Sainsbury *et al.*, 1984: 166.

Material examined. (20:92–211) — WESTERN AUSTRALIA: WAM P 22309 (1:191), P 23892-95 (4:200–211), P 25926-005 (1:133), P 26182-010 (1:105), P 26187-005 (1:156), P 27208-004 (1:154), P 27215-001 (1:144). NORTHERN TERRITORY: ANSP 147706 (6:93–100). CSIRO ML B 2158 (4:92–103).

Recommended common name. Whitefin trevally.

Other common name. Horse trevally.

Diagnosis. Breast fully scaled (Fig.7c); preoperculum uniformly silver, without black posterior margin; head profile almost straight from origin of spinous dorsal fin to mouth cleft; soft dorsal and soft anal fins low, anterior rays of both with white tips; vomerine tooth patch with diamond-shaped anterior portion and long medial posterior projection (Fig.8c).

Colour notes. Body silver blue to green above; silver white below. Soft dorsal and soft anal fins dusky yellow basally, anterior rays of both with dark grey brown median and white distal bands; caudal fin dusky yellow; pectoral and pelvic fins white. Juveniles with 5–7 dark vertical bands through body.

Description. D VIII + I, 23–25; A II + I, 21–23; gill rakers 7–9 + 20–22 = 28–30; snout 8.9–10.4%; eye 9.6–10.2%; head length 30.3–31.7%; snout to spinous dorsal fin 35.0–41.6%; scutes weak, 23–24.

Body oval, strongly compressed; head profile straight. Soft dorsal and soft anal fins low, not falcate, with scaly basal sheaths; pectoral fins subfalcate, not reaching junction of

straight and curved lateral line segments. Curved lateral line segment moderately arched, longer than straight (CLL/SLL = 1.60–2.00). Maxilla reaches to below front half of eye. Villiform teeth in series on both jaws, vomer, palatines and on central band on tongue (Fig.8c).

Comparison with other species. *Carangoides equula* and *C. plagiotaenia* are the only Australian *Carangoides* species with completely scaled breasts. They may be easily distinguished from each other on the basis of preoperculum colouration (preoperculum uniformly silver

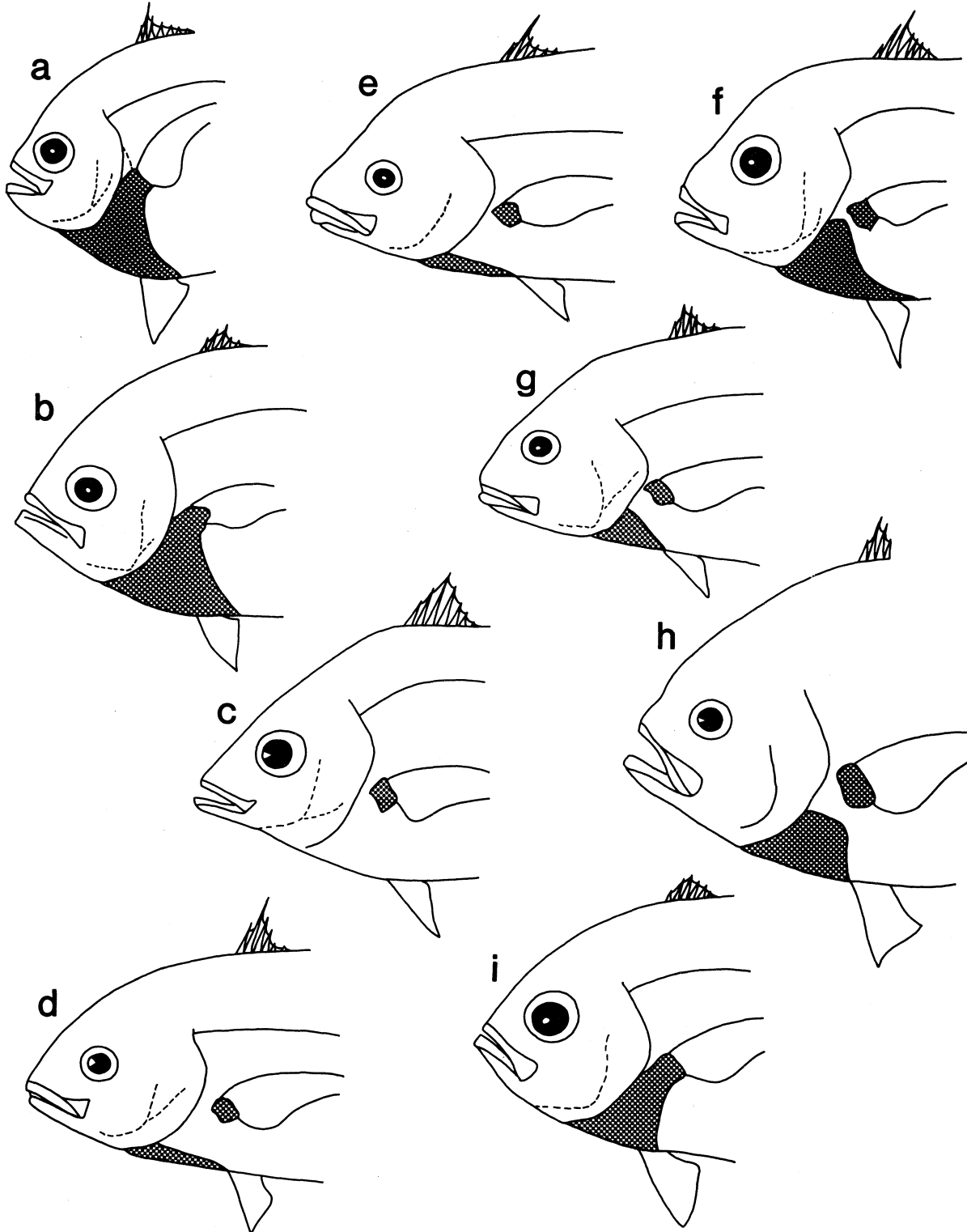


Fig.7. Breast squamation of north Australian carangid fishes (naked area of breast shaded) — Part 2. a: *Ulua aurochs*; b: *Ulua mentalis*; c: *Carangoides equula*; d: *C. ferdau*; e: *C. orthogrammus*; f: *C. fulvoguttatus*; g: *C. oblongus*; h: *Uraspis secunda*; i: *Uraspis uraspis*.

in *C. equula*; preoperculum with black posterior margin in *C. plagiotaenia*, shape of the vomer (vomerine tooth patch with diamond-shaped anterior portion and long medial posterior projection in *C. equula*; triangular without any posterior projection in *C. plagiotaenia*) and soft dorsal and soft anal fin shape (fins low and not falcate in *C. equula*; fins

comparatively high with falcate anterior lobes in *C. plagiotaenia*).

Remarks. The maximum recorded size is 237 mm (CSIRO unpublished data, F.R.V. *Soela* Cruise 07/80). *Carangoides equula* is a new record for Australian waters.

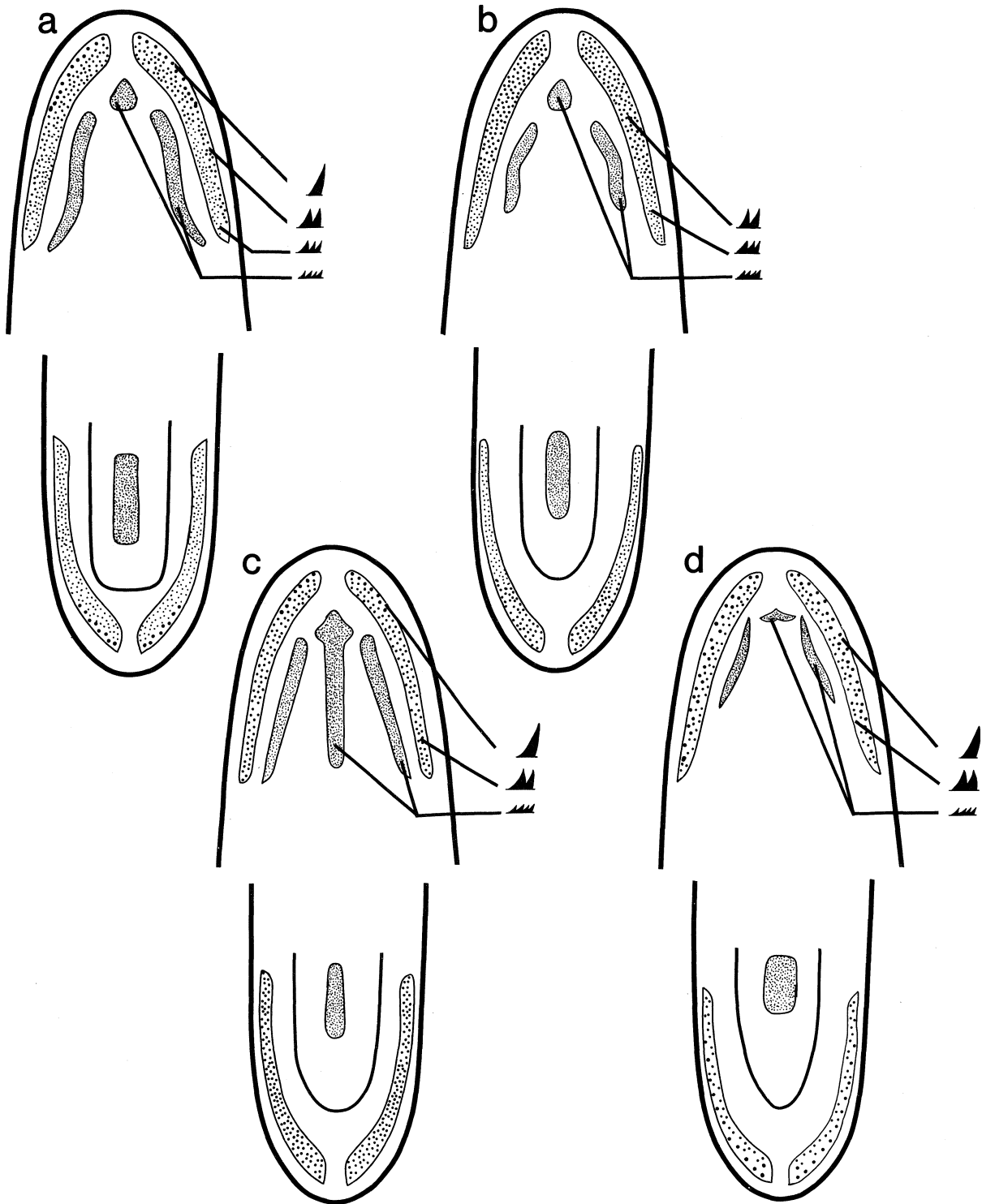


Fig.8. Dentition of the premaxillary, dentary, vomer, palatines and tongue of north Australian *Carangoides* species — Part 1. a: *C. coeruleopinnatus*; b: *C. chrysophrys*; c: *C. equula*; d: *C. ferdau*.

Ecological notes. In north Australian waters, *C. equula* is largely restricted to shelf slope habitats in the depth range 100 to 200 m. It was the only *Carangoides* species recorded in depths of greater than 160 m during this study. The species feeds on a wide range of fish, crustaceans and cephalopods.

Distribution. General — tropical Indo-West and central Pacific. Australia — *Carangoides equula* has been recorded as far south as 27°57'S on the Western Australian coast (Fig. 12) and occurs in shelf slope waters as far north as the Arafura Sea (8°S). The species has not been recorded from the east Australian coast, probably because shelf slope habitats in these areas have been infrequently sampled. Prior to this study, *C. equula* was thought to have an antitropical distribution (Randall, 1981).

Carangoides ferdau (Forsskål)

Figs 7d,8d,13,Pl.6b

Scomber ferdau Forsskål, 1775: 55 (type locality Red Sea).

Caranx laticaudis Alleyne & Macleay, 1877: 325, pl.10, fig.2 (type locality Hall Sound, Papua New Guinea).

Ferdauia lindemanensis Whitley, 1951a: 66 (type locality Lindeman Island, Queensland).

Caranx laticaudis.—McCulloch, 1924: 74, pl.12.

Carangoides laticaudis.—Munro, 1960b: 18, No. 837.—Munro, 1967: 230, No. 380.—Russell, 1983: 53.

Material examined. (11:144–302) – AMS IA 7491 (1:182) HOLOTYPE *Ferdauia lindemanensis* Whitley, 1951. Type locality – Lindeman Island, Queensland. AMS I 16303-001 (1:240) HOLOTYPE *Caranx laticaudis* Alleyne & Macleay, 1877. Type locality – Hall Sound, Papua and New Guinea. QUEENSLAND East Coast: QM I 16008 (1:221), I 17424 (1:187). NEW SOUTH WALES: AMS I 4924 (1:144), QM I 10143 (1:167).

PAPUA AND NEW GUINEA: CSIROML C 44 (1:181), C 403 (1:166), C 424 (1:302), C 1538 (1:157), C 1558 (1:155).

Recommended common name. Blue trevally.

Diagnosis. Naked area on breast extends less than one third of distance to naked pectoral base (Fig. 7d); in life and immediately post mortem, yellow or orange spots usually absent from sides of body but if present spots are small, numerous and inconspicuous; adults typically with 5–7 broad, vertical dusky bars on sides of body; lips never papillose; snout 6.9–8.1%; eye 6.2–8.1%; upper jaw length to snout ratio 1.2–1.4; snout to eye ratio 0.95–1.22; curved lateral line segment only slightly arched, longer than straight (CLL/SLL=1.15–1.65).

Colour notes. Body blue green to yellow green above, silver below. Soft dorsal and soft anal fins dark green, anterior lobes of both often with white tips, distal margin of soft anal fin occasionally white; caudal fin green.

Description. D VIII + I, 28–34; A II + I, 25–27; gill rakers 8–9 + 17–21 = 26–30; snout to spinous dorsal fin 37.3–38.8%; snout to soft dorsal fin 46.3–51.5%; head length 25.6–28.2%; body depth 36.5–44.2%; upper jaw length 9.1–10.9%; height of soft dorsal fin lobe 24.9–36.5%; height of soft anal fin lobe 17.7–31.4%; scutes weak, 24–30.

Body ovate to elongate-ovate, compressed; head profile gently sloping; snout blunt; eye relatively low set, slightly above level of tip of snout. Spinous dorsal fin low; soft dorsal and soft anal fins falcate; pectoral fins falcate, long, reaching to junction of straight and curved lateral line segments. Maxilla extends to below front edge to middle of eye; posterior adipose eyelid moderately developed. Villiform teeth in bands on both jaws, in large specimens teeth are often slightly enlarged and conical on central anterior portions of both jaws; villiform teeth also on vomer, palatines and on central band on tongue (Fig. 8d).

Comparison with other species. Breast squamation and lateral line characteristics distinguish *C. ferdau* from all other north Australian *Carangoides* species except *C. orthogrammus*. Meristic values for *C. ferdau* and *C. orthogrammus* broadly overlap, and morphometric values do not generally allow separation of the two species. However, within the size range of material examined there were specific differences in the eye diameter (5.1–6.3% in *C. orthogrammus*; 6.2–8.1% in *C. ferdau*), snout length (8.4–9.9% in *C. orthogrammus*; 6.9–8.1% in *C. ferdau*), upper jaw length to snout length ratio (1.11–1.20 in *C. orthogrammus*; 1.20–1.40 in *C. ferdau*) and snout length to eye diameter ratio (1.44–1.87 in *C. orthogrammus*; 0.95–1.22 in *C. ferdau*). Smith-Vaniz (personal communication, 1982) notes that, despite these small differences, the most reliable characters to distinguish between the species are colouration (in life and immediately post mortem, *C. orthogrammus* has two to seven large, elliptical, brown spots with yellow borders on the sides of the body, and usually has no dusky vertical bars on the sides; in *C. ferdau* yellow or orange spots are usually absent or, if present, are small, numerous and inconspicuous, and adults typically have five to seven relatively broad, dusky vertical bars on the sides of the body) and lip morphology (lips papillose in all but juvenile *C. orthogrammus*; lips never papillose in *C. ferdau*).

Remarks. The maximum recorded size for this species is 400 m (Fourmanoir & Laboute, 1976).

The systematics of *C. orthogrammus* and *C. ferdau* are currently being revised by Smith-Vaniz and Poss. The two species have a complex history of synonymies throughout the Indo-Pacific, and in the Australian literature the two have apparently not been distinguished. Munro (1960a) and Grant (1978), for example, use *C. laticaudis* as the name for a “blue trevally”.

Distribution. General — tropical and sub-tropical Indo-West and Central Pacific. Australia — *Carangoides ferdau* is known to occur in inshore and reef habitats from north Queensland to Sydney on the east coast (Fig. 13). The species has not been recorded from the Gulf of

Carpentaria, Arafura Sea or the Western Australian coast. However, this is more likely to be a result of inadequate sampling of suitable habitats in these areas than an indication of the absence of the species.

Carangoides fulvoguttatus (Forsskål)

Figs 7f, 9a, 14, Pl. 5b

Scomber fulvoguttatus Forsskål, 1775: 56 (type locality Red Sea).

Turrum emburyi Whitley, 1932: 337, pl. 38 (type locality North West Island, Queensland).

Ferdauia claeszooni Whitley, 1946: 136, pl. 11, fig. 2 (type locality Cape Baskerville, Western Australia).

Carangoides emburyi.—Munro, 1960b: 17, No. 835.—Grant, 1978: 238.—Coleman, 1981: 103.

Caranx emburyi.—Marshall, 1964: 222, No. 233.

Carangoides fulvoguttatus.—Munro, 1960b: 17, No. 838.—Munro, 1967: 230, No. 379.—Russell, 1983: 53.—Sainsbury *et al.*, 1984: 164.

Material examined. (17: 202–1030) — WESTERN AUSTRALIA: CSIRO ML CA 2468 (1:322), CA 2481 (1:202), CA 2482 (1:222), CA 2483 (1:230). WAM P 23964 (1:559), P 27147-001, (1:1030). QUEENSLAND East Coast: QM I 5562 (1:885), I 5563 (1:802), I 8846 (1:263), I 10328 (1:350), I 16697 (1:349), I 17478 (1:362).

MATERIAL NOT RETAINED (3:202–232) — Western Australia, 12°27'S, 124°25'E, July 1980. (2:290–353) — Northern Territory, 12°10'S, 136°50'E, Jan. 1980.

Recommended common name. Yellowspotted trevally.

Other common names. Turrum, albacore, gold-spotted trevally.

Diagnosis. Naked area on breast triangular, dorsally extending approximately half way to pectoral base (Fig. 7f); D VIII + I, 25–29; A II + I, 22–24; curved lateral line segment gently to moderately arched; small golden spots on upper two thirds of body; head profile relatively steep throughout life (angle of the head with the horizontal axis of the body 43–48°); gill rakers 6–7 + 17–18 = 24–25; scutes weak, 14–20.

Colour notes. In juveniles (less than 100–120 mm LCF), body uniformly silvery grey, with a few golden spots. In larger specimens, body blue green above; silver below; many yellow to golden spots on upper two thirds of body; dark blotches along lateral line; black spot on operculum inconspicuous or absent. Soft dorsal and soft anal fins dusky yellow, anterior rays of latter white; pectoral and caudal fins dusky yellow; pelvic fins white.

Description. Snout 10.1–10.7%; eye 5.0–8.2%; head length 25.8–29.3%.

Body subovate in juveniles, becoming moderately elongate with age; strongly compressed. Soft anal and soft dorsal fins falcate; pectoral fins falcate, long, reaching to

junction of straight and curved lateral line segments. Curved lateral line segment slightly longer than straight (CLL/SLL = 1.21–1.24). Maxilla extends to below front edge of eye; mouth cleft below eye level in specimens greater than 150 mm LCF. Villiform teeth on both jaws, vomer, palatines and on narrow central band on tongue (Fig. 9a).

Comparison with other species. *Carangoides fulvoguttatus*, *C. gymnostethus*, *C. ferdau* and *C. orthogrammus* are all known as gold-spotted, yellow-spotted or golden-spotted trevallies in different parts of the Indo-Pacific region. They are superficially similar, each having two or more yellow or golden spots on the side of the body, but the spots are inconsistent in number, size and colour. The species can be separated with meristic and morphometric characters.

Fin ray counts (D 25–29, A 22–24 in *C. fulvoguttatus*; D 29–31, A 25–26 in *C. orthogrammus*; D 28–34, A 25–27 in *C. ferdau*), gill raker counts (6–7 + 17–18 = 24–25 in *C. fulvoguttatus*; 9–10 + 21–22 = 30–31 in *C. orthogrammus*; 8–9 + 17–21 = 26–30 in *C. ferdau*), curved lateral line shape (gently to moderately arched in *C. fulvoguttatus*; only very slightly sloping in *C. orthogrammus* and *C. ferdau*) and breast squamation (naked area on breast extends approximately half way to pectoral fin base in *C. fulvoguttatus*; extends less than one third of this distance in *C. orthogrammus* and *C. ferdau*) allow separation of *C. fulvoguttatus* from *C. orthogrammus* and *C. ferdau*.

Carangoides fulvoguttatus may be differentiated from *C. gymnostethus* on breast squamation (in *C. gymnostethus*, the naked area on the breast extends up to and includes the pectoral base (Fig. 6h); in *C. fulvoguttatus*, a patch of scales separates the naked breast from the naked pectoral base [Fig. 7f]). Other characters separating the species are a comparatively steep head profile in *C. fulvoguttatus* (angle of the head with the horizontal axis of the body 33 to 42° in *C. gymnostethus*; 43 to 48° in *C. fulvoguttatus*), and the shape and width of the villiform tooth band on the tongue (relatively thick with truncate anterior and posterior margins in *C. fulvoguttatus* (Fig. 9a); relatively thin and spearhead shaped with bluntly pointed margins in *C. gymnostethus* (Fig. 9b).

Remarks. The holotypes of both *Turrum emburyi* Whitley and *Ferdauia claeszooni* Whitley are apparently lost. However, Whitley's (1932, 1947) descriptions provide adequate evidence of their status as junior synonyms of *Carangoides fulvoguttatus* (Forsskål).

The maximum recorded size of *C. fulvoguttatus* in Australian waters is 1030 mm. Grant (1978) cites a record weight of 91 lbs for the species but gives no length for the specimen.

Carangoides fulvoguttatus and *C. gymnostethus* commonly co-occur on the North West Shelf. Preliminary analyses of their diets suggest that *C. fulvoguttatus* takes mainly fish and cephalopods while *C. gymnostethus* takes mainly crustaceans.

Distribution. General — tropical Indo-West Pacific.

Australia — *Carangoides fulvoguttatus* is most abundant in tropical waters from Exmouth Gulf to the southern limits of the Great Barrier Reef (Fig.14). The species is largely restricted to isolated reef systems on the North West Shelf and in the Timor and Arafura Seas and Gulf of Carpentaria. As is the case for many of the larger carangids with

primarily tropical distributions, *C. fulvoguttatus* is occasionally caught south of 30°S on the Western Australian coast. The southern-most confirmed record on the east coast is from just north of Brisbane. However, there are a number of unconfirmed records from the Solitary Islands in northern New South Wales.

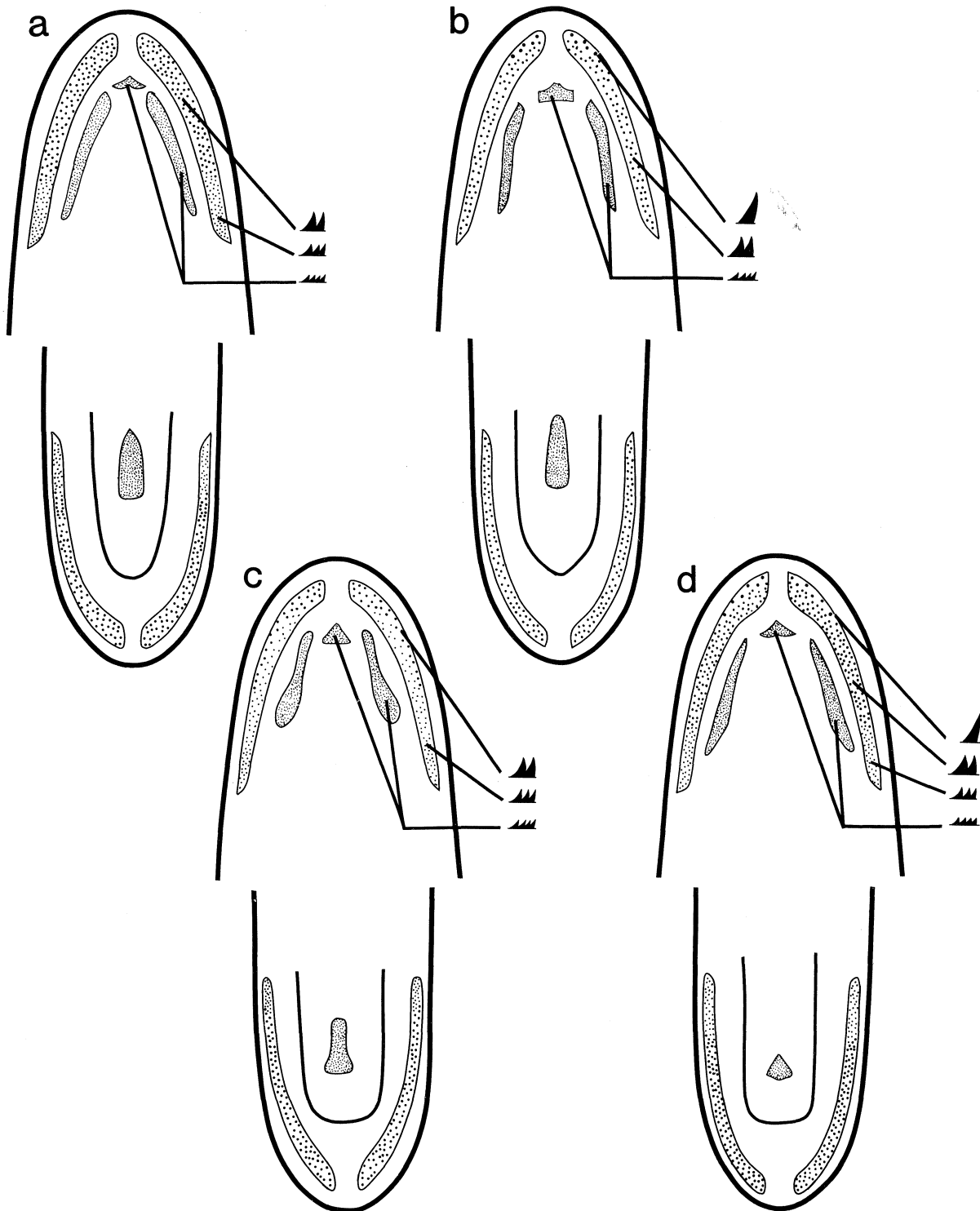


Fig.9. Dentition of the premaxillary, dentary, vomer, palatines and tongue of north Australian *Carangoides* species — Part 2. a: *C. fulvoguttatus*; b: *C. gymnostethus*; c: *C. hedlandensis*; d: *C. humerosus*.

Carangoides gymnostethus (Cuvier)

Figs 6h, 9b, 14, Pl. 7a

Caranx gymnostethus Cuvier in Cuvier & Valenciennes, 1833: 73 (type locality Seychelles).*Ferdauia claeszooni prestonensis* Whitley, 1947: 137 (type locality Cape Preston, Western Australia)*Carangoides gymnostethoides*.—Munro, 1960b: 17, No. 833.—Munro, 1967: 230, No. 381.*Caranx gymnostethoides*.—Taylor, 1964: 180.*Carangoides gymnostethus*.—Grant, 1978: 242.—Russell, 1983: 54.—Sainsbury *et al.*, 1984: 164.

Material examined. (8:158–450) – WESTERN AUSTRALIA: CSIRO ML CA 275 (1:158), CA 1928 (1:216). WAM P 25354-034 (2:190–204), P 26188-001 (1:177). QUEENSLAND East Coast: QM I (1:450), I 19145 (1:379).

MATERIAL NOT RETAINED (1:335) – Western Australia, 20°24'S, 115°30'E, July 1980.

Recommended common name. Bludger.

Diagnosis. Naked area on breast extends up to, but not above, pectoral fin base (Fig. 6h); D VIII + I, 28–33; A II + I, 24–27; gill rakers 8–9 + 19–22 = 28–31; small golden spots sometimes present on sides of body; head profile relatively steep in small juveniles (less than 150 mm LCF) becoming less steep with age, large adults elongate with very shallow head profile (angle of head with the horizontal axis of the body 33–42°); curved lateral line gently to moderately arched.

Colour notes. In specimens up to 200 mm, body silver to silvery green with a few scattered golden spots on sides; dark line running obliquely through eye, fading with age. In larger specimens, body green to blue green above, silver below; with or without gold to golden brown spots (usually less than 30) on sides. Dorsal, anal, caudal and pelvic fins olive green; soft dorsal and soft anal fins often with white tips; pectoral fins hyaline.

Description. Snout 9.8–10.0%; eye 6.5–7.9%; body depth 30.4–40.0%; head length 29.0–29.4%; pectoral 32.3–34.6%; scutes feeble to weak, 15–20.

Body progresses from ovate to elongate with age, compressed. Soft dorsal and soft anal fins falcate; in specimens less than 200 mm first and second rays of both fins produced to long filaments; pectoral fins falcate and long, almost reaching to junction of straight and curved lateral line segments. Curved lateral line segment gently to moderately arched, longer than straight (CLL/SLL = 1.19–1.52). Maxilla extends to below front edge of eye; cleft of mouth below eye level. Villiform teeth on both jaws, vomer, palatines and on narrow central band on tongue (Fig. 9b).

Comparison with other species. *Carangoides gymnostethus* may be distinguished from the majority of

north Australian *Carangoides* species on the basis of having more than 25 dorsal and more than 22 anal fin rays. However, *C. fulvoguttatus*, *C. ferdau* and *C. orthogrammus* have approximately the same number of fin rays as *C. gymnostethus*. *Carangoides orthogrammus* and *C. ferdau* may be differentiated from *C. gymnostethus* on the basis of breast squamation (naked area on the breast of *C. orthogrammus* and *C. ferdau* extends less than one third of the way to the pectoral base; in *C. gymnostethus* the naked area extends up to the pectoral base) and curved lateral line shape (very gently curved to almost straight in *C. orthogrammus* and *C. ferdau*; gently to moderately curved in *C. gymnostethus*).

See the 'Comparison with other species' section in *C. fulvoguttatus* for a comparison with *C. gymnostethus*.

Remarks. The holotype of *Ferdauia claeszooni prestonensis* Whitley is apparently lost. However, Whitley's (1947) description provides adequate evidence of this species synonymy with *Carangoides gymnostethus* (Cuvier).

Munro (1960b) and Grant (1978) record 30 inches (750 mm) as the maximum size attained by *C. gymnostethus* in Australian waters.

Ecological notes. *Carangoides gymnostethus* is common in waters of the North West Shelf and the Great Barrier Reef. In the predominantly turbid water and soft bottom conditions of the Arafura Sea and Gulf of Carpentaria, both juveniles and adults are restricted to isolated reef systems. On the North West Shelf, juvenile and young adult (less than 350 mm) *C. gymnostethus* are abundant over sandy bottoms in depths of 40 to 70 m, while larger fish inhabit shallow coral reef systems. Crustaceans, particularly penaeids, mysids, stomatopods and euphausiids, are the species' major food resource.

Distribution. General — tropical Indo-West Pacific. Australia — *Carangoides gymnostethus* has been recorded in tropical waters from Dampier on the Western Australian coast to the Gulf of Carpentaria (Fig. 14). While no material was examined from the Australian east coast in the present study, the species is well known from the Great Barrier Reef (Munro, 1960; Grant, 1978).

Carangoides hedlandensis (Whitley)

Figs 6c, 9c, 15, Pl. 8a–b

Olistus hedlandensis Whitley, 1934: 156, fig. 2 (type locality Port Hedland, Western Australia).*Caranx armatus* (non Rüppell).—Alleyne & Macleay, 1877: 323.—Macleay, 1881: 171.—McCulloch, 1929: 189.—Munro, 1967: 231, pl. 26, No. 383.*Caranx* (*Carangoides*) *armatus* (non Rüppell).—Weber & de Beaufort, 1931: 233.*Carangoides schlegeli* (non Wakiya).—Munro, 1960a: 19, No. 828.*Carangoides armatus* (non Rüppell).—Grant, 1978: 244.

Carangoides hedlandensis.—Sainsbury *et al.*, 1984: 162.

Material examined. (44:75–263) — AMS I 12957 (1:171) HOLOTYPE *Olistus hedlandensis* Whitley, 1934. Type locality — Port Hedland, Western Australia. WESTERN AUSTRALIA: CSIROML C 2396 (1:173), C 2593 (1:108), C 2750 (1:112), CA 1057 (1:132),

CA 2493 (1:175). WAM P 4272 (1:120), P 4293 (1:97), P 7621 (1:161), P 8878 (1:100), P 8879 (1:100), P 8880 (1:112), P 15465 (1:174), P 15466 (1:166), P 15467 (1:160), P 25095-044 (1:121), P 26224-004 (1:113). GULF OF CARPENTARIA: CSIROML A 2903 (1:89), B 2162 (5:152–173). QM I 3977 (1:165). QUEENSLAND East Coast: QM I 2303 (1:185), I 3977 (1:165), I 6234 (1:229),

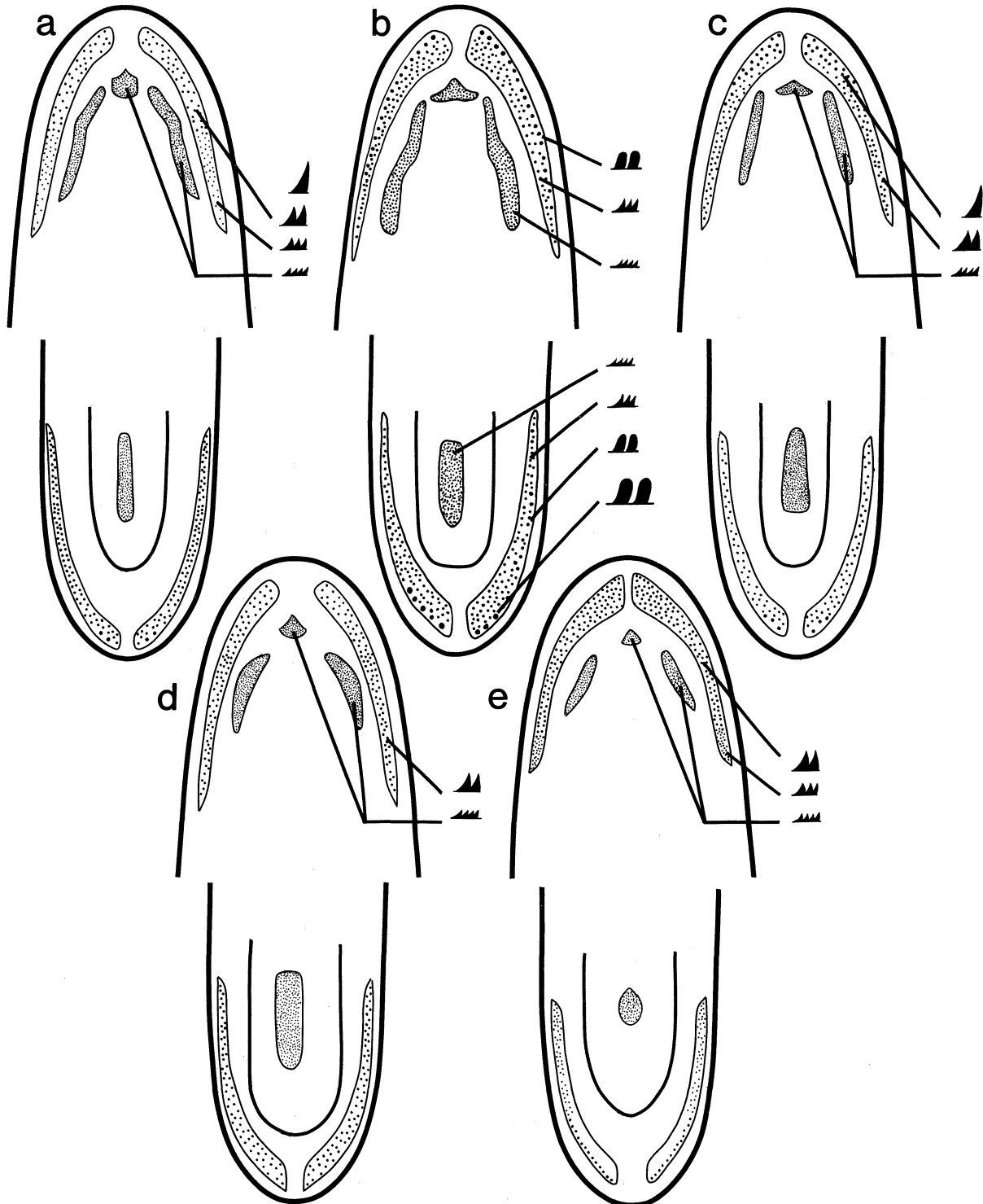


Fig.10. Dentition of the premaxillary, dentary, vomer, palatines and tongue of north Australian *Carangoides* species — Part 3. a: *C. malabaricus*; b: *C. oblongus*; c: *C. orthogrammus*; d: *C. talamparoides*; e: *C. plagiotaenia*.

I 6937 (1:263), I 7531 (1:243), I 10600 (1:75), I 13171 (1:112), A 274 (1:114), C 179 (1:193), C 236 (1:145),
 (1:184), I 17251 (1:129), I 17252 (1:135), C 1071 (1:164), C 1072 (1:189), C 1499 (1:135), C 1639
 PAPUA NEW GUINEA: CSIROML A 12 (1:111), A 273 (1:123), C 1776 (1:107), C 1875 (1:112).

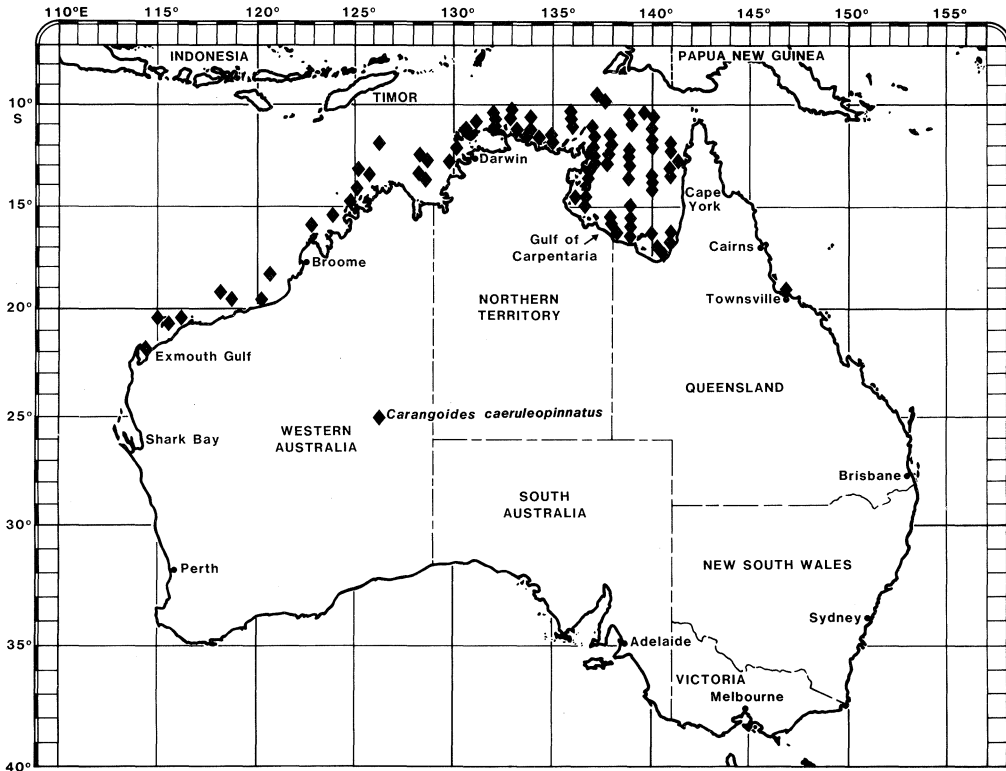


Fig.11. Australian distribution of *Carangoides caeruleopinnatus*.

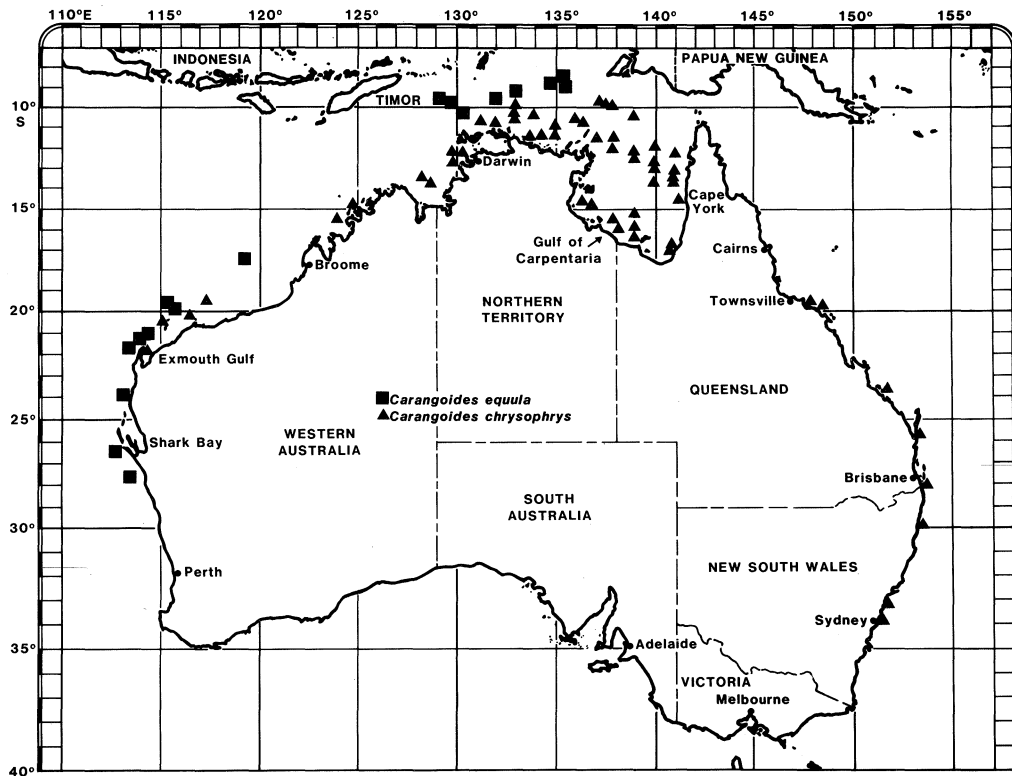


Fig.12. Australian distribution of *Carangoides chrysophrys* and *C. equula*.

Recommended common name. Bumpnose trevally.

Diagnosis. Head profile steep with distinct bulge or bump on interorbital in larger juveniles and adults (bulge scarcely apparent in small juveniles); gill rakers 6–11 + 14–17

Other common name. Port Hedland trevally.

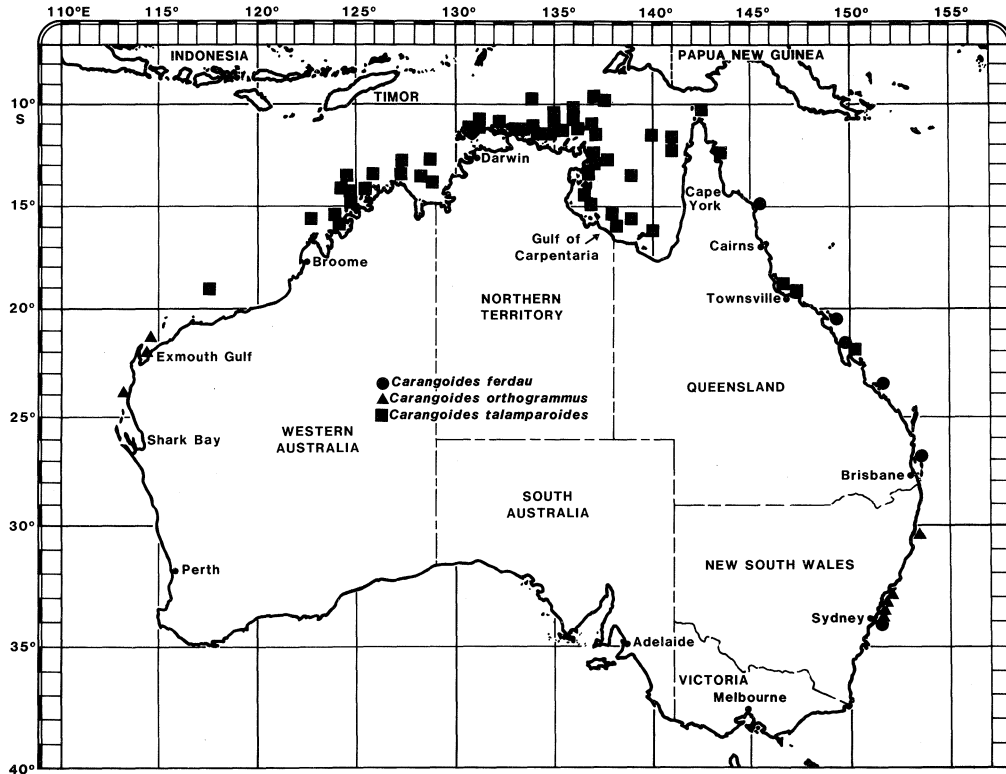


Fig.13. Australian distribution of *Carangoides orthogrammus*, *C. ferdau* and *C. talamparoides*.

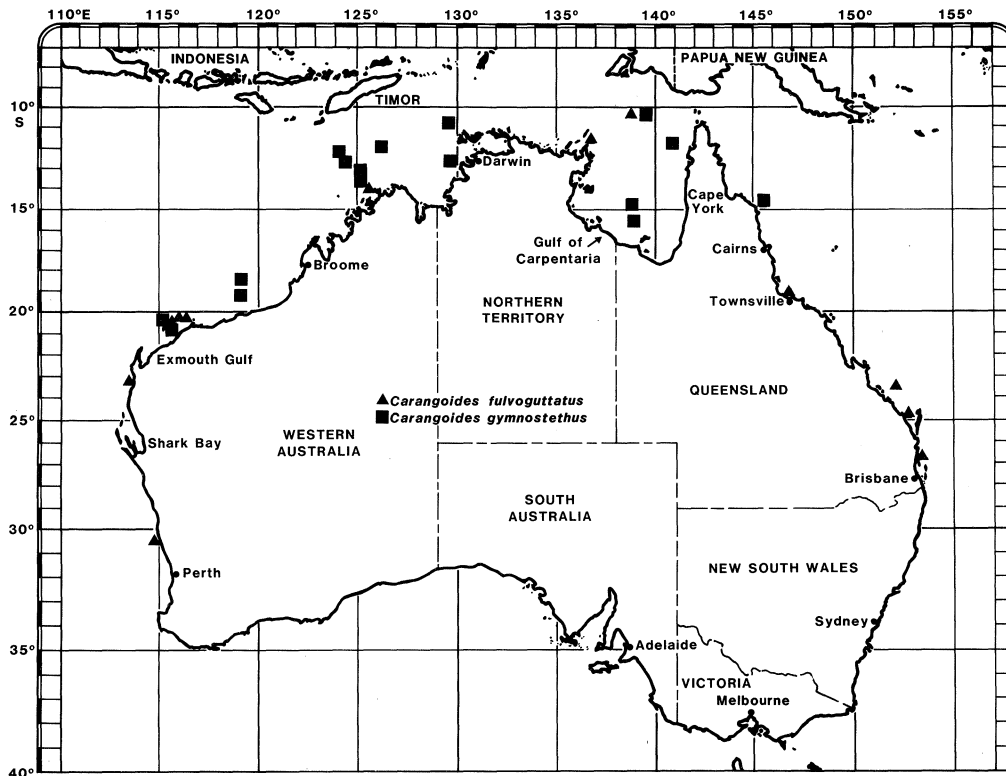


Fig.14. Australian distribution of *Carangoides fulvoguttatus* and *C. gymnostethus*.

= 20–27; naked area on breast extends from posterior margin of ventral groove up to pectoral base, not beyond it (Fig.6c); variable number of central soft dorsal (4–7) and soft anal (3–7) fin rays produced as long filaments in mature males, weakly developed in females, absent in juveniles of both sexes.

Colour notes. Body silvery blue green above; silver to white below; small dark spot on upper operculum. Anterior rays of soft dorsal fin and distal portions of dorsal filaments black; anal fin rays and filaments white; pelvic fins with black tips; caudal fin dark; dorsal surface of caudal peduncle black. Juveniles with 5–7 broad, dark vertical crossbars.

Description. D VIII + I, 19–22; A II + I, 16–18; snout 7.6–7.9%; eye 9.8–10.1%; head length 27.4–28.2%; body depth 46.5–51.8%; scutes, 22–25.

Body oval to sub-orbicular, strongly compressed. Soft dorsal and soft anal fins with filamentous anterior rays in juveniles and adults of both sexes; pelvic fins short; pectoral fins subfalcate to falcate, reaching junction of straight and curved lateral line segments. Curved lateral line segment moderately arched, longer than straight (CLL/SLL=1.12–1.45). Maxilla extends to below middle of eye. Jaw teeth small and conical in distinct bands; villiform teeth on vomer, palatines and on narrow central band on tongue (Fig.9c).

Comparison with other species. A deep body, steep head profile with distinct interorbital bulge and elongated central soft dorsal and soft anal fin rays in males

distinguish *C. hedlandensis* from other Australian Carangoides species.

Carangoides armatus (Rüppell), which occurs throughout the Indo-West Pacific but has not been recorded in Australian waters, is similar in general appearance to *C. hedlandensis*. However, its head profile is relatively straight from nape to snout and it has more rakers on the first gill arch (10–15 + 20–24 = 31–37 for *C. armatus* (Williams *et al.*, 1980); 6–11 + 14–17 = 20–27 for *C. hedlandensis*).

Remarks. The maximum recorded size is that of the holotype of *Olistus malabaricus* (a synonym of *C. hedlandensis*) from Malabar, India, which measures 283mm.

Williams *et al.* (1980), in a review of the *C. armatus* group, provide a thorough description of *C. hedlandensis* and discuss the species' synonymy, geographic variation and taxonomic status. These authors (Williams *et al.*, 1980: 19) draw attention to the lack of records for *C. hedlandensis* and postulate that "...many collections previously identified as *C. armatus* Forsskäl will contain specimens of both *C. armatus* Rüppell and *C. hedlandensis*".

Material held in Australian museums reflects the confusion over the identity of the two species. Various listed as *C. armatus*, *C. schlegeli* and *C. hedlandensis*, all specimens are *C. hedlandensis*. Thus, despite records of *C. armatus* Forsskäl by Alleyne & Macleay (1877), Klunzinger (1879), Günther (1880), Waite (1905), McCulloch & Whitley (1925), Weber & de Beaufort (1931), Munro (1960a) and Grant (1978) from West Australian, Northern Territory and Queensland waters, this species is

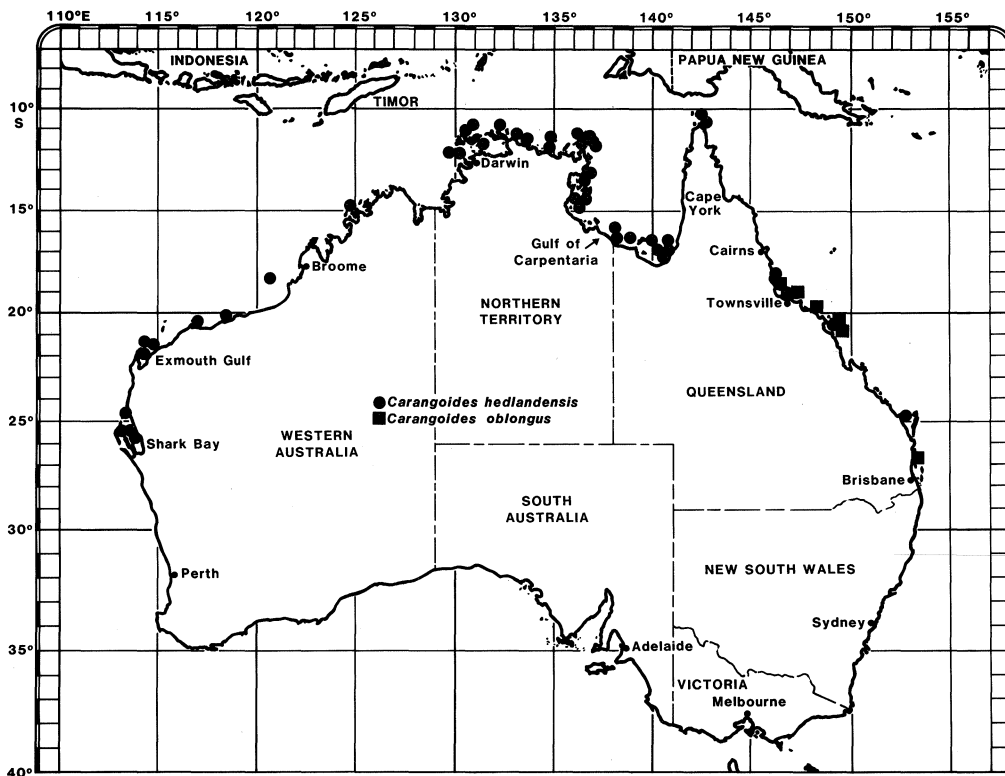


Fig.15. Australian distribution of *Carangoides hedlandensis* and *C. oblongus*.

not represented in Australian collections.

Ecological notes. In north Australian waters *C. hedlandensis* is most abundant in depths of less than 50 m. It commonly co-occurs with *C. humerosus*, *Ulua aurochs*, *Caranx bucculentus* and *Selaroides leptolepis*. Collectively these carangids are a dominant component of the shallow continental shelf fish fauna.

Limited data suggest that *C. hedlandensis* feeds on small crustaceans and demersal fish.

Distribution. General — tropical Indo-West Pacific. Australia — *Carangoides hedlandensis* occurs in tropical waters from Shark Bay in Western Australia to Bundaberg on the Queensland coast (Fig. 15).

***Carangoides humerosus* (McCulloch)**

Figs 6d, 9d, 16, Pl. 9a

Caranx humerosus McCulloch, 1915: 137, pl. 25 (type locality Bustard Head, Queensland).

Caranx humerosus.—Marshall, 1964: 224.

Carangoides humerosus.—Munro, 1960b: 17, No. 834.—Grant, 1978: 244.—Russell, 1983: 54.—Sainsbury *et al.*, 1984: 164.

Material examined. (47:94–255) — AMS E 1436 (1:148) HOLOTYPE *Caranx humerosus* McCulloch, 1915. Type locality — Bustard Head Light, Queensland. AMS E 2662 (1:149) PARATYPE *Caranx humerosus*. Type

locality — Bowen, Queensland. AMS I 11107 (1:141) PARATYPE *Caranx humerosus*. Type locality — Bustard Bay, Queensland. AMS I 13539 (5:123–212) PARATYPE *Caranx humerosus*. Type locality — 11–14 miles north 59°W of Pine Peak Island, Queensland. WESTERN AUSTRALIA: CSIRO ML CA 1058 (1:154). WAM P 8888 (1:94), P 8889 (1:132), P 8910 (1:149), P14761 (1:150), P 26578-001 (1:196). NORTHERN TERRITORY: CSIRO ML CA 1017 (1:173), CA 1018 (1:153), WAM P 14365 (1:180). GULF OF CARPENTARIA: CSIRO ML A 2289 (1:107), A 2843 (1:111), A 3208 (1:109), C 3939 (1:162), CA 3289 (1:164), CA 3385 (1:140). QUEENSLAND East Coast: CSIRO ML CA 725 (1:110). QM I 2199 (1:136), I 2359 (1:185), I 2360 (1:178), I 11620 (2: 113–117), I 11175 (1:118), I 16211 (1:126), I 17200 (1:130), I 17221 (1:115), I 17223 (1:100), I 18266 (1:194), I 18314 (1:208).

MATERIAL NOT RETAINED (9:152–175) — Gulf of Carpentaria, 15°00'S, 140°00'E, Nov. 1981. (2:249–255) — Queensland east coast, 19°30'S, 146°50'E, Oct. 1982.

Recommended common name. Dusky shoulder trevally.

Other common name. Epaulette trevally.

Diagnosis. Spinous dorsal fin black; distinct black spots between bases of soft dorsal fin rays; naked area on breast extends up to and includes pectoral base (Fig. 6d); D VIII + I, 19–21; A II + I, 16–19.

Colour notes. Body green above; silver below; adults and juveniles often with 5–6 broad, vertical, dark crossbars;

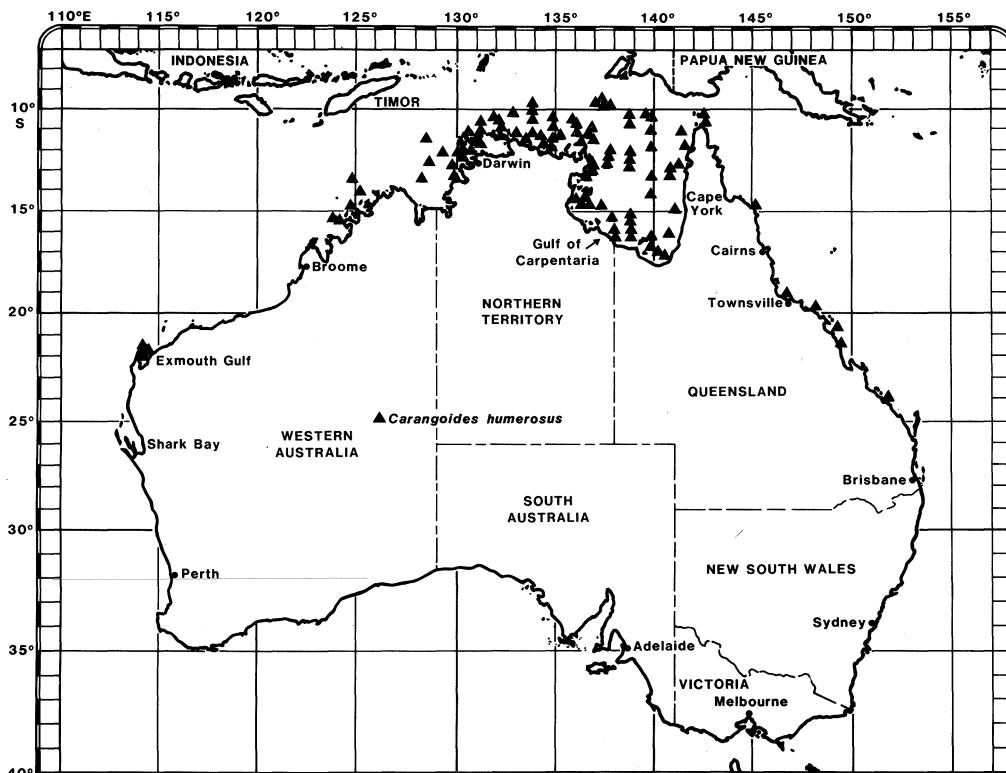


Fig. 16. Australian distribution of *Carangoides humerosus*.

large black spot usually present on shoulder; smaller spots on operculum and axil of pectoral fin. Distal portions of branchiostegals black in adult males, white in females and juveniles. Soft dorsal, soft anal and caudal fins dusky; pectoral and pelvic fins white to hyaline.

Description. Gill rakers 6–9 + 16–19 = 23–28; snout 7.2–8.8%; eye 6.8–9.1%; snout to spinous dorsal fin 35.1–38.8%; head length 25.6–29.72%; body depth 35.7–40.4%; scutes weak to moderate, 26–33.

Body oval to elongate oval, compressed; dorsal profile more convex than ventral; head profile gently sloping to moderately convex; in large males head profile with a distinct bulge, bulge absent in females and juveniles of both sexes. Soft dorsal and soft anal fins falcate, first rays of both fins produced to filaments in small juveniles (less than 100 mm LCF); pectoral fins falcate, extending almost to junction of straight and curved lateral line segments; pelvic fins short. Curved lateral line segment gently arched, equal to, or slightly longer than, straight lateral line (CLL/SLL = 1.09–1.43). Maxilla broad posteriorly, extends to below middle of eye; cleft of mouth below eye level. Villiform teeth on both jaws, vomer, palatines and on central triangular patch on tongue; in large specimens outer row of teeth on both jaws may be enlarged (Fig.9d).

Comparison with other species. A black spinous dorsal fin and distinct black spots (visible after formaldehyde and alcohol fixation and preservation) between the bases of soft dorsal fin rays distinguish *C. humerosus* from other Australian *Carangoides* species.

Carangoides oblongus is superficially similar in appearance to *C. humerosus*, both species showing development of enlarged jaw teeth at large sizes. However, the two may be separated on the basis of scute strength and numbers (scutes strong, 35–45, in *C. oblongus*; weak to moderate, 26–33, in *C. humerosus*), breast squamation (naked area extends only two thirds of the distance to pectoral base in *C. oblongus*; extends up to and includes pectoral base in *C. humerosus*), colouration (spinous dorsal dusky, black spots at bases of soft dorsal fin rays absent in *C. oblongus*; spinous dorsal black, black spots at bases of soft dorsal fin rays present in *C. humerosus*) and CLL/SLL ratio (0.79–1.00 in *C. oblongus*; 1.09–1.43 in *C. humerosus*).

Carangoides dinema, a species that occurs throughout the Indo-Pacific but not in Australian waters, has black spots between the bases of soft dorsal fin rays similar to those described for *C. humerosus*. However, *C. dinema* has a pale spinous dorsal fin and fewer dorsal fin rays (18–19 in *C. dinema*; 19–21 in *C. humerosus*) (Smith-Vaniz, 1984).

Ecological notes. *Carangoides humerosus* is most abundant at depths of less than 50 m in north Australian waters. Its diet consists of a variety of demersal or bottom associated fishes, crustaceans and cephalopods.

Distribution. General — endemic to north Australian and the Gulf of Papua waters. Australia — *Carangoides humerosus* occurs in tropical waters from Exmouth Gulf in

Western Australia to Gladstone on the Queensland east coast (Fig.16).

Carangoides malabaricus (Bloch & Schneider)

Figs 6a,10a,17,Pl.10a

Scomber malabaricus Bloch & Schneider, 1801: 31 (type locality India).

Carangoides malabaricus.—Sainsbury *et al.*, 1984: 160.

Material examined. (97:70–210) — WESTERN AUSTRALIA: CSIROML CA 2435 (1:169). WAM P 26194-004 (7:193–210). GULF OF CARPENTARIA: CSIROML B 2171 (3:76–87), B 2173 (3:80–87). QUEENSLAND East Coast: QM I 3568 (1:144), I 3781 (2:78–79), I 10662 (1:84), I 10663 (1:78), I 10710 (1:100), I 13806 (1:70), I 13809 (1:103), I 13826 (2:96–97), I 14534 (1:120), I 15719 (1:147), I 17115 (1:177).

MATERIAL NOT RETAINED (7:129–136) — Western Australia, 15°45'S, 122°46'E, July 1980. (20:133–195) — Western Australia, 13°30'S, 125°50'E, July 1980. (20:109–173) — Northern Territory, 10°30'S, 135°00'E, Nov. 1980. (20:126–187) — Gulf of Carpentaria, 15°00'S, 139°00'E, June 1981. (3:163–197) — Queensland East Coast, 19°00'S, 147°00'E, Oct. 1982.

Recommended common name. Malabar trevally.

Other common names. Hunchback trevally, white-spot trevally.

Diagnosis. Gill rakers 7–11 + 22–26 = 32–36; lower gill rakers clearly visible in open mouth; naked area on breast extends up to and above pectoral base, often reaching level of lateral line, posteriorly extends diagonally from pectoral base towards pelvic origin where it constricts to a narrow band, often extending to anal spines (Fig.6a); tongue brown to grey-brown, with narrow central villiform tooth band (Fig.10a); soft dorsal and soft anal fins only slightly falcate, if at all, even in very small juveniles (from 50mm LCF).

Colour notes. Body silver blue grey above; silvery white below; black spot on operculum. Tongue densely coloured with brown or grey brown chromatophores. Caudal, soft dorsal and soft anal fins dusky; caudal with black spot at fork; soft anal fin with white spots bordered by faint yellow margins on membranes between rays (sometimes absent on first 2 and/or last 1 or 2 interspaces). Juveniles with 5–6 vertical dark bands through body.

Description. D VIII + I, 20–23; A II + I, 17–19; snout 9.4–11.1%; eye 8.2–10.6%; snout to spinous dorsal fin 38.8–42.1%; head length 27.6–29.7%; scutes feeble, 27–37.

Body oval, strongly compressed; head profile relatively steep. Pectoral fins subfalcate, not reaching junction of straight and curved lateral line segments; pelvic fins short. Curved lateral line segment greater than, or equal in length

to, straight lateral line (CLL/SLL = 1.09–1.35). Maxilla reaches to between front edge and middle of eye. Villiform teeth on both jaws, vomer, palatines and tongue (Fig. 10a).

Comparison with other species. *Carangoides malabaricus* and *C. talamparoides* may be distinguished from other Australian *Carangoides* species on the basis of breast squamation: they are the only species in which the naked area on the breast extends above the pectoral fin base.

Carangoides malabaricus can be distinguished from *C. talamparoides* on gill raker counts (7–11 + 22–26 = 32–36 for *C. malabaricus*; 6–9 + 18–21 = 26–30 for *C. talamparoides*) and tongue pigmentation (tongue densely pigmented with brown or grey-brown chromatophores in *C. malabaricus*; tongue white or sparsely pigmented with pale grey chromatophores in *C. talamparoides*).

Remarks. The maximum recorded size for this species is 222 mm. (CSIRO unpublished data, F.R.V. *Soela* Cruise 05/83).

Williams & Venkataramani (1978) present a detailed diagnosis and description of *C. malabaricus*. They analysed material collected from throughout the Indo-West Pacific (with the exception of the Australian region) and of particular interest is an east-west gradient in gill raker counts, eastern populations (from the Gulf of Thailand) having the lowest counts. Mean total gill raker counts for north Australian *C. malabaricus* fall between those for the Gulf of Thailand and Burma/Malaysia (Table 1), thereby representing a discontinuity in the east-west gradient. If, as Williams & Venkataramani (1978) suggest, lower counts

from the Gulf of Thailand represent the primitive condition, the implication of the Australian data is that the species radiated in both westerly and south-easterly directions.

Ecological notes. *Carangoides malabaricus* is abundant throughout the continental shelf waters of northern Australia. It commonly co-occurs with *C. talamparoides*, *C. coeruleopinnatus* and *C. equula* in depths of 30 to 140 m. The species feeds on a wide range of fish, crustaceans and cephalopods.

Distribution. General — tropical Indo-West Pacific. Australia — *Carangoides malabaricus* occurs in tropical continental shelf waters from the southern extremities of the North West Shelf in Western Australia to Moreton Bay on the Queensland east coast (Fig. 17).

Carangoides oblongus (Cuvier)

Figs 7g, 10b, 15, Pl. 9b

Caranx oblongus Cuvier in Cuvier & Valenciennes, 1833: 128 (type locality New Guinea).

Caranx auriga De Vis, 1884: 539 (type locality Cairns, Queensland).

Citula gracilis Ogilby, 1915: 75, pl. 23 (type locality Darnley Island, Queensland).

Caranx aurifa.—Kent, 1893: 368 (misspelling of *Caranx auriga* De Vis).

Carangoides oblongus.—Munro, 1960a: 20, No. 832.—

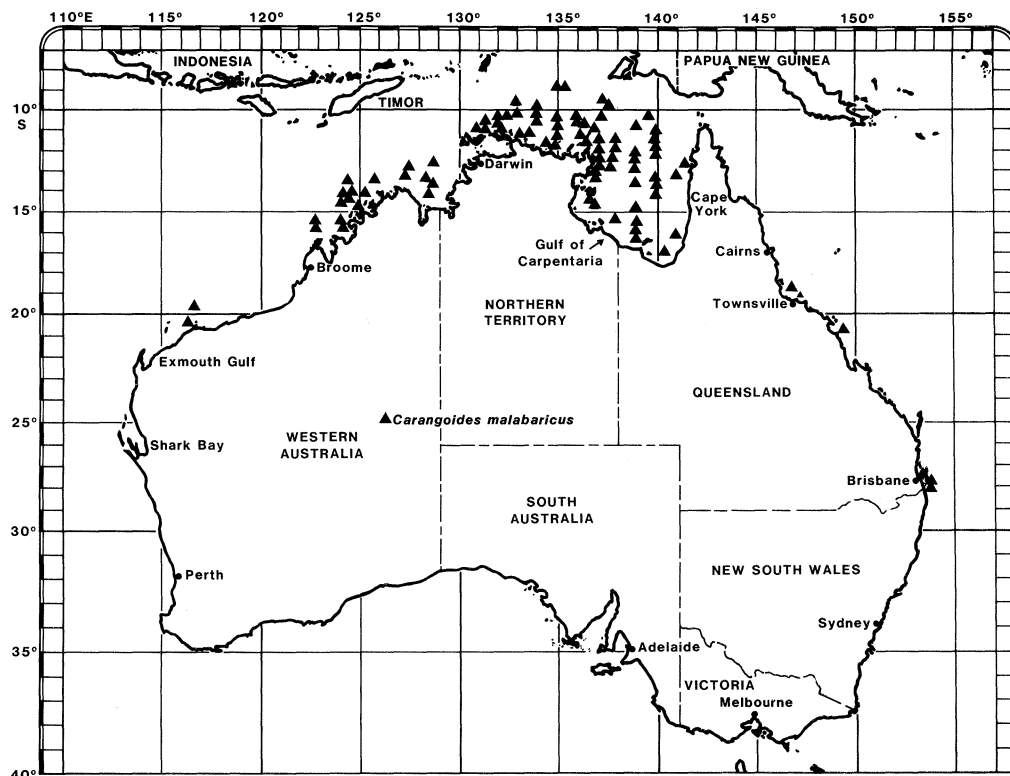


Fig. 17. Australian distribution of *Carangoides malabaricus*.

Munro, 1967: 242, No. 382.—Grant, 1978: 242, pl.93.
Caranx (Carangoides) oblongus.—Weber & de Beaufort,
 1931: 235.
Caranx oblongus.—Taylor, 1964: 224.

Material examined. (23:112–275) – QM I 2157 (1:190) HOLOTYPE *Citula auriga* De Vis, 1884. Type locality – Cairns, Queensland. QM I 1499 (1:204) HOLOTYPE *Citula gracilis* Ogilby, 1915. Type locality – Darnley Island, Queensland. QUEENSLAND East Coast: AMS IA 2070 (1:245), IA 6706 (1:225), IA 7873 (1:207SL). QM I 2158 (1:157), I 2159 (1:112), I 5660 (1:154).

PAPUA NEW GUINEA: CSIROML A 74 (1:119), A 75 (1:123), A 76 (1:120), A 81 (1:125), A 263 (1:132), A 264 (1:133), A 266 (1:127), A 267 (1:124), A 268 (1:127), C 43 (1:241), C 86 (1:243), C 153 (1:178), C 463 (1:275), C 1798 (1:169).

PHILIPPINES: AMS I 10534 (1:198).

Recommended common name. Coachwhip trevally.

Diagnosis. Scutes strong, 35–45; naked area on breast triangular, highest anteriorly where it extends two thirds of distance to pectoral base (Fig.7g); posteriorly, naked area ends in a distinct angle above pelvic origin; straight lateral line segment longer than, or equal to curved (CLL/SLL = 0.79–1.00); DVIII+I, 20–22; AII+I, 18–19; second ray of soft dorsal fin produced into a long filament which extends to or past caudal peduncle; outer row of teeth on both jaws often enlarged and conical in large adults, no canine development.

Colour notes. Body dusky olive green above; silver

to silvery yellow below. Upper caudal fin lobe and soft dorsal fin blue; soft anal yellow, filamentous anterior rays with white tips; all other fins yellow.

Description. Gill rakers 7–8 + 18–20 = 25–27; snout 7.2–8.4%; eye 6.1–7.2%; head length 25.6–28.4%; body depth 36.3–41.7%.

Body elongate oval, compressed; dorsal profile more convex than ventral; head profile shallow and smoothly convex. Soft dorsal and soft anal fins strongly falcate, both fins with well developed, scaly basal sheaths; pectoral fins long and falcate, extending beyond junction of straight and curved lateral line segments. Curved lateral line moderately arched. Maxilla extends to below middle of eye; cleft of mouth below eye level. Villiform teeth on both jaws, vomer, palatines and on central band on tongue; large specimens with some enlarged teeth among anterior villiform series on both jaws (Fig.10b).

Comparison with other species. *Carangoides oblongus* may be easily distinguished from other Australian *Carangoides* species by its 35 to 45 strong scutes. In all other species, scutes range from feeble to moderate and generally number fewer than 35.

Large adults of *C. oblongus* closely resemble *Caranx (sensu stricto)* species with respect to development of conical jaw teeth and strong scutes on the posterior, straight segment of the lateral line. However, in contrast to the single row of dentary teeth characteristic of *Caranx* species, the lower jaw dentition of *C. oblongus* comprises an outer row of enlarged conical teeth bordered by an inner band of small villiform teeth.

Remarks. The maximum recorded size for this species

Table 1. Comparison of total gill raker counts for north Australian populations of *Carangoides malabaricus* and *C. talamparoides* with those of Williams & Venkataramani (1978) for other areas of the Indo-Pacific.

	Williams & Venkataramani (1978) data					Data from this study
	Gulf of Thailand	Burma/Malaysia	South India/Sri Lanka	Arabian Sea	East Africa	Northern Australia
<i>C. malabaricus</i>						
Number of specimens examined	6	20	93	122	26	58
Range	32-34	32-37	33-37	32-38	33-37	32-36
Mean	33.17	34.25	34.61	35.23	35.28	33.50
Standard deviation	0.75	1.52	0.93	1.13	1.13	1.14
<i>C. talamparoides</i>						
Number of specimens examined	27	-	22	15	-	56
Range	27-30	-	27-30	28-31	-	26-30
Mean	28.07	-	28.45	29.07	-	27.4
Standard deviation	0.83	-	0.74	0.80	-	1.04

is 350 mm (Munro, 1960a).

Distribution. General — tropical Indo-West Pacific. Australia — *Carangoides oblongus* is comparatively rare in Australian waters. It has been collected from Noosa to just north of Townsville on the Queensland east coast (Fig.15) and is known to occur in inshore waters off Arnhem Land in the Northern Territory (Taylor, 1964). Its widespread distribution in the Indian Ocean suggests that the species may also occur along the Western Australian coastline, although the absence of large estuaries, apparently a preferred habitat of *C. oblongus*, on the Western Australian coast between Exmouth and Derby may partly account for the lack of records from this area.

Carangoides orthogrammus (Jordan & Gilbert)

Figs 7e, 10c, 13, Pl. 6a

Caranx orthogrammus Jordan & Gilbert, 1881: 226 (type locality Revillagigedo Island, Mexico).

Carangoides fulvoguttatus (non Forsskål).—Coleman, 1981: 104.

Material examined. (14:202–667) — WESTERN AUSTRALIA: WAM P 1944 (1:253), P 24539 (1:667), P 25916-002 (1:486), P 27148-001 (1:545). QUEENSLAND East Coast: QM I 15376 (1:273). NEW SOUTH WALES: AMS I 5251 (1:207), I 16731-001 (1:244), I 17134-001 (1:225), IB 2920 (1:202), IB 3230 (1:207). CSIRO ML CA 2478 (1:360).

LORD HOWE ISLAND: AMS I 4120 (1:292), I 12859 (1:360).

NORFOLK ISLAND: AMS I 10752 (1:413).

Recommended common name. Island trevally.

Other common name. Yellowspot trevally, thicklip trevally.

Diagnosis. Naked area on breast small (Fig.7e), extends less than one third of distance to pectoral fin base; in life, 2–7 relatively large, elliptical yellow spots with brown borders on sides of body; lips thick and papillose, especially in large adults; snout 8.4–9.9%; eye 5.1–6.3%; upper jaw length to snout ratio 1.1–1.2; snout to eye ratio 1.44–1.87; curved lateral line segment only slightly arched, equal to or greater than straight (CLL/SLL = 1.01–1.46).

Colour notes. Colour patterns in *C. orthogrammus* change drastically after death.

In life — body pale green above; silvery below; 2–7 brown, yellow-bordered spots scattered along body close to midline; with or without 9–10 dark vertical crossbars through body from head to caudal peduncle. Soft dorsal, soft anal and caudal fins (in particular lower lobe) brilliant blue; other fins pale green to hyaline.

Immediately post mortem — body darkens considerably

to become dusky green to greenish grey above; silver to silvery green or grey below; vertical crossbars through body become less conspicuous as they fade; yellowish brown spots still conspicuous but often darker. Soft dorsal, soft anal and caudal fins progress through dark bluish green to dark green.

More than 1 hour post mortem — body dark greyish green above; silvery green to dusky grey green below; vertical crossbars inconspicuous; spots on sides of body range from yellowish brown to dark brown. Soft dorsal, soft anal and caudal fins dark green, leading edge of soft anal and lower caudal lobe may be white.

Description. D VIII + I, 29–33; A II + I, 23–27; gill rakers 9–10 + 21–22 = 30–31; snout to spinous dorsal fin 37.5–37.7%; head 26.0–27.4%; body depth 35.7–39.6%; upper jaw length 10.1–11.5%; height of soft dorsal fin lobe 24.4–29.1%; height of soft anal fin lobe 23.0–24.4%; scutes weak, 21–30.

Body elongate oval, compressed; head profile only gently sloping; snout blunt; eye low set, at level of tip of snout. Spinous dorsal fin low; soft dorsal and soft anal fins falcate; pectoral fins falcate, long, reaching to beyond junction of curved and straight lateral line segments. Maxilla extends to below front edge to front third of eye. Villiform teeth in bands on both jaws, in large specimens slightly enlarged with conical teeth sometimes present on central anterior portions of both jaws; villiform teeth also on vomer, palatines and on central band on tongue (Fig.10c).

Comparison with other species. *Carangoides orthogrammus* may be easily differentiated from all other Australian *Carangoides* species, except *Carangoides ferdau*, on the basis of breast squamation and lateral line characteristics.

See *C. ferdau* for a comparison with *C. orthogrammus*.

Remarks. A systematic revision of *Carangoides orthogrammus* and *C. ferdau* (Smith-Vaniz & Poss, personal communication) has clarified the synonymies and diagnostic characters of these species. The only Australian record of *C. orthogrammus* prior to this study was a misidentified photograph of Coleman (1981). However, it is more than likely that other specimens of *C. orthogrammus* have been confused with *C. ferdau* and assigned to *C. laticaudis*, a junior synonym of the latter.

Distribution. General — tropical and sub-tropical Indo-West, Central and East Pacific. Australia — *Carangoides orthogrammus* is largely restricted to reef systems in sub-tropical waters on both the Western Australian and New South Wales coasts. The species has been recorded from Coral Bay to the Dampier Archipelago on the west coast, with several unconfirmed reports of specimens from Rottnest Island off Perth. On the east coast, the species is common on reef systems of the Solitary Islands and has been recorded as far south as Sydney (Fig.13).

Carangoides plagiotaenia Bleeker

Figs 6f, 10e, Pl. 7b

Carangoides plagiotaenia Bleeker, 1857: 59 (type locality Ambon).**Material examined** (1:374). QUEENSLAND: QM I 19471 (1:374).**Recommended common name.** Barcheek trevally.**Diagnosis.** Breast fully scaled (Fig. 6f); posterior edge of preoperculum black; lower jaw projects beyond upper jaw; vomer triangular, without medial posterior projection.**Colour notes.** Only one preserved specimen of *C. plagiotaenia* is held in Australian museum collections. In alcohol, the posterior margin of the preoperculum of this specimen is distinctly black, the body is dark green above and silver below and the soft dorsal, soft anal and caudal fins are dusky. The roof and floor of the mouth and the tongue are darkly pigmented.Photographs of the species in Fourmanoir & Laboute (1976, as *C. fulvoguttatus*), Kyushin *et al.* (1977, as *C. compressus*) and Masuda *et al.* (1975, as *C. compressus*) show a variety of general body and fin colour patterns. However, in each case the preopercular margin is black. The body ranges from silvery green to dark green above and silver to silvery green below. The soft dorsal, soft anal and caudal fins are dusky green in all cases. The live specimen photographed by Fourmanoir & Laboute (1976) has white distal margins on its anal fin rays. This colouration is not present in the other two photographs. Kyushin *et al.* (1977) note that the oral cavity and branchiostegal membrane are dark and that there are five dark bands on the body. However, the latter character is not obvious on the 298 mm specimen photographed and is probably a juvenile colour pattern, the bands fading with age.**Description.** D VIII + I, 22; A II + I, 19; gill rakers 8 + 19; snout 8.2%; eye 7.0%; upper jaw length 10.1%; head length 26.4%; snout to spinous dorsal fin; pectoral fin 36.4%; scutes feeble, 16.

Body elongate oval, compressed; dorsal and ventral profiles equally convex; head profile straight from snout to above eye; crest of head with very sharp edge. Soft dorsal and soft anal fins low, only slightly falcate; pectoral fins long and strongly falcate, not reaching junction of straight and curved lateral line segments. Curved lateral line moderately arched, longer than straight (CLL/SLL = 1.69). Maxilla reaches to below front margin of eye. Villiform teeth in series on both jaws, vomer, palatines and on central band on tongue (Fig. 10e).

Comparison with other species. *Carangoides plagiotaenia* and *C. equula* are the only Australian *Carangoides* species with completely scaled breasts. An outline of the characters that distinguish the two species isprovided in the description of *C. equula*.**Remarks.** *Carangoides plagiotaenia* is a new record for Australian waters.**Distribution.** General — Indo-west and Central Pacific. Australia — one specimen of *C. plagiotaenia* from Lizard Island, Queensland (14°42'S, 145°28'E) and a photograph of another from the same locality constitute the only records of the species from Australian waters. Numerous underwater observations of *C. plagiotaenia* by the author on both inshore and outer barrier reefs close to Lizard Island suggest the species may be common in the infrequently sampled waters of the far northern Great Barrier Reef.*Carangoides talamparoides* Bleeker

Figs 6b, 10d, 13, Pl. 10b

Carangoides talamparoides Bleeker, 1852: 91 (type locality Sumatra).*Carangoides talamparoides*.—Sainsbury *et al.*, 1984: 162.**Material examined.** (56:101–258) — WESTERN AUSTRALIA: ANSP 147704 (4:170–258). CSIRO ML CA 2470 (1:256). WAM P 25396-017 (2:149–151). QUEENSLAND East Coast: AMS I 20826-035 (1:205). QM I 6890 (1:249), I 15607 (1:204), I 17229 (4:129–163), I 2361 (1:124), I 2362 (1:144). WAM P 259 (2:161–166).

MATERIAL NOT RETAINED (34:101–144) — Western Australia, 14°00'S, 125°30'E, July 1980. (4:164–213) — Northern Territory, 11°10'S, 135°00'E, July 1981.

Recommended common name. Imposter trevally.**Diagnosis.** Gill rakers 6–9 + 18–21 = 26–30; lower gill rakers barely visible in open mouth; naked area on breast extends up to and above pectoral base, often reaching level of lateral line, posteriorly extends diagonally from pectoral base towards pelvic origin at which point further posterior extension may be in the form of a thin continuous band, a separate naked patch or alternatively may be absent (Fig. 6b); tongue usually white, occasionally with sparse, small grey chromatophores; central tooth band on tongue narrow (Fig. 10d); soft dorsal and soft anal fins strongly falcate throughout life, first and occasionally second ray of both fins filamentous in small juveniles.**Colour notes.** Body silver blue grey above; silver white below; black spot on operculum. Soft dorsal and soft anal fins dusky; central caudal rays dusky yellow with black distal margin. Juveniles with 5–6 vertical dark bands through body.**Description.** D VIII + I, 20–23; A II + I, 17–19; snout 10.7–12.6%; eye 8.7–10.7%; snout to spinous dorsal fin 39.5–45.0%; head length 30.1–32.4%; scutes feeble, 21–32.

Body oval, strongly compressed; head profile relatively steep. Pectoral fins subfalcate; pelvic fins short. Curved lateral line segment longer than straight (CLL/SLL = 1.15–1.47). Maxilla extends to below front to middle of eye. Villiform teeth on both jaws, vomer, palatines and on central band on tongue (Fig.10d).

Comparison with other species. *Carangoides talamparoides* and *C. malabaricus* may be distinguished from other north Australian *Carangoides* species on the basis of breast squamation: they are the only species in which the naked area on the breast extends above the pectoral fin base.

An outline of the characters that distinguish *C. talamparoides* from *C. malabaricus* is given in the description of the latter.

Remarks. Williams & Venkataramani (1978) present a detailed diagnosis and description of *C. talamparoides* and discuss and resolve the problems encountered by earlier workers (e.g. Munro, 1960a; Smith, 1967) in the separation of species within the "*C. malabaricus* group".

As for *C. malabaricus*, Williams & Venkataramani (1978) report an east-west gradient in gill raker counts for *C. talamparoides* in the Indo-Pacific (no Australian material was included in their analyses). Counts from eastern populations from the Gulf of Thailand and Southern India/Sri Lanka were significantly lower than those from the Arabian Sea. Mean total gill raker counts from north Australian *C. talamparoides* (Table 1) are lower than those from the Gulf of Thailand and as such, represent a continuation of the observed east-west gradient.

Ecological notes. *Carangoides talamparoides* is abundant throughout the continental shelf waters of northern Australia. It commonly co-occurs with *C. malabaricus* and *C. coeruleopinnatus* in depths of 30 to 140 m. The species feeds on a wide range of fish, crustaceans and cephalopods.

Distribution. General — tropical Indo-West Pacific. Australia — *Carangoides talamparoides* is common in tropical continental shelf waters from the North West Shelf to the central east coast of Queensland (Fig.13). The species is most abundant in the Gulf of Carpentaria and Arafura Sea.

"*Caranx*" (*non Caranx* Lacepède)

"*Caranx*" *kleinii* (Bloch)

Fig.4, Pl.2b

Scomber kleinii Bloch, 1793: 86–87, pl.347, fig.2 (type locality Malabar Coast, India).

Micropteryx queenslandiae De Vis, 1884: 541 (type locality Queensland coast).

Alepes kalla (*non* Cuvier).—Ogilby, 1915: 62, pl.20.—Munro, 1960a: 17, No. 816.—Munro, 1967: 228, No.

373.—Grant, 1978: 247.

Caranx kalla (*non* Cuvier).—McCulloch, 1915: 139.—Marshall, 1964: 222, No. 234.

Caranx (*Selar*) *kalla* (*non* Cuvier).—Weber & de Beaufort, 1931: 216, fig.44.

"*Caranx*" *para*.—Sainsbury *et al.*, 1984: 170.

Material examined. (64:46–153) — NORTHERN TERRITORY: CSIROML B 2152 (9:133–148), CA 1076 (1:125), CA 2469 (1:133). GULF OF CARPENTARIA: CSIROML A 2456 (1:130), B 2158 (15:136–139). QUEENSLAND East Coast: AMS I 20826-032 (1:124), I 20907-030 (9:116–132). CSIROML A 1204/05/06 (3:46–77), A 1228 (1:85), A 1229 (1:57). QM I 2087 (1:115), I 2233 (1:150), I 2355/56/57/58 (4:150–153), I 7558 (1:76), I 10536 (1:77–91), I 15718 (1:124), I 15746 (1:112–125). WAM P 262 (4:129–148).

MATERIAL NOT RETAINED (4:126–143) — Northern Territory, 10°50'S, 132°00'E, Nov. 1980. (4:133–147) — Gulf of Carpentaria, 15°10'S, 140°00'E, July 1981.

Recommended common name. Razorbelly trevally.

Other common names. Sharp-bellied scad, herring trevally, banded scad.

Diagnosis. Premaxillary dentition pluriserial posteriorly, dentary dentition triserial posteriorly; ventral profile significantly more convex than dorsal; scutes strong, 36–43; maximum scute height 16.2–20.0% body depth; upper caudal fin lobe longer than lower; anterior adipose eyelid not well developed.

Colour notes. Body grey green to blue grey above; silver below; distinct black spot on upper operculum. Dorsal, anal, pectoral and pelvic fins white to hyaline; soft dorsal occasionally pale yellow green; upper caudal fin lobe dusky yellow to green with dark fringe. Tongue black.

Description. D VIII + I, 21–26; A II + I, 19–22; gill rakers 11 + 27–30 = 38–41; snout 5.7–7.0%; eye 7.2–8.7%; head length 22.8–26.4%; body depth 36.9–40.4%. Body oval to elongate oval, strongly compressed; snout pointed; ventral profile strongly convex; ventral margin compressed to sharp edge between pelvic and anal fins. Dorsal and anal fins low, not falcate; soft dorsal and soft anal fins with scaly basal sheaths; pectoral fins subfalcate, extending to junction of straight and curved lateral line segments. Curved lateral line segment moderately arched, shorter than straight (CLL/SLL=0.51–0.62). Maxilla extends to below middle of eye; posterior adipose eyelid well developed, reaching almost to centre of pupil. Jaw teeth fine; villiform teeth on vomer, palatines and on central band on tongue.

Comparison with other species. General body shape, jaw dentition and scute size are characters by which "*Caranx*" *kleinii* can be distinguished from other north Australian carangids.

Remarks. The maximum recorded size for this species is 200mm (Munro, 1960a).

Smith-Vaniz *et al.* (1979) outlined the specific nomenclature of “*Caranx*” para, a junior synonym of “*Caranx*” *kleinii* (Bloch, 1793) and resolved previous confusion over the identity of *Alepes kalla* of Ogilby (1915) and *Caranx (Selar) kalla* of Weber & de Beaufort (1931). Subsequent work by Smith-Vaniz (personal communication Mar. 1987), in which he comments that Bloch’s (1793) “...drawing of the species in unmistakable, as is the first sentence of the description...‘this fish is characterized by the oblique direction of its mouth and by the lateral line, half of which is equipped with scutes’”, has further resolved the synonymy of “*Caranx*” *kleinii*.

While there remains no adequate generic category for “*Caranx*” *kleinii*, the species’ unique jaw dentition suggests it would be best placed in a monotypic genus.

Ecological notes. “*Caranx*” *kleinii* is largely restricted to depths of less than 60 m in north Australian waters. Limited information on diet suggests the species takes predominantly small, epibenthic crustacean prey.

Distribution. General — tropical Indo-West Pacific. Australia — the species has a continuous distribution from North West Cape in Western Australia to Brisbane on the Queensland east coast (Fig.4) but is most abundant in the Timor and Arafura Seas and Great Barrier Reef Lagoon.

Elagatis Bennett

Elagatis Bennett, 1840: 283 (type species *Elagatis bipinnulata* Bennett, 1840 [= *Seriola bipinnulata* Quoy & Gaimard, 1825] by monotypy).

Elagatis bipinnulata (Quoy & Gaimard)

Fig. 18, Pl. 11a

Seriola bipinnulata Quoy & Gaimard, 1825: 363, pl. 61, fig. 3 (type locality Keeling Island).

Elagatis bipinnulatus.—Weber & de Beaufort, 1931: 293, fig. 58.—Munro, 1958: 19, No. 806.—Marshall, 1964: 231, No. 241.—Munro, 1967: 234, No. 394.—Grant, 1978: 249.

Elagatis bipinnulata.—Russell, 1983: 55.—Sainsbury *et al.*, 1984: 172.

Material examined. (6:307–800) — WESTERN AUSTRALIA: WAM P 23292 (1:800). GULF OF CARPENTARIA: CSIRO ML CA 2472 (1:307). NEW SOUTH WALES: AMS I 15274, IA 7340, IB 7276, IB 7394.

Recommended common name. Rainbow runner.

Diagnosis. No scutes on lateral line; soft dorsal and soft anal fins with 1 detached finlet posteriorly, each finlet with 2 rays; pectoral fin short, not falcate; soft dorsal fin base much longer than that of soft anal.

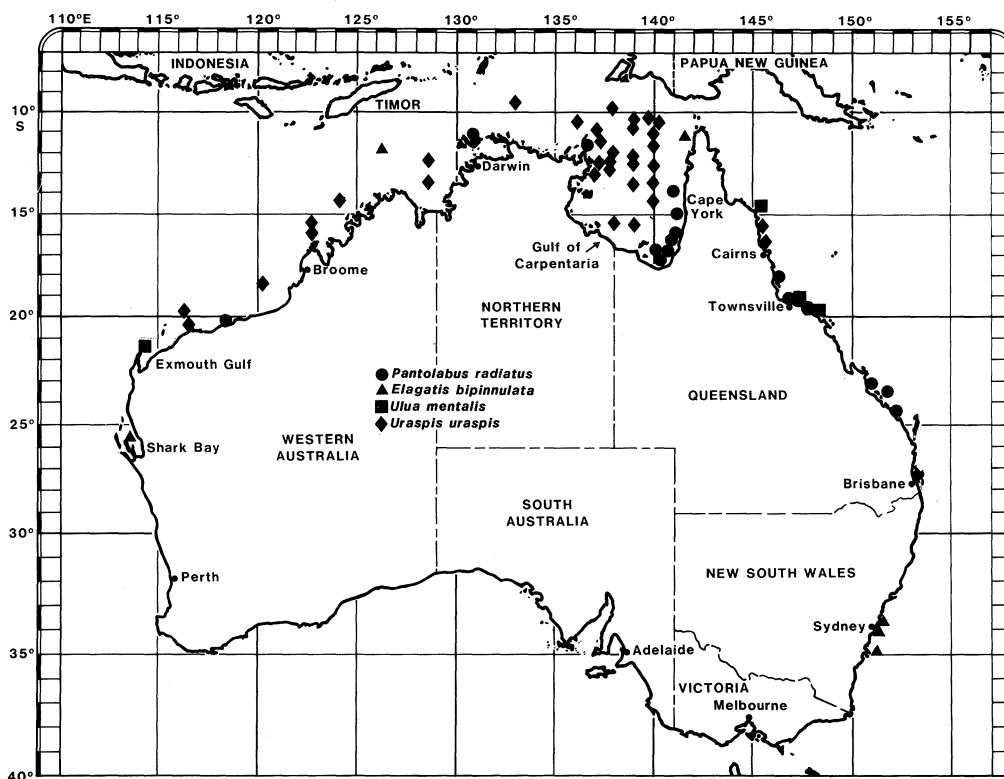


Fig. 18. Australian distribution of *Elagatis bipinnulata*, *Pantolabus radiatus*, *Ulua mentalis* and *Uraspis uraspis*.

Colour notes. Body blue to blue green above, silvery white below; broad yellow band bordered by 2 narrow blue bands runs from eye to caudal peduncle (bands fade quickly and eventually disappear after death). Fins yellow to dusky green.

Description. DV-VI+I, 23-24+2; AII-0+I, 16-17+2; gillrakers 10-11+26=36-37; snout 8.6-8.7%; eye 5.6-5.8%; body depth 21.8-22.4%; pectoral fin 12.3-12.6%; soft dorsal fin base 41.0-41.8%; soft anal fin base 26.8-27.4%.

Body elongate, subcylindrical, slightly compressed; head pointed, with long snout and small eye. Dorsal and anal fins low, not falcate; soft dorsal and soft anal fins with scaly basal sheaths; caudal fin deeply forked. Curved lateral line gently arched, shorter than straight (CLL/SLL = 0.90-0.96). Maxilla with supplemental bone (largely hidden by preorbital); maxilla does not extend to anterior margin of eye; adipose eyelids weakly developed. Villiform teeth on both jaws (in bands), vomer, palatines and on central band on tongue.

Comparison with other species. *Elagatis bipinnulata* may be distinguished from the superficially similar *Seriola*, *Seriolina* and *Naucrates* species by the presence of finlets behind the soft dorsal and soft anal fins. Finlets are present in *Megalaspis cordyla* and species of the genus *Decapterus*. However, these species have scutes on the posterior segment of the lateral line.

Remarks. Munro (1958) and Grant (1978) reported lengths of up to 4 ft (1200 mm) for *E. bipinnulata* in Australian

waters.

Ecological notes. *Elagatis bipinnulata* inhabits rock and coral reef systems throughout northern Australia. The species often forms large schools on offshore reefs and feeds on a wide range of fish and cephalopod prey.

Distribution. General — Circumtropical. Australia — *Elagatis bipinnulata* is relatively uncommon in Australian waters. The few records available suggest a wide distribution from Shark Bay in Western Australia through sub-tropical and tropical western and northern waters (Fig.18). The species has been reported from the Queensland east coast (Marshall, 1964) and is known to occur as far south as Sydney in New South Wales.

Gnathanodon Bleeker

Gnathanodon Bleeker, 1851: 343,352 (type species *Scomber speciosus* Forsskäl, 1775, by monotypy).

Gnathanodon speciosus (Forsskäl)

Fig.19, Pl.12a-b

Scomber speciosus Forsskäl, 1775: 54 (type locality Red Sea).

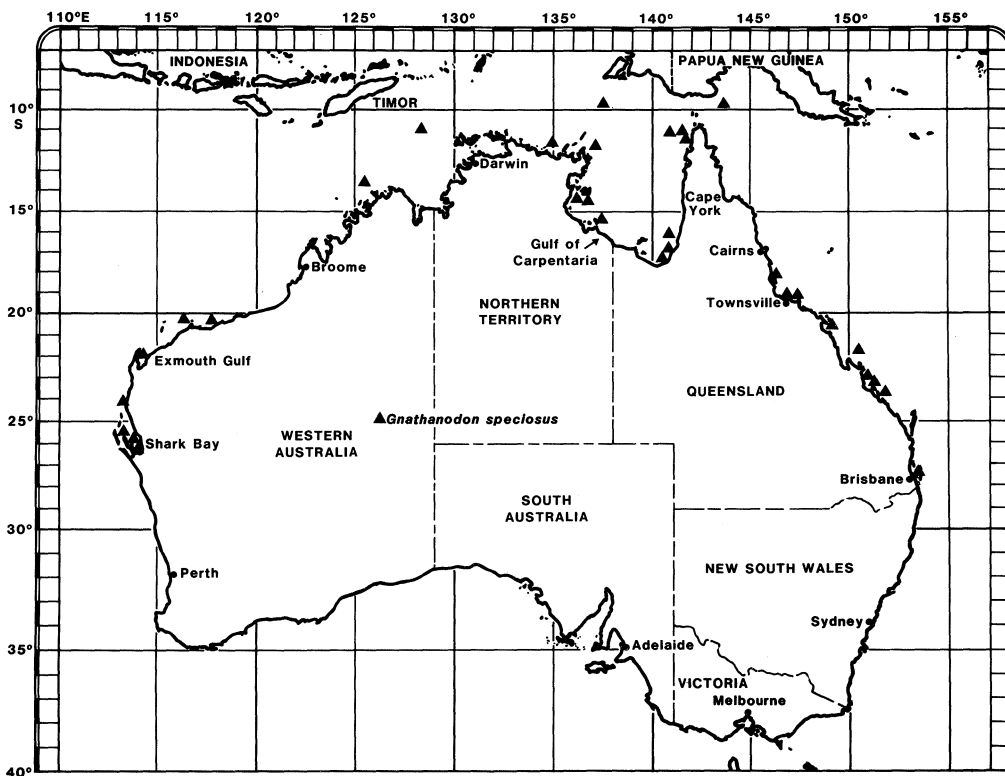


Fig.19. Australian distribution of *Gnathanodon speciosus*.

- Caranx pooloosoo* Richardson, 1848: 136 (type locality Australia) (referred to as *Caranx speciosus* in the text).
Caranx edentulus Alleyne & Macleay, 1877: 327, pl.11, fig.2 (type locality Percy Island, Queensland).
Caranx obtusiceps Macleay, 1882: 357 (type locality New Guinea).
Caranx cives De Vis, 1884: 540 (type locality North Queensland).
Caranx speciosus.—Klunzinger, 1879: 377.—Macleay, 1881: 535.—Ogilby, 1915: 67, pl. 21.—Marshall, 1964: 223, No. 236.—Taylor, 1964: 179.
Caranx cives.—Kent, 1893: 369.
Caranx edentulus.—Macleay, 1881: 534.
Caranx (Gnathanodon) speciosus.—Weber & de Beaufort, 1931: 265, fig.50.
Gnathanodon speciosus.—Munro, 1960b: 18, No. 841.—Munro, 1967:226, No. 367.—Grant, 1978: 226, pl.85.—Russell, 1983: 55.—Sainsbury *et al.*, 1984: 174.

Material examined. (45:60–316) – AMS I 16297-001 (4:231–298) HOLOTYPE *Caranx edentulus* Alleyne & Macleay, 1877. Type locality – Percy Island, Queensland. AMS I 16301-001 (9:303–316) SYNTYPES *Caranx obtusiceps* Macleay, 1882. Type locality – Papua New Guinea. WESTERN AUSTRALIA: CSIROML A 1280 (1:98), A 1327 (1:99), C 2673 (1:133), WAM P 2416 (1:295), P 4268 (2:118–120), P 4534 (1:110), P 8911 (1:120), P 14579 (1:75), P 14687 (1:110), P 23773 (1:114), P 24348 (1:292). GULF OF CARPENTARIA: CSIROML B 2163 (5:158–176), C 3980 (1:216), C 4475 (1:203), CA 706 (1:358). WAM P 10821 (1:79), P 12797 (1:60). QUEENSLAND East Coast: QM I 1097 (1:270), I 1475 (1:219), I 1476 (1:213), I 3711 (1:220), I 3712 (1:176), I 3713 (1:255), I 7118 (1:253), I 9402 (1:263), I 11533 (1:297).

Recommended common name. Golden trevally.

Other common name. Banded trevally.

Diagnosis. Specimens greater than 90 mm without teeth on jaws, vomer or palatines; tongue with minute denticles; lips papillose, particularly in large adults; eye small (5.2–7.3% LCF); body colouration golden, with or without dark, vertical cross bars.

Colour notes. In juveniles, body golden with 7–11 black, vertical crossbars over length of body. All fins yellow; caudal fin lobes with black tips. Upper operculum with black posterior edge. In adults, dark crossbars on body fade with age, being replaced by dark blotches in large specimens. Body yellowish green above, pale yellow below. Spinous dorsal fin yellow; soft dorsal and soft anal fins with falcate lobes and tips of remaining rays yellow, inner margins of these rays pale green; caudal fin dusky. Dark posterior edge of upper operculum fades with age.

Description. D VIII + I, 19–21; A II + I, 16–17; gill rakers 7–8 + 19–20 = 27–28; snout 8.9–11.7%; head length 28.6–30.9%, body depth 33.5–38.5%; scutes feeble, 14–25.

Body elongate oval, compressed. Spinous dorsal fin

low; soft dorsal and soft anal fins low, slightly falcate; pectoral fin long, falcate, extending to or slightly beyond junction of straight and curved lateral line segments. Curved lateral line moderately arched, approximately equal in length to straight (CLL/SLL = 0.8–1.4). Maxilla extends to below anterior third of eye. In small juveniles (less than 90 mm), villiform teeth in series on upper and lower jaws; larger specimens without teeth.

Comparison with other species. *Gnathanodon speciosus* may be distinguished from other carangid species on the basis of its dentition, colouration, and papillose lip development.

Remarks. *Gnathanodon speciosus* attains lengths of up to 40 inches (1000 mm) (Munro, 1960b; Grant, 1978) in Australian waters.

Ecological notes. *Gnathanodon speciosus* is abundant on the Great Barrier Reef and the North West Shelf. The species is less common in the soft bottom, turbid water habitats of the Timor and Arafura Seas and Gulf of Carpentaria. In these regions it is usually found around rock and coral reef systems. The species apparently feeds close to the bottom on small crustaceans and micromolluscs.

Distribution. General — tropical Indo-West, Central and East Pacific. Australia — *Gnathanodon speciosus* occurs in inshore, reef and continental shelf habitats from Shark Bay in Western Australia to Brisbane on the Queensland east coast (Fig.19).

Megalaspis Bleeker

Megalaspis Bleeker, 1851: 343,352 (type species *Scomber rotleri* Bloch, 1793 [= *Scomber cordyla* Linnaeus, 1758] by monotypy).

Megalaspis cordyla (Linnaeus)

Fig.20, Pl.3b

Scomber cordyla Linnaeus 1758: 298 (type locality unknown).

Megalaspis cordyla.—McCulloch, 1915: 139.—Weber & de Beaufort, 1931: 193, fig.40.—Munro, 1958: 20, No. 809.—Munro, 1967: 225, No. 362.—Grant, 1978: 219.—Sainsbury *et al.*, 1984: 174.

Material examined. (37:106–488) – WESTERN AUSTRALIA: CSIROML B 2157 (10:168–174), B 2170 (7:170–182). WAM P 3407 (1:447), P 4013 (1:238), P 5276 (1:165), P 8614/15 (2:180–199), P 15930/31 (2:190–195), P16321/22/23 (3:191–230), P 25919-001 (1:488), P 27228-003 (1:295). QUEENSLAND East Coast: QM I 3052 (1:245), I 7196 (1:243), I 7664 (1:235),

I 11509 (1:318), I 13475 (1:126), I 15935 (1:106).
NEW SOUTH WALES: AMS I 14779 (1:358), I 21126-001
(1:342).

Recommended common name. Torpedo scad.

Other common names. Finletted mackerel scad, hardtail scad.

Diagnosis. 6–9 finlets behind soft dorsal and anal fins; 54–65 strong scutes (maximum scute height 36.1–46.0% body depth); D VIII+I, 9–11+7–9; A II+I, 8–10+6–8; anterior and posterior adipose eyelids well developed; curved lateral line short, strongly arched (CLL/SLL=0.17–0.26).

Colour notes. Body bluish grey above; silver to silvery white below; conspicuous black spot on upper operculum. All fins pale to dusky grey, occasionally with yellowish tinge; caudal fin lobes often with dark tips.

Description. Snout 5.4–5.9%; eye 5.8–6.3%; head length 23.5–24.7%; body depth 24.0–26.8%.

Body torpedo-shaped, elongate, subcylindrical; snout pointed; dorsal and ventral profiles equally convex. Breast naked, naked area extending to between one third and one half distance to pectoral base. Dorsal and anal fins low; soft dorsal and soft anal with subfalcate anterior lobes; pectoral fins falcate, extending to well beyond junction of straight and curved lateral line segments and to beyond

origin of soft anal fin. Maxilla extends to below middle of eye. Pluriseriate villiform teeth on upper jaw, vomer, palatines and tongue; outer teeth on upper jaw may be slightly enlarged; small pointed teeth uniseriate on lower jaw.

Comparison with other species. *Megalaspis cordyla* differs from all other carangid species in having 6–9 finlets behind its soft dorsal and soft anal fins. *Elagatis bipinnulata* and *Decapterus* species have one finlet behind each fin; in other genera finlets are absent.

Ecological notes. Fish (in particular leiognathids) and cephalopods are the major prey of *M. cordyla*.

Distribution. General — tropical Indo-West Pacific. Australia — *Megalaspis cordyla* occurs in inshore and continental shelf waters from Geraldton in Western Australia to Sydney on the southern New South Wales coast (Fig.20). The species is most abundant in tropical shelf waters from Exmouth Gulf to Brisbane.

Pantolabus Whitley

Pantolabus Whitley, 1931: 108 (type species *Caranx parasitus* Garman, 1903 [= *Caranx radiatus* Macleay, 1881] by original designation).

Absalom Whitley, 1937: 132 (type species *Caranx radiatus* Macleay, 1881 by monotypy and original designation).

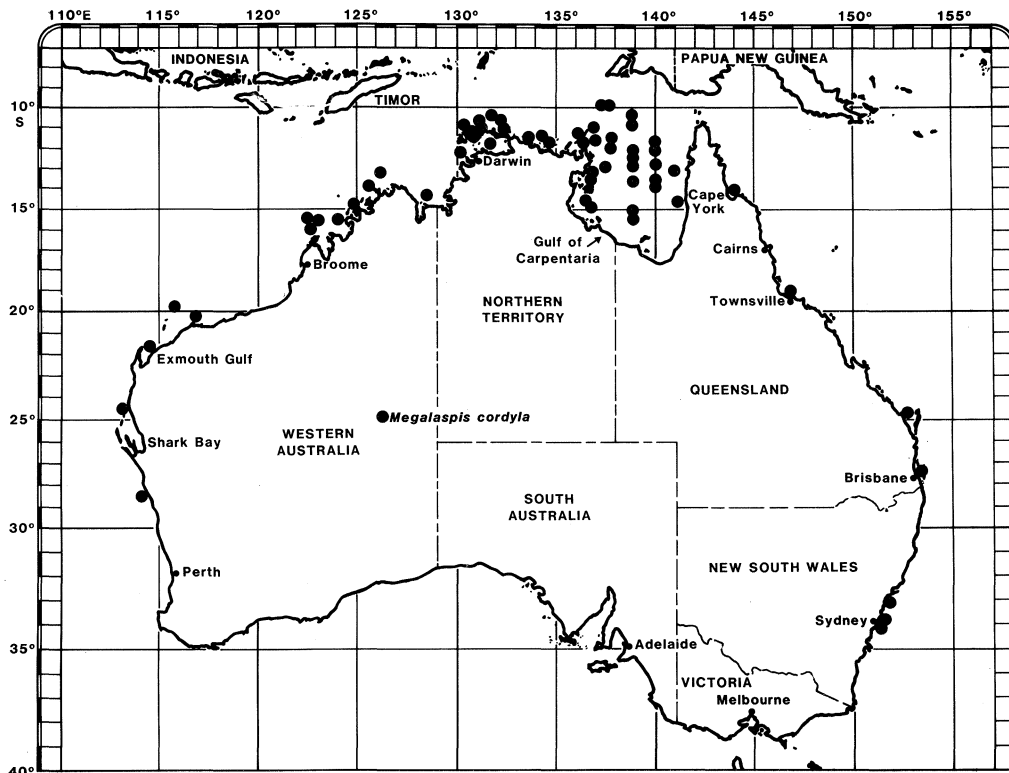


Fig.20. Australian distribution of *Megalaspis cordyla*.

***Pantolabus radiatus* (Macleay)**

Fig.18, Pl.13a-b

Caranx radiatus Macleay, 1881: 537 (type locality Rockingham Bay, Queensland).

Caranx compressus Macleay, 1884: 204 (type locality Burdekin River, Queensland).

Caranx parasitus Garman, 1903: 232 (type locality Cairns, Queensland).

Caranx radiatus.—Kent, 1893: 368, pl.16, fig.1.—McCulloch, 1915: 132, pl.23.—Marshall, 1964: 223, No. 235.—Taylor, 1964: 180.—Russell, 1983: 54.

Pantolabus parasitus.—Whitley, 1931: 108, pl.22, fig.1.

Absalom radiatus.—Whitley, 1937: 132.—Munro, 1960b: 18, No. 839.—Grant, 1978: 246.—Sainsbury *et al.*, 1984: 156.

Material examined. (29:56–244) – AMS I 16299-001 (1:214) HOLOTYPE *Caranx radiatus* Macleay, 1881. Type locality – Rockingham Bay, Queensland. AMS A 18279/80 (2:225) SYNTYPES *Caranx compressus* Macleay, 1884. Type locality – Burdekin River, Queensland. WESTERN AUSTRALIA: CSIRO ML CA 1062 (1:143). GULF OF CARPENTARIA: CSIRO ML C 3596 (1:145), C 3648 (1:189), C 3649 (1:163), C 4019 (1:188), C 4020 (1:169), C 4028 (1:182), C 4049 (1:151), C 4145 (1:166), C 4156 (1:156). QUEENSLAND East Coast: AMS IA 4310. (1:58) NTMAS 10540-001. (4:56–84). QM I 2299 (1:175), I 5525 (1:244), I 6251 (1:220), I 6252 (1:217), I 6695 (1:237), I 6907 (1:209), I 8008 (1:204), I 8078 (1:230), I 11382 (1:189), I 11955 (1:200), I 11956 (1:233).

Recommended common name. Fringe fin trevally.

Diagnosis. Single row of moderately enlarged, conical teeth on lower jaw; outer row of conical teeth on upper jaw bordered by inner bands of small (but not villiform), sharply pointed teeth; gill rakers 11–13 + 23–26 = 34–39; curved lateral line moderately arched, much shorter than straight (CLL/SLL = 0.49–0.66); adult males with all soft dorsal and soft anal fin rays produced to filaments (Pl.13a); filaments longest anteriorly; females with fins normal (Pl.13b); tip of upper caudal fin lobe black; breast usually scaled, occasionally with very small naked patch in front of pelvic base.

Colour notes. Body olive green to bluish green above; silver to white below; black spot on operculum large (roughly size of eye). Spinous and soft dorsal, caudal and soft anal fins orange; pelvic fins white; pectoral fins pale orange to hyaline.

Description. D VIII + I, 20–22; A II + I, 18–19; snout 6.0–7.3%; eye 6.5–7.8%; snout to spinous dorsal fin 31.4–34.4%; head length 25.1–27.0%; body depth 31.1–37.0%; scutes moderate, 38–45.

Body elongate oval, compressed; dorsal and ventral profiles equally convex. Spinous dorsal fin relatively high, equal or sub-equal to soft dorsal in females; soft dorsal and soft anal fins with well developed, scaly basal sheaths;

pectoral fins falcate, extending to beyond junction of straight and curved lateral line segments. Maxilla extends to below middle of eye; cleft of mouth at eye level. Villiform teeth on vomer, palatines and on central band on tongue.

Comparison with other species. *Pantolabus radiatus* may be distinguished from all but *Caranx* species on the basis of jaw dentition.

Characters that distinguish it from Australian *Caranx* species include body shape (body shallow with dorsal and ventral profiles equally convex in *P. radiatus*; body generally deep with dorsal profile more convex than ventral and comparatively steep head profile in *Caranx* spp.), total gill raker counts (34–39 in *P. radiatus*; less than or equal to 31 in *Caranx* spp.) and, in adult males, relative development of filamentous soft dorsal and soft anal fin rays (filaments present in *P. radiatus*; absent in *Caranx* spp.).

Remarks. Munro (1960b) reports *P. radiatus* specimens to 15 inches (375 mm). The replacement of the commonly employed *Absalom* with *Pantolabus* as the generic category for *Caranx radiatus* Macleay, 1881 follows examination of the syntypes of *Caranx parasitus* Garman, 1903. Whitley (1931) designated *Caranx parasitus* Garman as the orthotype of the new genus *Pantolabus* on the bases of Garman's (1903) descriptions and the examination of another specimen AMS IA 4310, collected from under a *Crambessa medusa* at Port Curtis, North Queensland. Garman's syntypes (MCZ 28288, 2: 31.5–41.8 mm S.L. — examined by W.F. Smith-Vaniz, 1983), also collected from within the tentacles of a *Crambessa mozaica medusa*, and AMS IA 4310 are juvenile *Caranx radiatus* Macleay. Consequently, *Pantolabus* Whitley, 1931 takes priority over *Absalom* Whitley, 1937.

Ecological notes. *Pantolabus radiatus* occurs in inshore waters in northern Australia and is rarely found at depths exceeding 30 m. The species feeds primarily on epibenthic crustaceans.

Distribution. General — endemic to north Australian, south Papuan and south Irian Jayan waters. Australia — *Pantolabus radiatus* occurs in estuarine and inshore waters from Port Hedland in Western Australia to Gladstone on the Queensland east coast (Fig.18).

***Scomberoides* Lacepède**

Scomberoides Lacepède, 1801: 50 (type species *Scomberoides commersonianus* Lacepède, 1801, by subsequent designation of Jordan, 1917, Genera of Fishes: 60).

Chorinemus Cuvier in Cuvier & Valenciennes, 1832: 367 (type species *Scomberoides commersonianus* Lacepède, 1802, by subsequent designation of Jordan, 1917: 137).

Eleria Jordan & Seale, 1905: 774 (type species *Eleria philippina* Jordan & Seale, 1905, by monotypy).

Key to Australian Species of *Scomberoides*

1. Soft dorsal fin uniformly pigmented; anterior lobes of soft dorsal and soft anal fins elevated and falcate; total gill rakers less than or equal to 15 2
- Soft dorsal fin with distinct black distal margin anteriorly; anterior lobes of soft dorsal and soft anal fins low and only slightly falcate, if at all; total gill rakers greater than or equal to 21 3
2. Maxilla extends posteriorly to well beyond posterior margin of eye (upper jaw length 57.5–62.1% of head length); sides of body with 5–8 large oval to round blotches (greater than or equal to eye) on or above lateral line; scales broadly lanceolate *S. commersonianus* Lacepède, 1801
- Maxilla extends posteriorly to slightly beyond posterior margin of eye (upper jaw length 51.4–54.2% of head length); sides of body with 4–8 large, vertically elongate blotches (greater than eye) above or intersecting with lateral line; scales lanceolate *S. tala* (Cuvier, 1832)
3. Maxilla extends posteriorly to below posterior margin of eye (upper jaw length 53.3–55.8% of head length); sides of body with 6–8 small blotches (less than or equal to eye) above and 6–8 below lateral line; scales lanceolate *S. lysan* (Forsskål, 1775)
- Maxilla does not extend to posterior margin of eye (upper jaw length 47.0–49.3% of head length); sides of body with 5–8 small blotches (equal to or slightly smaller than eye) above or intersecting with lateral line; scales needlelike *S. tol* (Cuvier, 1832)

Scomberoides commersonianus Lacepède

Fig.21, Pl.14a

285–615) QM I 1459 (1:395), I 1924 (1:327), I 5582 (1:262), I 6849 (1:271), I 11506 (1:287), I 12167 (2:239–259), I 12339 (2:245–324), I 12660 (3:284–310).

Scomberoides commersonianus Lacepède, 1801: 50, 53, pl.20, fig.3 (type locality Madagascar).*Chorinemus lysan* (non Forsskål).—Weber & de Beaufort, 1931: 277.—Munro, 1960b: 20, No. 847.—Marshall, 1964: 228, No. 239.—Munro, 1967: 232, No. 389.*Scomberoides lysan* (non Forsskål).—Taylor, 1964: 178; Grant, 1978: 213.*Scomberoides commersonianus*.—Smith-Vaniz & Staiger, 1973: 205, fig.1.*Scomberoides commersonianus*.—Sainsbury *et al.*, 1984: 174.

Material examined. (21:157–615) – WESTERN AUSTRALIA: CSIROML CA 2464 (1:287). WAM P 180 (1:323), P 2772 (1:306), P 16294 (1:304), P 23387 (1:266). NORTHERN TERRITORY: CSIROML CA 2457 (1:213). GULF OF CARPENTARIA: QM I 11199 (1:157). QUEENSLAND East Coast: AMS A 18299 – 18300 (2:

Recommended common name. Talang queenfish.**Other common names.** Skinny fish, white fish, giant dart, leatherskin, queenfish.

Diagnosis. Soft dorsal fin dusky green (occasionally yellow), always uniformly pigmented; gill rakers 1–3+9–12 = 10–15, rakers short and stout; 5–8 large (equal to or greater than eye) oval to round blotches above or intersecting with lateral line; maxilla long (upper jaw 57.5–62.1% head length), extends to well beyond posterior margin of eye, extension most pronounced in large specimens; snout 19.4–26.0% head length; scales broadly lanceolate.

Colour notes. Body silvery blue to dusky green above; silvery white to golden below; lateral blotches

plumbeous grey. Soft anal fin generally dusky green (occasionally yellow), always uniformly pigmented; pectoral fins in adults often with dusky blotch ventrally.

Description. D VI–VII + I, 19–21; A II + I, 17–19; eye 4.8–5.3%; head length 20.1–21.8%; body depth 30.9–32.5%; soft dorsal fin lobe height 14.4–19.8%; soft anal fin lobe height 13.5–18.5%.

Body elongate-oval to oblong, moderately to strongly compressed; snout blunt and rounded. Soft dorsal and soft anal fins low, with falcate anterior lobes, posterior rays of both fins consisting of semi-detached finlets; pectoral fins short, not falcate; pelvic fins short, depressible into shallow abdominal groove. Upper jaw with an outer row of enlarged, conical teeth and inner row of villiform teeth; dentary with 2 rows of subequal enlarged teeth in adults; juveniles with dentary teeth on outer row more numerous and closely spaced than those of the inner row; juveniles also with 1 pair or 2 pairs of symphyseal canines on dentary, these becoming less distinct with age; villiform teeth on vomer, palatines and pterygoids.

Comparison with other species. Differences in the size, shape and number of the lateral blotches allow separation of Australian *Scomberoides* species in the field. However, the blotches fade rapidly after death and are often of little use in the identification of preserved material.

Scomberoides commersonnianus may be distinguished from other species in the genus using the characters provided in the generic key to *Scomberoides*.

Remarks. Munro (1960b) and Grant (1978) record a

maximum size of "...at least..." 40 inches (100 cm) and 25 lb (11.5 kg) for *S. commersonnianus* from Australian waters.

A revision of the genus *Scomberoides* by Smith-Vaniz & Staiger (1973) resolved problems with the nomenclature of the genus and its four recent and one fossil species.

Ecological notes. *Scomberoides commersonnianus* is primarily an inshore, shallow-water species in northern Australia. Small specimens are caught by demersal trawls in depths of up to 30 m, while large specimens, which are prized as sport-fish, are caught by trolling and angling in estuaries and around reef systems throughout the region. The species is also taken as a by-catch of gillnet and dropline fisheries throughout northern waters. The species is piscivorous.

Distribution. General — tropical Indo-West Pacific. Australia — *Scomberoides commersonnianus* occurs in tropical inshore habitats from Exmouth Gulf in Western Australia to just south of Brisbane on the Queensland east coast (Fig.21).

Scomberoides lysan (Forsskål)

Fig.21, Pl.14c

Scomber lysan Forsskål, 1775: 54 (type locality Red Sea).
Chorinemus sanctipetri.—Klunzinger, 1879: 378.—Weber & de Beaufort, 1931: 280.—Munro, 1960b: 20, No. 845.—Marshall, 1964: 227.

Scomberoides sanctipetri.—Taylor, 1964: 178.

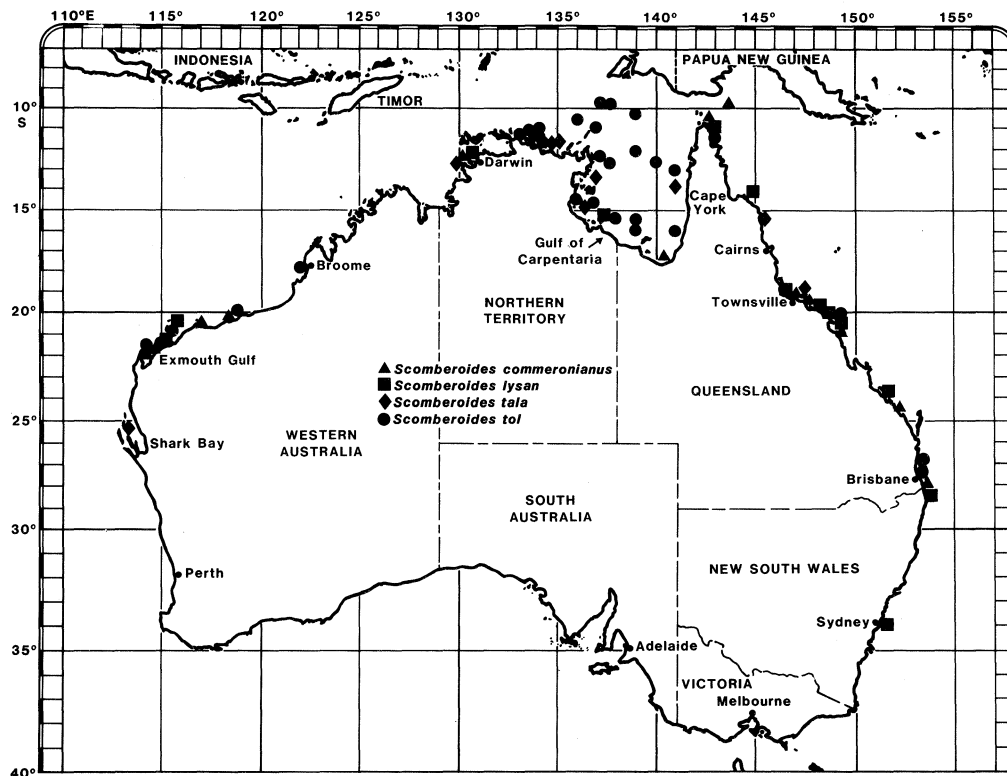


Fig.21. Australian distribution of *Scomberoides commersonnianus*, *S. lysan*, *S. tala* and *S. tol*.

Chorinemus tolooparah.—Weber & de Beaufort, 1931: 278.—Munro, 1960b: 20, No. 846.—Munro, 1967: 233, No. 390.

Scomberoides lysan.—Smith-Vaniz & Staiger, 1973: 205, fig.1.—Russell, 1983: 55.

Material examined. (38:35–411) – WESTERN AUSTRALIA: WAM P 15487 (1:174), P 23233 (1:411). NORTHERN TERRITORY: AMS IA 7679 (1:136), IA 7680 (1:200). GULF OF CARPENTARIA: AMS IA 1488 (1:129), IA 2559 (1:144). QUEENSLAND East Coast: AMS I 5314 (1:175), I 5315 (1:187), I 9712 (1:206), I 9713 (1:217), I 9714 (1:217), I 12495 (1:141), IA 2324 (1:150), IA 2325 (1:164), IA 6126/7 (4:35–132), IA 6288/89/90 (3:112–290), IA 6647 (2:110–128), IA 7498/499/500/501 (4:51–75). CSIROML A 831 (1:107), A 832 (1:90). QM I 12532 (1:209), I 14062 (1:158). NEW SOUTH WALES: AMS IB 4232 (1:290).

PAPUA NEW GUINEA: CSIROML C 535 (1:150), C 1679 (1:90), C 1697 (1:121), C 1878 (1:110), C 1881 (1:134), C 1915 (1:135).

Recommended common name. Doublespotted queenfish.

Other common names. Queenfish, Lesser queenfish, St Peter's leatherskin.

Diagnosis. Tip of anterior lobe of soft dorsal fin black; gill rakers 5–8 + 15–18 = 22–26, rakers long and slender; 6–8 small (equal to or generally less than eye) round blotches above and below lateral line, occasionally connected by narrow isthmus; maxilla relatively long (upper jaw 53.3–55.8% head length), extends to below posterior margin of eye; scales lanceolate.

Colour notes. Body blue to blue green above; silver to silvery white below; lateral blotches dark grey to black; other than soft dorsal fins white to hyaline.

Description. D VI–VII + I, 19–21; A II + I, 17–19; eye 4.3–5.6%; head length 21.3–22.3%; body depth 25.0–27.9%; soft dorsal fin lobe height 11.8–13.2%; soft anal fin lobe height 9.4–10.7%.

Body elongate-oval to oblong, moderately to strongly compressed; snout pointed. Soft dorsal and soft anal fins low, anterior lobes only slightly falcate, if at all; posterior rays of both fins consist of semi-detached finlets; pectoral fins short, not falcate; pelvic fins short, depressible into shallow abdominal groove. Upper jaw with outer row of enlarged conical teeth and inner row of villiform teeth; dentary with inner and outer rows of teeth subequal in adults; juveniles with numerous dentary teeth on outer row and considerably more closely spaced than those on inner; juveniles also with 1 or 2 pairs of symphyseal canines on dentary, these becoming less distinct with age; villiform teeth on vomer, palatines and pterygoids.

Comparison with other species. *Scomberoides lysan* may be distinguished from other species in the genus

using the characters provided in the generic key to *Scomberoides*.

Remarks. Munro (1960) gives a maximum recorded size of 2.5 ft (750 mm) and 30 lbs (13.6 kg) for *Chorinemus sanctipetri* and 3.5 ft (1050 mm) and 25 lb (11.5 kg) for *C. tolooparah* from Australian waters.

Ecological notes. Smith-Vaniz & Staiger (1973) noted that *S. lysan* is the only *Scomberoides* species that occurs east of the Solomon Islands. Unlike the other three species, which are generally restricted to shallow neritic and estuarine waters, *S. lysan* occurs on oceanic islands in both the Indian and Pacific Oceans. Smith-Vaniz & Staiger (1973) suggest this indicates a fundamental difference in the biology of the species. In north Australian waters, *S. lysan* co-occurs with the other *Scomberoides* species in inshore and estuarine habitats and is common on the outer barrier reefs of the northern Great Barrier Reef.

Distribution. General — tropical Indo-West and Central Pacific. Australia — *Scomberoides tala* has been recorded from tropical inshore and reef habitats ranging from Exmouth Gulf in Western Australia to just south of Brisbane on the Queensland east coast (Fig.21). There is also a single record from Sydney.

Scomberoides tala (Cuvier)

Fig.21, Pl.14b

Chorinemus tala Cuvier in Cuvier & Valenciennes, 1832: 377 (type locality Malabar).

Eleria tala.—Ogilby, 1913: 90.

Chorinemus tala.—Weber & de Beaufort, 1931: 281.—Munro, 1960b: 20, No. 848.

Scomberoides tala.—Taylor, 1964: 178.—Smith-Vaniz & Staiger, 1973: 199, fig.1.

Material examined. (5:67–247) – NORTHERN TERRITORY: AMS I 5291/2 (2:76–100), IA 3639 (1:67). GULF OF CARPENTARIA: CSIROML CA (1:247). QUEENSLAND East Coast: QM I 5581 (1:188).

Recommended common name. Barred queenfish.

Other common name. Deep leatherskin.

Diagnosis. Soft dorsal fin dusky green, uniformly pigmented; gill rakers 1–3 + 7–11 = 11–14, rakers short and stout; 4–8 large, vertically elongate blotches above, or intersecting with, lateral line; maxilla long (upper jaw 51.4–54.2% head length), extends to slightly beyond posterior margin of eye; snout 26.1–30.1% head length; scales lanceolate.

Colour notes. Silvery blue to blue green above; silvery white below; lateral blotches dark grey to black.

Soft anal and caudal fins dusky green, uniformly pigmented.

Description. D VI–VII + I, 19–21; A II + I, 17–19; body depth 29.0–34.9%; soft dorsal fin lobe height 14.6–18.0%; soft anal fin lobe height 13.1–16.2%.

Body elongate-oval to oval, moderately to strongly compressed; snout pointed. Soft dorsal and soft anal fins low with falcate anterior lobes, posterior rays of both fins consisting of semi-detached finlets; pectoral fins short, not falcate; pelvic fins short, depressible into shallow abdominal groove. Upper jaw with an outer row of enlarged conical teeth and inner row of villiform teeth; dentary with inner row of large and outer row of small teeth; dentary also with 1 or 2 pairs of symphyseal canines in juveniles, becoming less distinct with age; villiform teeth on vomer, palatines and pterygoids.

Comparison with other species. *Scomberoides tala* may be distinguished from other species in the genus using the characters provided in the generic key to *Scomberoides*.

Remarks. Munro (1960b) and Grant (1978) record a maximum size of 18 inches (450 mm) for *S. tala* from Australian waters.

Ecological notes. *Scomberoides tala* is primarily an inshore, shallow-water species in north Australian waters. Adults are caught by trolling in estuaries and around reef systems throughout the region. Juveniles are taken occasionally in small numbers by demersal trawls. The species is piscivorous.

Distribution. General — tropical Indo-West Pacific. Australia — *Scomberoides tala* apparently has a more restricted distribution than its congeners in Australian waters. The species has been recorded from inshore and reef habitats from Darwin in the Northern Territory to Townsville on the east coast of north Queensland (Fig.21).

Scomberoides tol (Cuvier)

Fig.21, Pl.14d

Chorinemust tol Cuvier in Cuvier & Valenciennes, 1832: 385 (type locality Malabar).

Chorinemus tol.—Weber & de Beaufort, 1931: 283.—Munro 1960b: 17, No. 849.—Munro, 1967: 232, No. 387.

Scomberoides tol.—Smith-Vaniz & Staiger, 1973: 209, fig.1.—Sainsbury *et al.*, 1984: 176.

Material examined. (23:87–270) — WESTERN AUSTRALIA: AMS IB 1638 (1:128). CSIROML C 1750 (1:151), C 2359 (1:199). WAM P 15488/89/90 (3:

110–173), P 26188-006 (1:270). GULF OF CARPENTARIA: AMS I 15557-118 (5:87–172). CSIROML CA 2490 (1:170). QUEENSLAND East Coast: AMS I 2693/93 (2:90–91), IA 6373 (1:221). QM I 7912 (1:157), I 12167 (1:202), I 12366 (1:145).

PAPUA NEW GUINEA: CSIROML C 968/69/70/71 (4:127–199).

Recommended common name. Needlescaled queenfish.

Other common name. Slender leatherskin.

Diagnosis. Soft dorsal fin with distal half black; gill rakers 5–7 + 17–20 = 21–26, rakers long and slender; 5–8 moderate (equal to or generally smaller than eye) oval blotches above or intersecting with lateral line; maxilla short (upper jaw length 47.0–49.3% head length), does not extend to posterior margin of eye; scales slender, needle-like.

Colour notes. Body blue above; silver to silvery white below; lateral blotches dark grey to black. Fins (other than soft dorsal) white to hyaline.

Description. D VI–VII + I, 19–21; A II + I, 17–20; eye 4.6–5.9%; head length 19.6–20.9%; body depth 22.1–24%; soft dorsal fin lobe height 9.0–10.4%; soft anal fin lobe height 6.8–8.8%.

Body elongate oval, moderately to strongly compressed; snout pointed. Soft dorsal and soft anal fins low, anterior lobes only slightly falcate, if at all; posterior rays of both fins consisting of semi-detached finlets; pectoral fins short, not falcate; pelvic fins short, depressible into shallow abdominal groove. Upper jaw with an outer row of enlarged conical teeth and inner row of villiform teeth; dentary with inner and outer rows of teeth subequal in adults; in juveniles, dentary teeth on outer row only slightly more numerous and closely spaced than those on inner; juveniles also with 1 pair or 2 pairs of symphyseal canines on dentary, becoming less distinct with age; villiform teeth on vomer, palatines and pterygoids.

Comparison with other species. *Scomberoides tol* may be distinguished from other species in the genus using the characters provided in the generic key to *Scomberoides*.

Remarks. Munro (1960b) and Grant (1978) record a maximum size of 20 inches (500 mm) for *S. tol* in Australian waters.

Ecological notes. *Scomberoides tol* is largely an inshore and estuarine species in northern Australia. It feeds on a wide range of fish and crustacean prey. Juveniles are occasionally caught in demersal trawls in depths of up to 50 m.

Distribution. General — tropical Indo-West Pacific. Australia — *Scomberoides tol* has been recorded from Exmouth Gulf in Western Australia to Brisbane on the Queensland east coast (Fig.21).

Selar Bleeker

Selar Bleeker, 1851: 343,352 (type species *Caranx boops* Cuvier in Cuvier & Valenciennes, 1833, by subsequent designation of Jordan & Evermann, 1896: 916).

Key to Australian Species of *Selar*

1. Scutes strong (scute height 20.0–24.8% body depth), 43–46; curved lateral line short (CLL/SLL = 0.34–0.41), strongly arched prior to junction with straight lateral line below origin of soft dorsal fin *S. boops* (Cuvier, 1833)
- Scutes moderate (scute height 6.9–11.3% body depth), 31–40; curved and straight lateral lines approximately equal in length (CLL/SLL = 0.99–1.18), curved lateral line declines gently to junction with straight lateral line below tenth–twelfth soft dorsal fin ray *S. crumenophthalmus* (Bloch, 1793)

Selar boops (Cuvier)

Fig.22, Pl.15a

Caranx boops Cuvier in Cuvier & Valenciennes, 1833: 46 (type locality Vanicolo).
Caranx gervaisi Castlenau, 1875: 18. (type locality Cape York, Queensland).
Caranx gervaisi.—Macleay, 1881: 536.
Caranx boops.—McCulloch, 1915: 133.
Caranx (Selar) boops.—Weber & de Beaufort, 1931: 209, fig. 43.
Selar boops.—Munro, 1960a: 17, No. 814.—Taylor, 1964: 178.—Munro, 1967: 227, No. 370.—Sainsbury *et al.*, 1984: 176.

Material examined. (21:44–222) – WESTERN AUSTRALIA: AMS I 15421-029 (1:136). WAM P 22618-9 (2:44–55), P 25354-037 (1:207). GULF OF CARPENTARIA: CSIROML B 2165 (9:176–202). PAPA NEW GUINEA: CSIROML C 493 (1:222), C 494 (1:211), C 536 (1:181), C 550 (1:113), C 1816 (1:81), C 1964 (1:190), C 4149 (1:205), CA 216 (1:202).

Recommended common name. Oxeye scad.

Diagnosis. Deep furrow in lower margin of gill opening (as for *S. crumenophthalmus* in Pl.16a); scutes 43–46, beginning below origin of soft dorsal fin; scutes strong (height 20.0–24.8% body depth); curved lateral strongly arched, short (CLL/SLL = 0.34–0.41).

Colour notes. Body blue green to green above; silver to silvery gold below; in life and freshly post-mortem, a distinct, broad golden band extends from eye along upper body to caudal peduncle; black spot on operculum. Dorsal, anal and caudal fins pale green with dusky fringes; pelvic fins white; pectoral fins pale green to hyaline.

Description. D VIII + I, 24–25; A II + I, 19–21; gill rakers 9–12 + 25–28 = 34–39; snout 7.9–8.9%; eye 7.9–9.7%; head length 26.7–29.4%; body depth 24.9–30.3%.

Body elongate, moderately compressed. Soft dorsal and soft anal fins low, not falcate; pectoral fins falcate, reaching beyond junction of straight and curved lateral line segments. Maxilla extends to below anterior third to middle of eye; lower jaw protrudes beyond upper jaw. Villiform teeth on both jaws uniseriate laterally, pluriseriate anteriorly; villiform teeth also on vomer, palatines and on central band on tongue.

Comparison with other species. The genus *Selar* may be distinguished from other carangid genera by the deep furrow in the lower margin of the gill opening. *Decapterus* species have a shallow furrow situated more to the lateral margin of the gill opening. Plate 16 illustrates the relative development of the furrow in *Selar*, *Decapterus* and *Alepes*.

Selar boops may be distinguished from *S. crumenophthalmus* on the basis of characters listed in the generic key for *Selar*.

Remarks. The maximum recorded size for this species is 263 mm (Munro, 1960a).

Ecological notes. *Selar boops* co-occurs with *S. crumenophthalmus* in north Australian waters. The species is common between 20 and 100 m in waters of the North West Shelf, Timor and Arafura Seas and Gulf of Carpentaria.

Distribution. General — tropical Indo-West Pacific and East Atlantic. Australia — *Selar boops* occurs in tropical continental shelf waters from the southern North West Shelf to Townsville on the east coast of Queensland (Fig.22).

Selar crumenophthalmus (Bloch)

Fig.22, Pls 15b,16a

Scomber crumenophthalmus Bloch, 1793: 77, pl.343 (type locality Guinea, West Africa).

Selar crumenophthalmus.—Munro, 1960a: 17, No. 813.—Taylor, 1964: 178.—Munro, 1967: 227, No. 369.—Russell, 1983: 55.—Sainsbury *et al.*, 1984: 176.

Caranx (Selar) crumenophthalmus.—Weber & de Beaufort, 1931: 210.

Material examined. (24:96–241) – WESTERN AUSTRALIA: CSIROML C 4822 (1:202), C 4823 (1:201), C 4828 (1:212), C 4825 (1:209), CA 213 (1:213). WAM P 25354-036 (1:118), P 26256-007 (2:96–99). GULF OF CARPENTARIA: CSIROML B 2164 (10: 168–183). QUEENSLAND East Coast: AMS I 19828-001 (1:241).

PAPUA NEW GUINEA: CSIROML A 2979 (1:163), C 1579 (1:103), C 1819 (1:141), C 3542 (1:144), C 3543 (1:144).

Recommended common name. Bigeye scad.

Other common name. Purse-eye scad.

Diagnosis. Deep furrow in lower margin of gill opening (Pl.16a); scutes 31–40, beginning below tenth-twelfth soft dorsal fin ray; scutes moderate (height 6.9–11.3% body depth); curved lateral line gently sloping, approximately equal in length to straight lateral line (CLL/SLL=0.99–1.18).

Colour notes. Body green to blue green above; silver below; in some specimens, a faint yellow band extends from eye along mid-line to caudal peduncle. Dorsal and anal fins pale green; pelvic fins white; caudal fin dusky.

Description. D VIII + I, 23–25; A II + I, 21–23; gill rakers 10–12+24–27=35–38; snout 7.5–9.2%; eye 7.7–9.7%; head length 26.7–30.4%; body depth 23.3–30.1%.

Body elongate, moderately compressed. Soft dorsal and soft anal fins low, not falcate; pectoral fins falcate, not reaching junction of straight and curved lateral line segments. Maxilla extends to below anterior third to middle of eye; lower jaw protrudes beyond upper. Villiform teeth on both jaws uniseriate laterally, pluriseriate anteriorly; villiform teeth also on vomer, palatines and on central band on tongue.

Comparison with other species. *Selar crumenophthalmus* may be distinguished from *S. boops* on the basis of characters listed in the generic key for *Selar*.

Remarks. The maximum size recorded for this species is 300 mm (Munro, 1960a).

Ecological notes. *Selar crumenophthalmus* has been recorded from demersal trawls at depths of 11 to 130 m. It feeds on a wide range of crustacean and cephalopod prey.

Distribution. General—circumtropical. Australia—the distribution of *S. crumenophthalmus* largely overlaps that of its congener, *S. boops*; i.e. it occurs in tropical

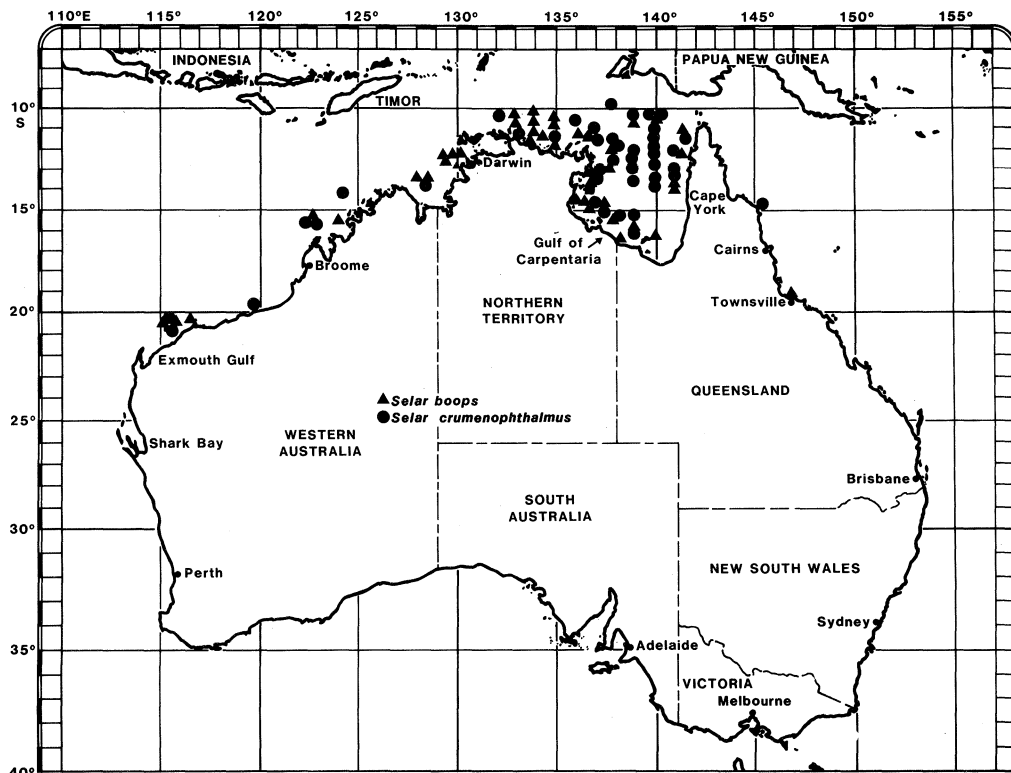


Fig.22. Australian distribution of *Selar boops* and *S. crumenophthalmus*.

continental shelf waters from the southern North West Shelf to those of north-east Queensland (Fig.22).

Selaroides Bleeker

Selaroides Bleeker, 1851: 343,352 (type species *Caranx leptolepis* Cuvier in Cuvier & Valenciennes, 1833, by monotypy).

***Selaroides leptolepis* (Cuvier)**

Fig.23, Pl.11b

- Caranx leptolepis* Cuvier in Cuvier & Valenciennes, 1833: 63 (type locality Java).
- Caranx cheverti* Alleyne & Macleay, 1877: 324, pl.10, fig.1 (type locality Katow, Papua New Guinea).
- Caranx procaranx* De Vis, 1884: 540 (type locality Cape York, Queensland).
- Caranx cheverti*.—Macleay, 1881: 534.
- Caranx leptolepis*.—Macleay, 1881: 534.—McCulloch, 1915: 129, pl.21.—McCulloch, 1924: 72, fig.5.
- Caranx (Selaroides) leptolepis*.—Weber & de Beaufort, 1931: 261, fig.49.
- Selaroides leptolepis*.—Munro, 1960a: 18, No. 820.—Munro, 1967: 226, No. 368.—Grant, 1978: 241, pl.91.—Sainsbury *et al.*, 1984: 178.

Material examined. (48:79–194) – AMS I 16300-001 (1:138) HOLOTYPE *Caranx cheverti* Alleyne & Macleay,

1877. Type locality – Katow, Papua New Guinea. QM I 77 (1:79) HOLOTYPE *Caranx procaranx* De Vis, 1884. Type locality – Cape York, Queensland. WESTERN AUSTRALIA: CSIROML B 2156 (25:135–159). WAM P 8906 (1:120), P 9380/81/82 (3:146–148), P 14759 (1:104), P 23612 (1:152), P 23613 (1:168), P 25354-038 (1:173), P 25367-011 (1:104), P 25508-046 (1:154). QUEENSLAND East Coast: AMS I 13350 (1:184), I 13352 (1:194). QM I 2155 (1:145), I 3355/56 (2:113–118), I 13751 (1:140), I 14554 (1:101), I 15675 (1:147), I 15832 (1:177). WAM P 260 (2:160–162).

Recommended common name. Yellowstripe scad.

Other common names. Smooth-tailed trevally, thin-scaled trevally.

Diagnosis. No teeth on upper jaw, palatines or vomer; single series of fine to villiform teeth on lower jaw; rudimentary dentition on tongue; gill rakers 11–13+29–30=41–43; breast scaled.

Colour notes. Body blue to blue green above; silver below; yellow band extending from above eye to caudal peduncle; distinct black spot on upper operculum. Dorsal, anal and caudal fins dusky; pelvic fins white; pectoral fins hyaline.

Description. D VIII + I, 25–26; A II + I, 21–23; snout 7.1–8.4%; eye 6.4–8.4%; head length 24.5–26.5%; body depth 30.2–33.1%; scutes weak, 20–25. Body elongate, oblong, compressed; dorsal and ventral profiles equally

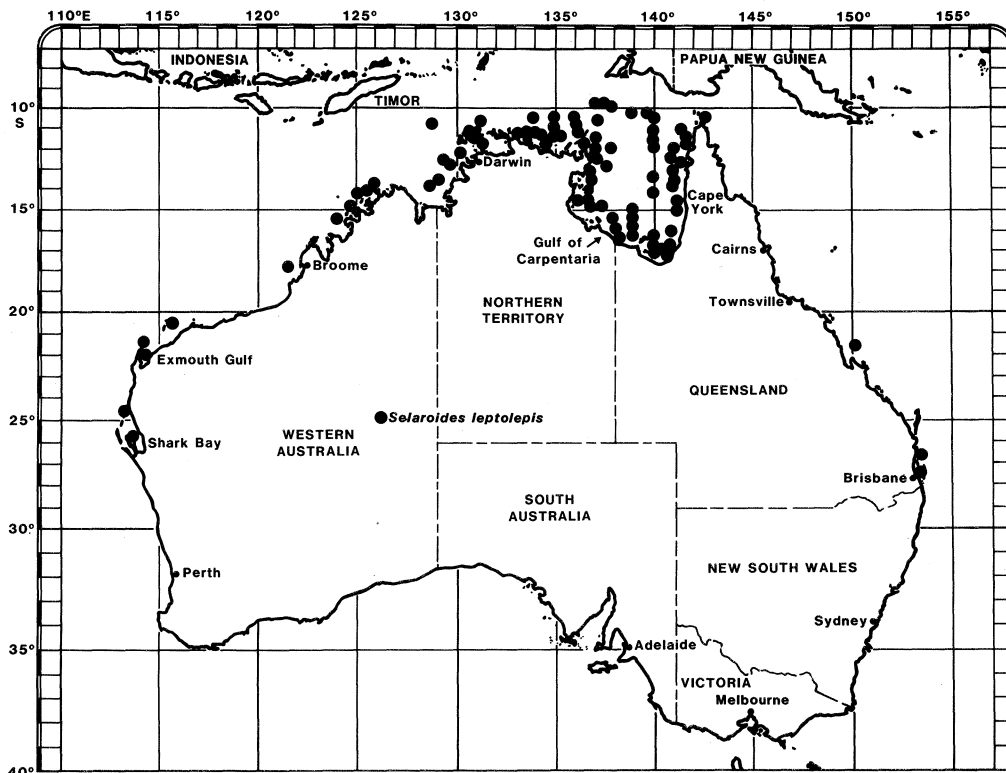


Fig.23. Australian distribution of *Selaroides leptolepis*.

convex; snout pointed. Soft dorsal and soft anal fins low, not falcate, both with scaly basal sheaths; pectoral fins falcate, not reaching junction of straight and curved lateral line segments. Curved lateral line gently arched, longer than straight lateral line ($CLL/SLL = 1.37-1.84$). Maxilla extends to below anterior edge of eye.

Comparison with other species. Dentition distinguishes *S. leptolepis* from all other carangids. The species is superficially similar to *Selar* but lacks the deep furrow in the gill opening characteristic of that genus.

Ecological notes. *Selaroides leptolepis* is one of the most abundant fishes in north Australian continental shelf waters. Restricted largely to depths of less than 50 m, the species occurs in large demersal schools over soft bottom habitats. Ostracods, gastropods and euphausiids are its most common prey.

Distribution. General — tropical Indo-West Pacific. Australia — *Selaroides leptolepis* is abundant throughout tropical inshore and shallow continental shelf waters of northern Australia. The species occurs from Shark Bay in Western Australia to Brisbane on the Queensland east coast (Fig.23).

Seriolina Wakiya

Seriolina Wakiya, 1924: 222,230 (type species *Seriola intermedia* Temminck & Schlegel, 1845 [= *Nomeus nigrofasciata* Rüppell, 1829] by monotypy).

Seriolina nigrofasciata (Rüppell)

Fig.24, Pl.17a-b

Nomeus nigrofasciata Rüppell, 1829: 82, pl.24, fig.1 (type locality Red Sea).

Seriola nigrofasciata.—Macleay, 1881: 174.—Weber & de Beaufort, 1931: 294, fig. 59.—Taylor, 1964: 179.

Zonichthys nigrofasciata.—Munro, 1958: 19, No. 805.—Munro, 1967: 235, No. 397.

Seriolina nigrofasciata.—Grant, 1978: 249, pl.95.—Russell, 1983: 56.—Sainsbury *et al.*, 1984: 178.

Material examined. (23:96-397) — WESTERN AUSTRALIA: CSIRO ML CA 2466 (1:329), WAM P 15439/40 (2:93-149), P 23437 (1:240), P 27225-007 (1:322), P 27230-002 (1:248). QUEENSLAND East Coast: QM I 3072 (1:251), I 6035 (1:345), I 9464 (1:227), I 10627 (3:96-105), I 11420 (1:338), I 13733 (2:113-131).

MATERIAL NOT RETAINED (8:166-397) — Western Australia, 20°05'S, 116°19'E, June 1983.

Recommended common name. Black-banded kingfish.

Other common name. Butter amberfish.

Diagnosis. Gill rakers knob-like, $1 + 5-7 = 6-8$; D VI + I, 31-34; AO + I, 15-16.

Colour notes. Body olive green to brown above, grading to silver below; dark bands and blotches on upper body conspicuous in specimens less than 180 mm,

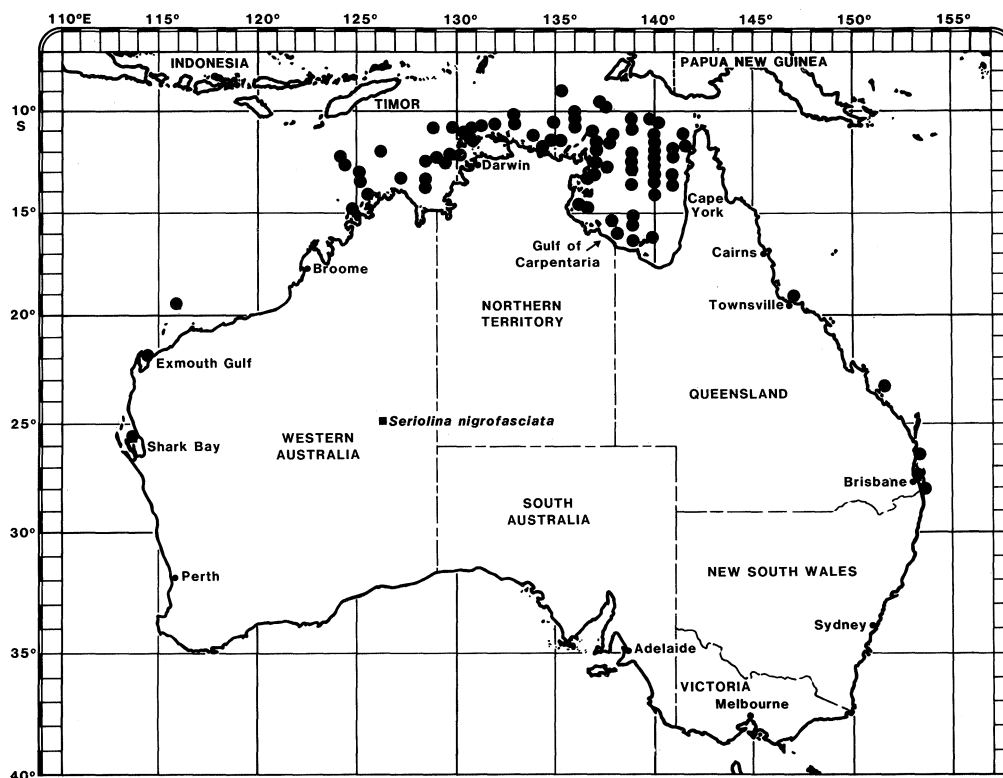


Fig.24. Australian distribution of *Seriolina nigrofasciata*.

blotches fade with age (Pl.17a,b). Spinous dorsal and caudal fins dark brown to black; soft dorsal and soft anal fins dusky brown, anterior rays with pale to white tips.

Description. Snout 6.4–9.2%; eye 6.2–8.4%; upper jaw length 11.9–13.3%; head length 24.2–27.1%; body depth 25.6–38.4%; pectoral fin 13.0–16.0%; pelvic fin 16.2–23.2%; soft dorsal fin base 42.6–44.7%; soft anal fin base 18.3–20.6%. Body elongate oblong, only moderately compressed; head profile rising steeply to eye level from which point it curves smoothly to origin of spinous dorsal fin. Dorsal and anal fins low, not falcate; pectoral fins short, not falcate; pelvic fins long; detached anal spines and posterior dorsal spines often embedded. Curved lateral line gently arched. Maxilla (with supplemental bone) extends to below posterior third of eye. Villiform teeth on both jaws (in series), vomer, palatines and on central band on tongue.

Comparison with other species. *Seriolina nigrofasciata* may be distinguished from the superficially similar *Seriola* species on the basis of gill raker morphology (gill rakers reduced and knob-like in *Seriolina nigrofasciata*; elongate and slender in *Seriola*

spp.).

Remarks. Munro (1958) and Grant (1978) record 27 inches (675 mm) as the maximum size attained by *S. nigrofasciata* in Australian waters.

Ecological notes. *Seriolina nigrofasciata* is common at depths of 20 to 150 m in north Australian continental shelf waters. Cephalopods and small demersal fish (e.g. leiognathids, nemipterids and synodontids) are its chief prey.

Distribution. General — tropical Indo-West Pacific. Australia — *Seriolina nigrofasciata* occurs in inshore and continental shelf waters from Shark Bay in Western Australia to Brisbane on the Queensland east coast (Fig.24).

***Ulua* Jordan & Snyder**

Ulua Jordan & Snyder, 1908: 39 (type species *Ulua richardsoni* Jordan & Snyder, 1908 [= *Caranx mentalis* Cuvier in Cuvier & Valenciennes, 1833], by monotypy).

Key to Australian Species of *Ulua*

- 1. Gill rakers 16–21 + 37–41 = 54–61; tongue with central band of villiform teeth; scutes 31–40; in specimens less than 150 mm, first anal fin ray produced but not filamentous, not extending beyond caudal peduncle *U. aurochs* (Ogilby, 1915)
- Gill rakers 23–25 + 50–56 = 73–80; tongue without central band of villiform teeth; scutes 25–32; in specimens less than 150 mm, filamentous first anal fin ray extends beyond caudal peduncle *U. mentalis* (Cuvier, 1833)

***Ulua aurochs* (Ogilby)**

Figs 7a,25, Pl.18a

Citula aurochs Ogilby, 1915: 79, pl.25 (type locality Edgumbe Bay, Queensland).
Caranx aurochs.—McCulloch, 1915: 136.—Marshall, 1964: 224.
Carangoides aurochs.—Munro, 1960a: 19, No. 827.
Ulua aurochs.—Sainsbury *et al.*, 1984: 180.

147710/11 (7:147–170). CSIROML A 3162 (1:105). QUEENSLAND East Coast: CSIROML CA 724 (1:130). QM I 2089 (1:131), I 17236 (1:144), I 17237 (1:139), I 17239 (1:112), I 17241 (1:115).
 MATERIAL NOT RETAINED (4:148–176) – Western Australia, 15°01'S, 124°55'E, July 1980.

Recommended common name. Silvermouth trevally.

Other common name. Black-crested trevally.

Material examined. (27:105–182) – QM I 2218 (1:158) HOLOTYPE *Citula aurochs* McCulloch, 1915. Type locality – Edgumbe Bay, Queensland. Western Australia: CSIROML CA 419 (1:142). WAM P 26259-003 (1:153). NORTHERN TERRITORY: CSIROML CA 2477 (1:182), CA 2491 (1:172), CA 2497 (1:152), CA 2499 (1:147), CA 2500 (1:174). GULF OF CARPENTARIA: AMS I 15557-111 (1:106). ANSP

Diagnosis. Gill rakers long and slender, partly projecting into mouth beside tongue, 16–21 + 37–41 = 54–61; naked area on breast reaches up to pectoral base and occasionally extends dorsally in a narrow band to lateral line (Fig.7a); snout short, 1.25–1.40 in eye; tongue with narrow central band of villiform teeth; scutes weak, 31–40.

Colour notes. Body blue to silvery blue above; silver below; dorsal surface of head dark blue to black; operculum with diffuse dark spot; lower jaw, inside of mouth and tongue brilliant silver (mirror-like). Dorsal filaments and inner rays of soft anal fin black; other fins dusky to hyaline. Juveniles with 5 or 6 dark, vertical crossbands through body.

Description. D VIII + I, 21–22; A II + I, 17–18; snout 6.2–7.8%; eye 9.1–10.3%; head length 26.7–27.9%.

Body oval, strongly compressed. First soft dorsal fin ray produced to long filament, in juveniles reaching beyond caudal tip; in large males, first 5–8 soft dorsal fin rays produced to filaments; anterior rays of soft anal fin slightly produced in both sexes, but not to filaments; pectoral fins falcate, reaching to well beyond junction of straight and curved lateral line segments. Curved lateral line moderately arched, shorter than straight lateral line (CLL/SLL = 0.70–0.89). Lower jaw protrudes slightly beyond upper jaw; maxilla extends to below anterior margin to middle of eye; cleft of mouth level with lower margin of eye. Villiform teeth on both jaws, vomer and palatines.

Comparison with other species. *Ulua aurochs* may be easily distinguished from *Carangoides* species on the basis of gill raker counts and CLL/SLL ratio. Characters distinguishing *U. aurochs* from *U. mentalis* are given in the generic key to *Ulua*.

Remarks. The maximum recorded size for this species is 259mm.

In this study *Citula aurochs* Ogilby, more recently known as *Carangoides aurochs*, has been reassigned to the genus *Ulua* Jordan and Snyder on the basis of the number and morphology of gill rakers on the first gill arch. The species has numerous (total G.R. 54–61), long, featherlike rakers projecting into the mouth beside the tongue, a character diagnostic of *Ulua* (Jordan & Snyder 1908). By comparison, the gill rakers of *Carangoides* species are less numerous (total G.R. less than 33), much shorter and thicker.

Ecological notes. In north Australian waters, the species is largely restricted to depths of less than 70 m. Throughout the Timor and Arafura Seas and Gulf of Carpentaria it is often caught in trawls with *Carangoides hedlandensis*, *C. humerosus* and *Caranx bucculentus*. Small crustaceans and cephalopods are the most important components in its diet.

Distribution. General — endemic to north Australian and Gulf of Papua waters. Australia — *Ulua aurochs* occurs in continental shelf waters from Broome in Western Australia to Ayr on the Queensland east coast (Fig.18).

Ulua mentalis (Cuvier)

Figs 7b,18, Pl.18b

Caranx mentalis Cuvier in Cuvier & Valenciennes, 1833: 124 (type locality Red Sea).

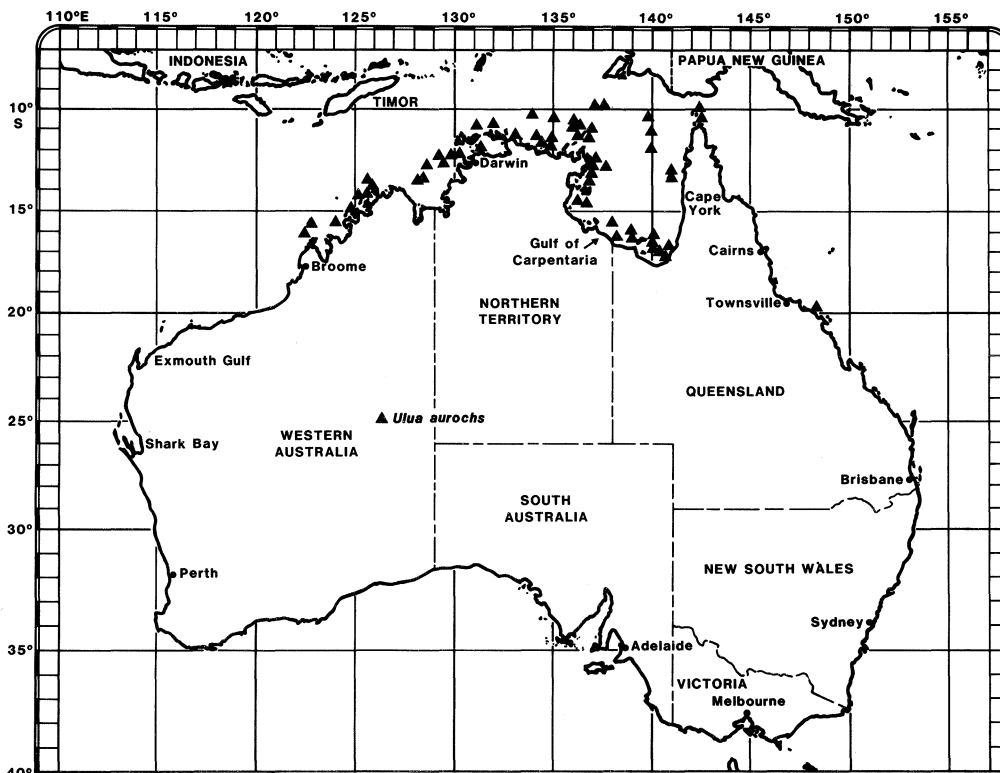


Fig.25. Australian distribution of *Ulua aurochs*.

Caranx mandibularis Macleay, 1882: 356 (type locality New Guinea).

Ulua mandibularis.—McCulloch, 1915: 140.—McCulloch, 1924: 75, pl.14.—Weber & de Beaufort, 1931: 266, fig. 51.—Munro, 1960b: 18, No. 842.—Marshall, 1964: 224, No. 237.—Taylor, 1964: 181.—Munro, 1967: 226, No. 355.

Ulua mentalis.—Grant, 1978: 244.—Sainsbury *et al.*, 1984: 180.

Material examined. (9:86–739) – AMS I 16302-001 (2:247–260) SYNTYPES *Caranx mandibularis* Macleay, 1882. Type locality – Port Moresby, Papua New Guinea. WESTERN AUSTRALIA: CSIRO ML CA 2498 (1:168). WAM P 24772 (1:739), P 26185-004 (1:163). QUEENSLAND East Coast: AMS I 20829-032 (2:86–91). QM I 6028 (1:315), I 6250 (1:267).

Recommended common name. Longrakered trevally.

Other common name. Cale cale.

Diagnosis. Gill rakers long, feather-like, projecting into mouth beside tongue, 23–25 + 50–56 = 73–80; naked area on breast extends up to and occasionally slightly above pectoral base (Fig. 7b); no teeth on tongue; scutes weak to moderate, 25–32.

Colour notes. Body blue green to olive green above; silvery white below; diffuse dark blotch on upper operculum in large specimens, faint or absent in small. Cheeks, lower jaw, inside of mouth and tongue silver in small specimens. Spinous dorsal fin dusky to black; soft dorsal and soft anal fins dusky green; in large specimens, anterior lobes of both these fins dark; in small specimens, filamentous soft dorsal fin rays black, filamentous soft anal fin rays white; caudal fin dusky. Juveniles with 7–8 dark, vertical crossbands through body.

Description. D VII–VIII + I, 20–22; A II + I, 17; snout 6.2–9.3%; eye 4.7–8.7%; snout to spinous dorsal fin 32.7–38.5%; head length 24.2–29.3%; body depth 35.1–51.8%.

Body changing from oval to elongate-oval with age,

compressed. Anterior lobes of soft dorsal and soft anal fins falcate in large specimens, produced to filaments in small specimens, with the dorsal filaments in specimens less than 150 mm reaching to caudal tip; anal filaments shorter, extending to mid-caudal; pectoral fins falcate, extending past junction of straight and curved lateral line segments; pelvic fins short. Curved lateral line moderately arched, shorter than straight (CLL/SLL = 0.76–0.86). Maxilla extends to below middle of eye; lower jaw projects beyond upper jaw, projection becoming more pronounced with age. Villiform teeth on both jaws (in narrow bands), vomer and palatines.

Comparison with other species. *Ulua mentalis* may be easily distinguished from *Carangoides* species on the basis of gill raker counts and CLL/SLL ratio. Characters distinguishing *U. mentalis* from *U. aurochs* are given in the generic key to *Ulua*.

Remarks. Rau & Rau (1980) report fish of up to 1000 mm from the Philippines, the maximum recorded size for this species.

Ecological notes. The species is reported to occur in shallow reef habitats in north Australian waters. Juveniles feed predominantly on small, epibenthic crustaceans, while adults take both crustaceans and fish.

Distribution. General — tropical Indo-West Pacific. Australia — the few records of *U. mentalis* from Australian waters indicate a wide distribution from Exmouth Gulf in Western Australia to just south of Townsville on the Queensland east coast (Fig. 18).

Uraspis Bleeker

Uraspis Bleeker, 1855: 417 (type species *Uraspis carangoides* Bleeker, 1855 [secondary junior homonym in *Caranx*] [= *Uraspis uraspis* Günther, 1860] by subsequent designation of Jordan & Evermann, 1896: 916).

Zamora Whitley, 1931: 108 (type species *Caranx hullianus* McCulloch, 1909 [= *Caranx secundus* Poey, 1860] by original designation).

Key to Australian Species of *Uraspis*

1. Naked area on breast extends approximately half way to pectoral fin base (Fig. 7h); D VII–VIII + I, 28; A 0 + I, 21; curved lateral line shorter than straight (CLL/SLL = 0.83–0.84); majority of scutes antrorse, 35–38 (posterior 4–6 retrorse) *U. secunda* (Poey, 1860)
- Naked area on breast extends up to pectoral fin base (Fig. 7i); D VI–VIII + I, 24–26; A II + I, 18–20; curved lateral line longer than straight (CLL/SLL = 1.08–1.39); scutes retrorse, 28–32 *U. uraspis* (Günther, 1860)

Uraspis secunda (Poey)

Fig. 7h, Pl. 19

Caranx secundus Poey, 1860: 223 (type locality Cuba).*Caranx hullianus* McCulloch, 1909: 319, pl. 91 (type locality Sydney, New South Wales).*Uraspis uraspis* (non Günther).—Munro, 1960b: 18, No. 838.

Material examined. (3:108–278) – AMS I 9261 (1:108) *Caranx hullianus* McCulloch, 1909. Type locality – Manly, New South Wales. WESTERN AUSTRALIA: CSIROML CA 3903 (1:257).

TASMAN SEA: CSIROML CA 3902 (1:278).

Recommended common name. Cottonmouth trevally.

Other common name. Basset-Hull's trevally.

Diagnosis. Tongue and inside walls of mouth brilliant white with dark blue to black border (Pl. 20b); naked area on breast extends approximately half way to pectoral base (Fig. 7h); scutes moderate to strong, majority antrorse (posterior 4–6 retrorse), 35–38; curved lateral line shorter than straight (CLL/SLL = 0.83–0.84); D VII–VIII + I, 28; A 0 + I, 21.

Colour notes. Body silvery blue to black above, darkest on top of head; black to silvery white below; with or without dark vertical banding. Spinous and soft dorsal, soft anal and caudal fins black to dark blue.

Description. Gill rakers 5–7 + 14–15 = 19–22; snout 7.5–8.1%; eye 6.5–6.6%; head length 25.8–26.1%; body depth 42.3–43.4%; pectoral fin 24.0–26.3%; pelvic fin 13.9–20.5%; scute height 5.2–5.8% body depth.

Body elongate oval, compressed; dorsal profile slightly, if at all, more convex than ventral profile. Spinous dorsal fin low, spines become embedded with age; soft dorsal and soft anal fins relatively high but not falcate; pectoral subfalcate, reaching to junction of straight and curved lateral line segments. Maxilla extends to below anterior third of eye. 1 or 2 rows of sharp, conical teeth on both upper and lower jaws; no teeth on vomer, palatines or tongue.

Comparison with other species. *Uraspis* species may be distinguished from the superficially similar *Carangoides* and *Caranx* species on the basis of dentition and mouth colouration.

Characters distinguishing *U. secunda* from *U. uraspis* are given in the key to the genus *Uraspis*.

Remarks. F. Williams of the University of Miami, USA is currently revising the genus *Uraspis*.

Distribution. General — world-wide tropical and subtropical. Australia — *Uraspis secunda* has been recorded once from the North West Shelf (19°10'S,

118°10'E), once from Freshwater, Sydney (McCulloch's *Caranx hullianus* holotype) and once from the Tasman Sea (34°02'S, 154°01'E).

Uraspis uraspis (Günther)

Figs 7i, 18, Pl. 20a–b

Caranx uraspis Günther, 1860: 444 (type locality Ambon). *Uraspis uraspis*.—Sainsbury *et al.*, 1984: 180.

Material examined. (25:101–264) – WESTERN AUSTRALIA: CSIROML CA 2448 (1:192), CA 2452 (1:171). WAM P 26194-007 (2:234–264). GULF OF CARPENTARIA: AMS I 20473-007 (1:167). ANSP 147707 (5:178–198). CSIROML CA 2450 (1:185), CA 2451 (1:219), CA 2454/55/56 (3:152–193), CA 2459/60/61/62 (4:195–209). QUEENSLAND East Coast: AMS I 20907 (2:108–131). QM I 10609 (1:101), I 15748 (1:125).

MATERIAL NOT RETAINED (2:198–204) – Northern Territory, 9°30'S, 133°00'E, July 1981.

Recommended common name. Whitetongue jack.

Other common name. White-mouthed trevally.

Diagnosis. Tongue and inside walls of mouth brilliant white with dark blue to black border (Pl. 20b); naked area on breast broad ventrally, constricts half way to pectoral forming a narrow isthmus that connects with naked pectoral base (Fig. 7i); scutes moderate, retrorse, 28–32; curved lateral line longer than straight (CLL/SLL = 1.08–1.39); D VI–VIII + I, 24–26; A II + I, 18–20.

Colour notes. Body silvery blue to silvery blue green, above silvery white below; head silvery, mirror-like; juveniles with 6–7 dark, vertical cross bands through body. Spinous dorsal fin black; soft dorsal and soft anal fins hyaline, occasionally with dusky to black tips; caudal fin dusky; pectoral fins hyaline; pelvic fins white to hyaline in larger specimens, inner rays dark in juveniles.

Description. Gill rakers 5–6 + 14–15 = 19–20; snout 8.3–9.6%; eye 9.3–12.0%; head length 30.3–32.2%; body depth 43.9–49.3%; pectoral fin 32.2–36.4%; scute height 3.6–4.9% body depth.

Body oval, compressed; dorsal and ventral profiles equally convex. Spinous dorsal fin low; soft dorsal and soft anal fins high but not falcate; pectoral fins falcate, reaching to beyond junction of straight and curved lateral line segments. Curved lateral line gently arched, longer than straight line. Maxilla extends to below anterior third of eye. 1 or 2 rows of sharp conical teeth on both upper and lower jaws; no teeth on vomer, palatines or tongue.

Comparison with other species. *Uraspis* species may be distinguished from the superficially similar *Carangoides* and *Caranx* species on the basis of dentition and mouth colouration.

Uraspis uraspis may be distinguished from *U. secunda* on the basis of characters given in the key to the genus *Uraspis*.

Ecological notes. Smith (1962:505) referred to *U. uraspis* as the rare "furred-tongue" and drew attention to the lack of specimen records in the literature. While not abundant, the species is common at depths of 50 to 130 m in north Australian waters. Limited information on feeding habits suggests that *U. uraspis* takes predominantly epibenthic crustacean and cephalopod prey.

Distribution. General — tropical Indo-West Pacific. Australia — *Uraspis uraspis* is common in tropical continental shelf waters from the southern North West Shelf to the Gulf of Carpentaria. The species also occurs along the Queensland east coast as far south as Brisbane (Fig.18).

ACKNOWLEDGMENTS. The generous assistance and constructive criticism of Dr W.F. Smith-Vaniz throughout all stages of this study is gratefully acknowledged. Thanks are also due to Mr I. Munro for his many helpful suggestions; Drs J. Paxton, D. Hoese and Mr G. Leyland for their reviews of the manuscript; Mrs Patricia Kailola for her help in the early stages of this study; Dr A. Lewis for the provision of transparencies of *Carangoides ferdau* and *C. orthogrammus*; Drs J. Paxton and B. Russell, Messrs I. Munro, R. MacKay, B. Hutchins and N. Sinclair, Ms H. Larson and Ms M. Titterton for assistance with their respective museum collections; Dr P. Hindley for editorial comments; Dr F. Williams for discussion of his *Uraspis* and *Carangoides coeruleopinnatus* data; Mr T Carter for assistance with production of plates and figures; CSIRO Division of Fisheries Word Processing Typists for typing the manuscript; Australian Fisheries Service Observers and the numerous CSIRO scientists who field tested the keys and descriptions throughout Australian waters and, in so doing provided many valuable comments on the format and content of the revision.

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APPENDIX

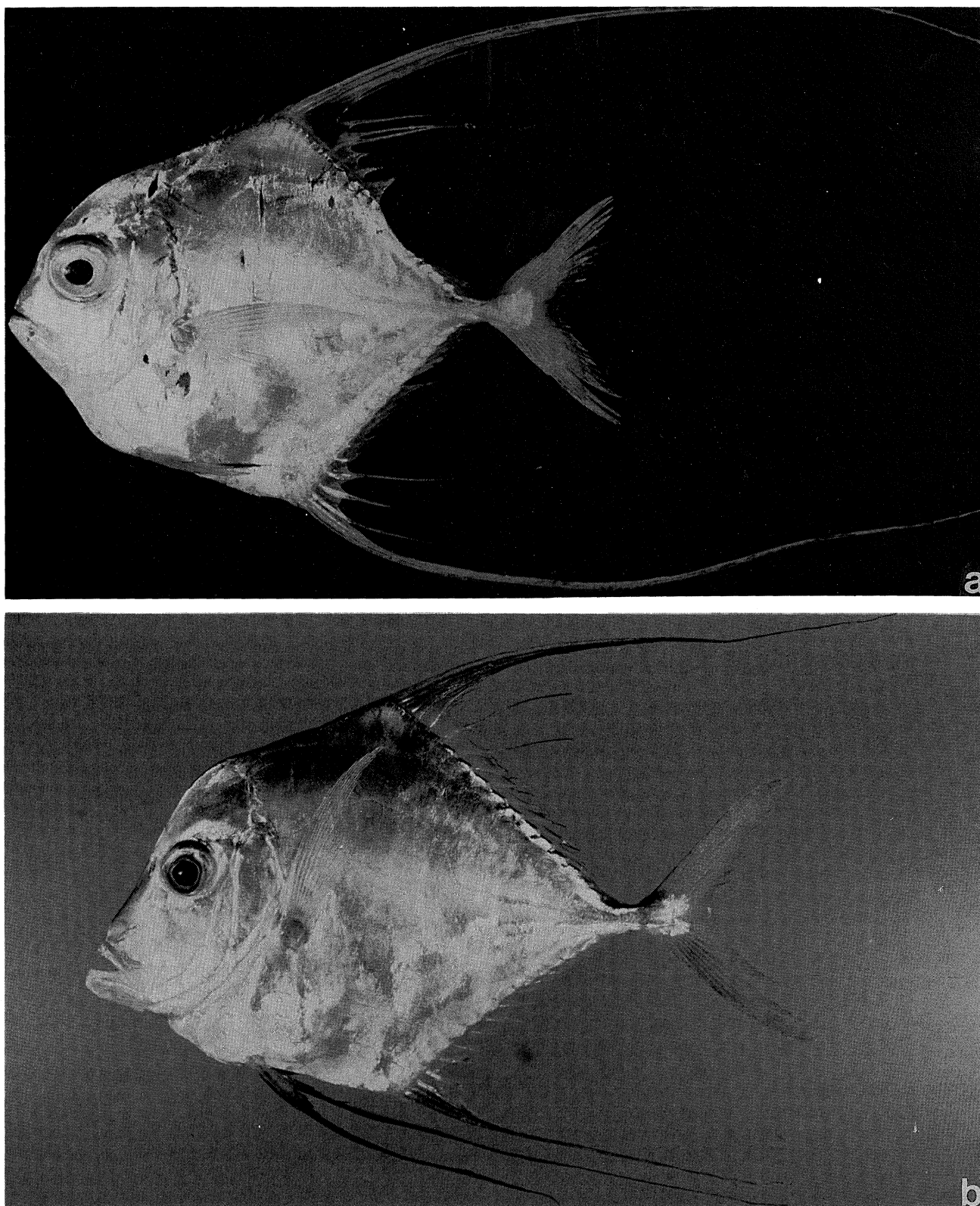


Plate 1. a: *Alectis ciliaris* — 16.3 cm LCF. b: *Alectis indicus* — 21.2 cm LCF.

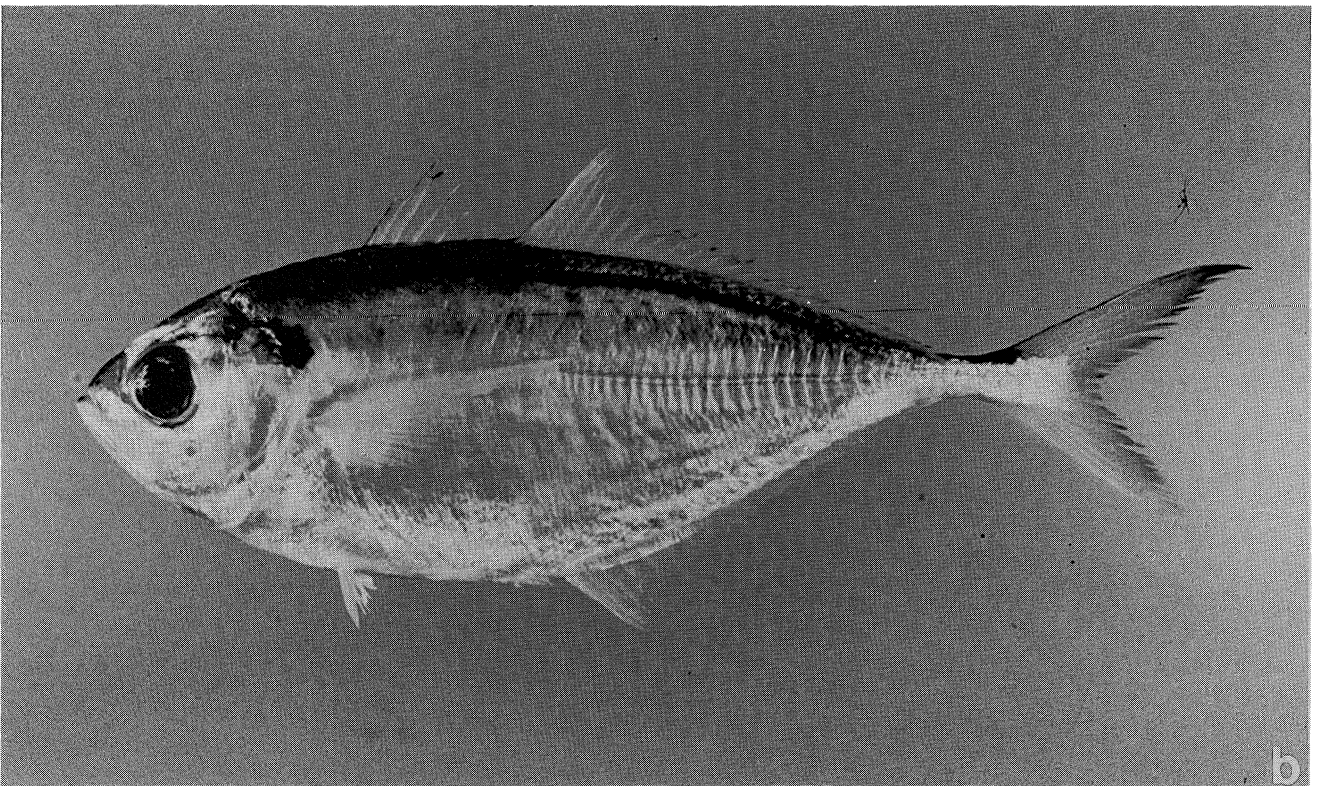
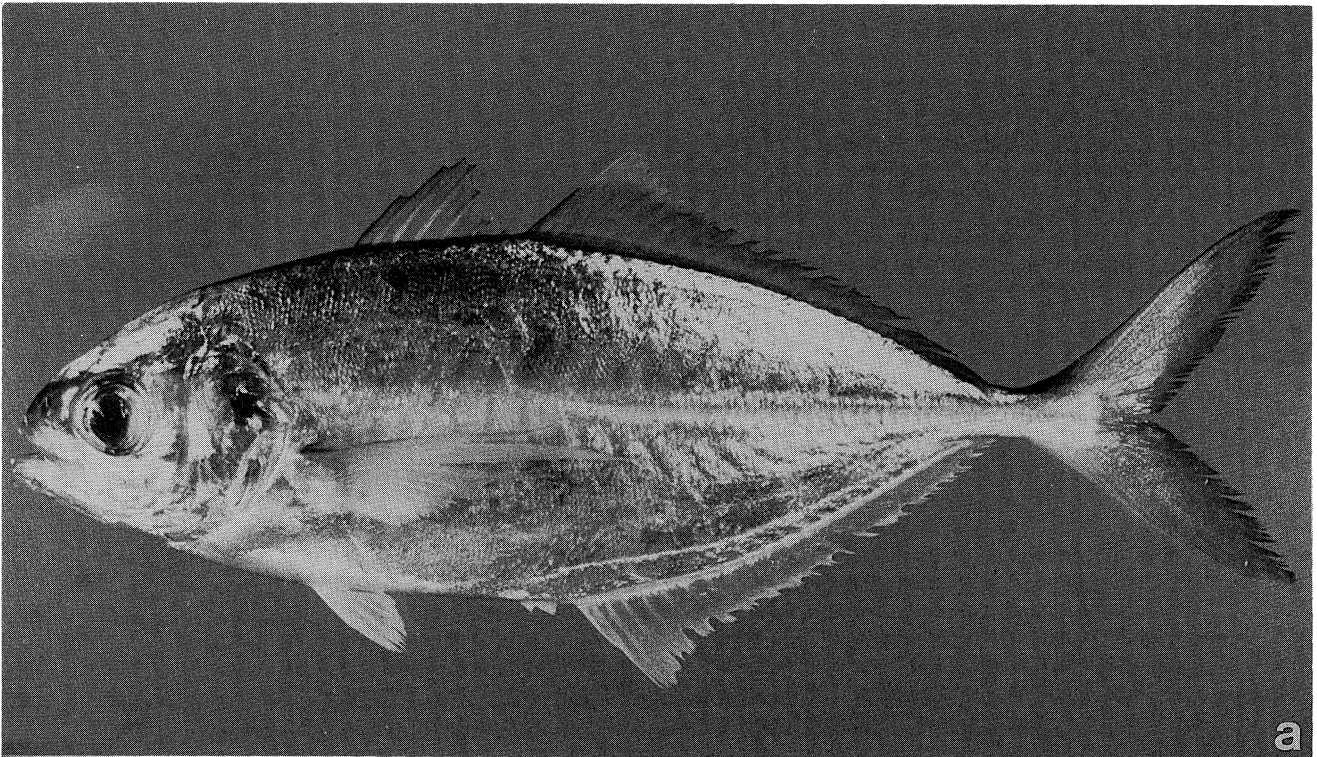


Plate 2. a: *Alepes* sp. — 17.8 cm LCF. b: "*Caranx*" *kleinii* —12.5 cm LCF.



Plate 3. a: *Atule mate* — 21.6 cm LCF. b: *Megalaspis cordyla* — 26.3 cm LCF.



Plate 4. a: *Carangoides coeruleopinnatus* — 27.7 cm LCF. b: *Carangoides chrysophrys* — 16.2 cm LCF.

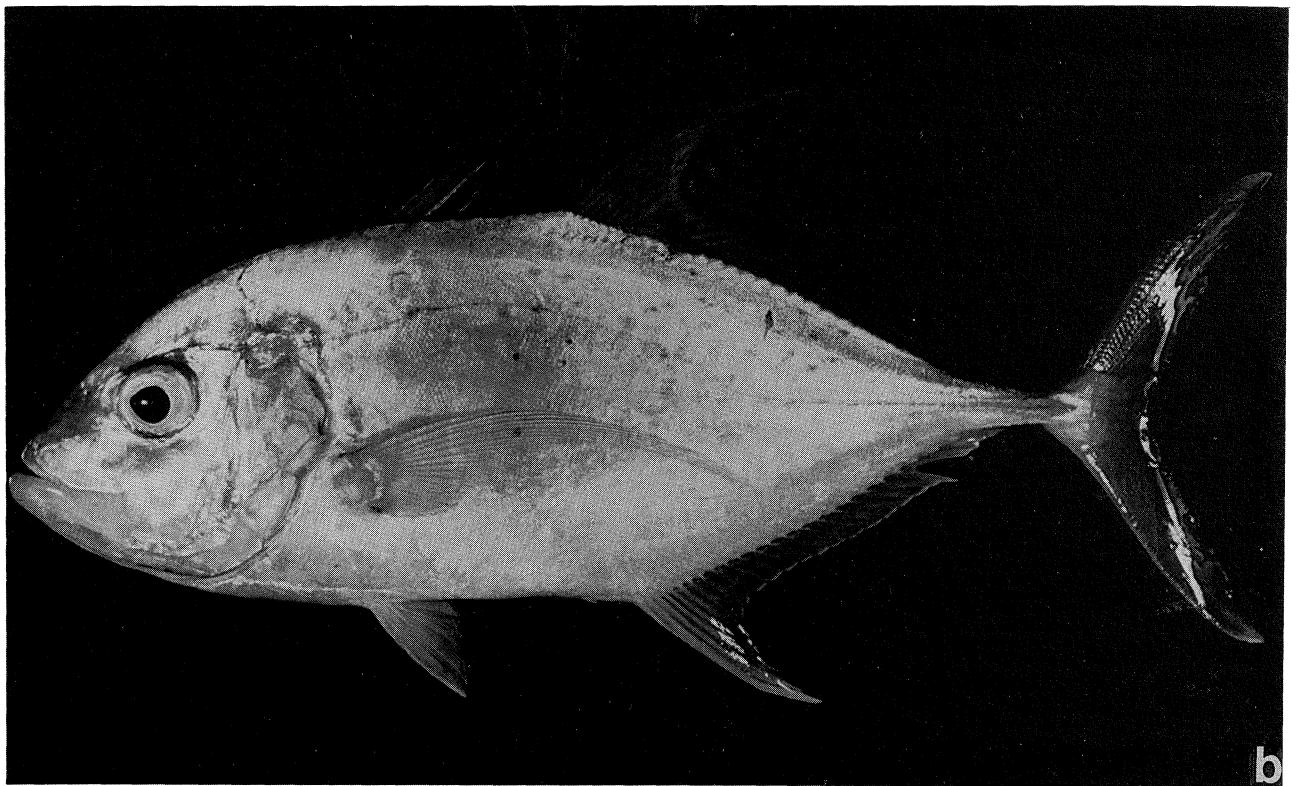
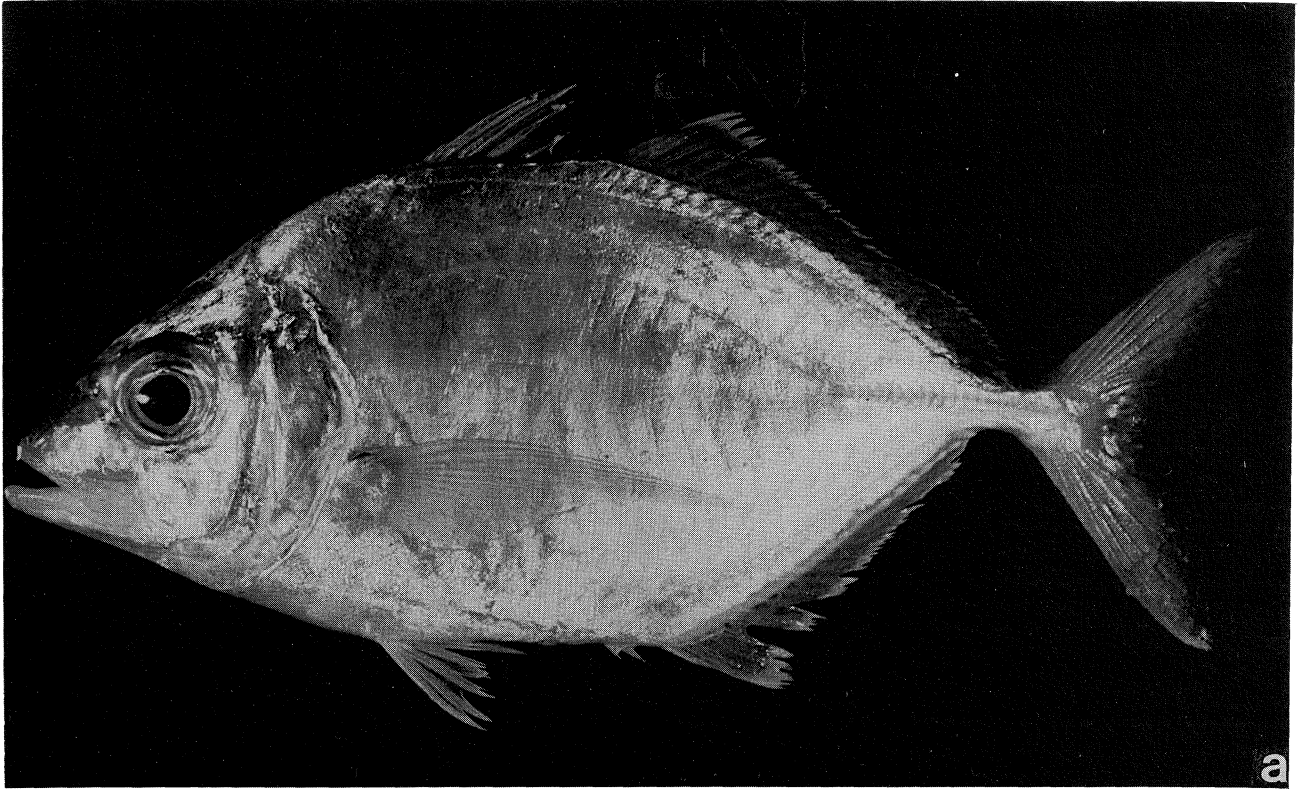


Plate 5. a: *Carangoides equula* — 15.3 cm LCF. b: *Carangoides fulvoguttatus* — 30.0 cm LCF.

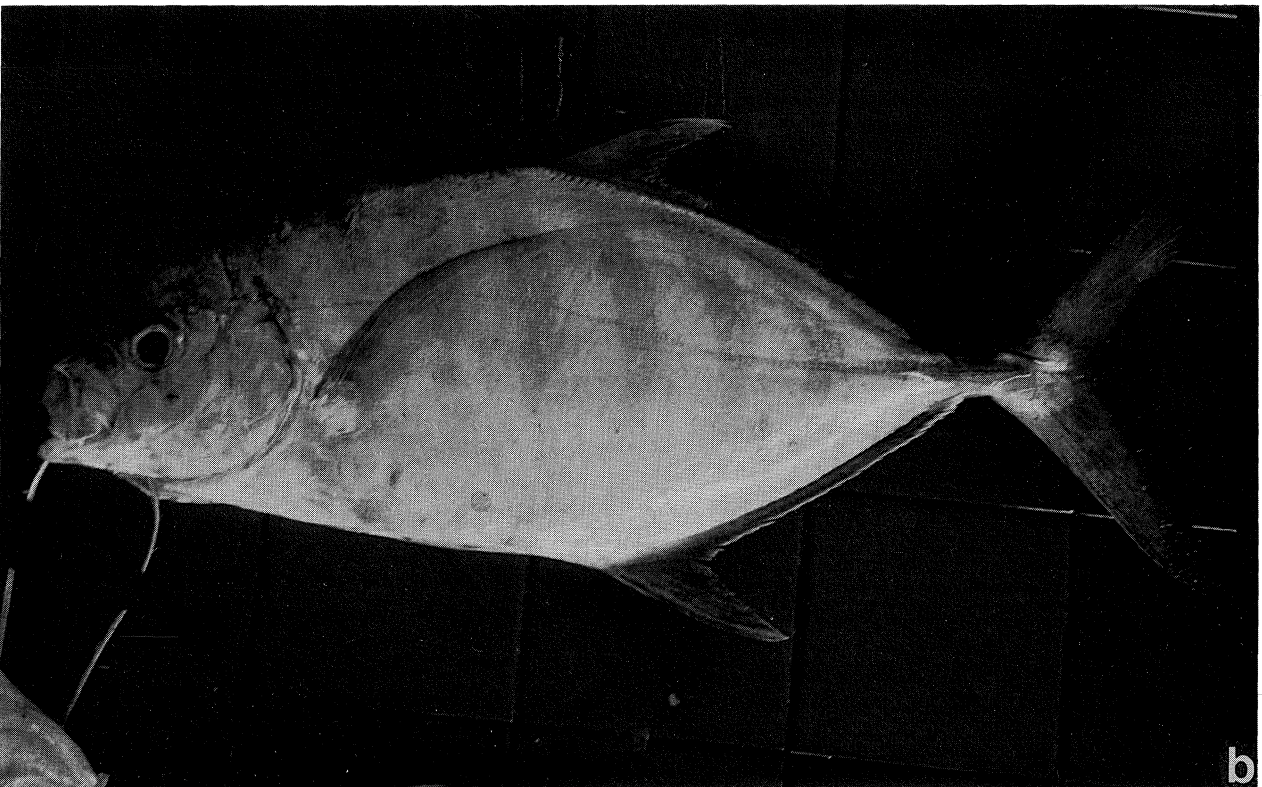
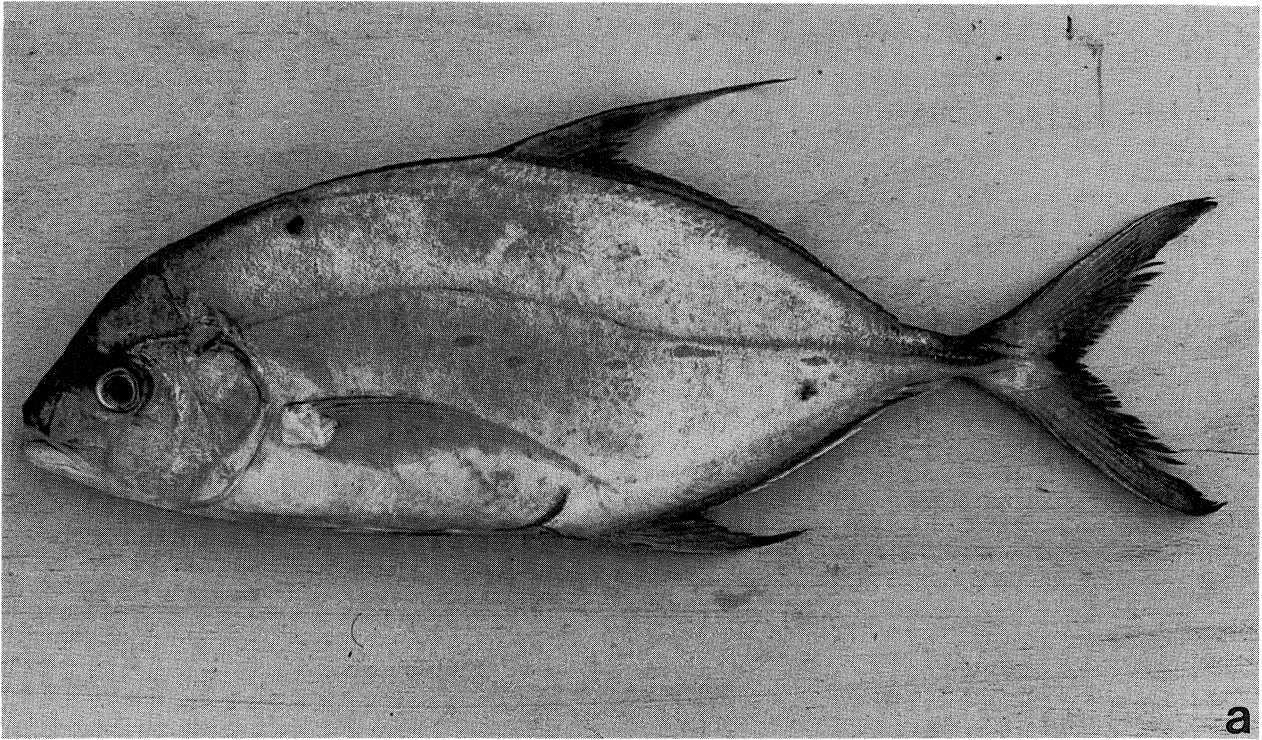


Plate 6. a: *Carangoides orthogrammus* — 40.0 cm LCF (Capture locality — Fiji). b: *Carangoides ferdau* — 35.0 cm LCF (Capture locality — Fiji).

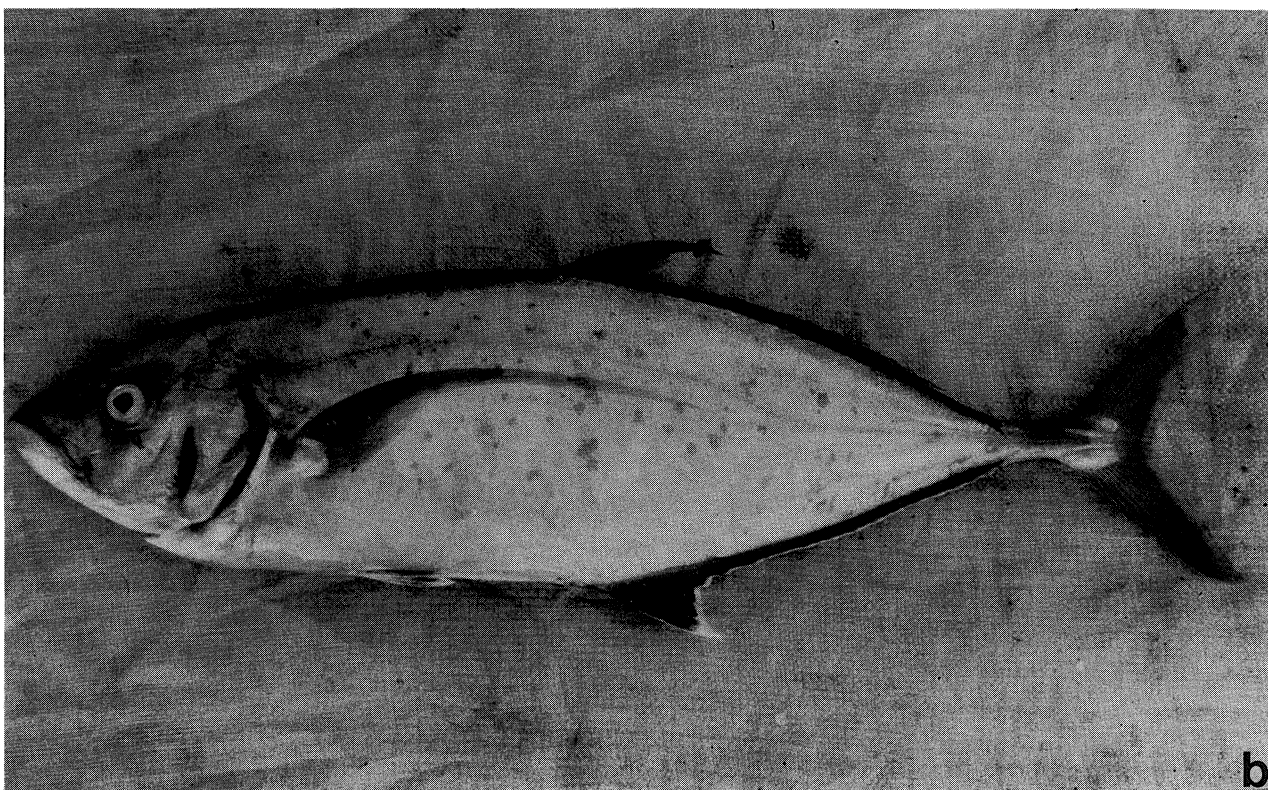


Plate 7. a: *Carangoides gymnostethus* — 26.1 cm LCF (inset = juvenile — 11.5 cm LCF). b: *Carangoides plagiotaenia* - 35.0 cm LCF.

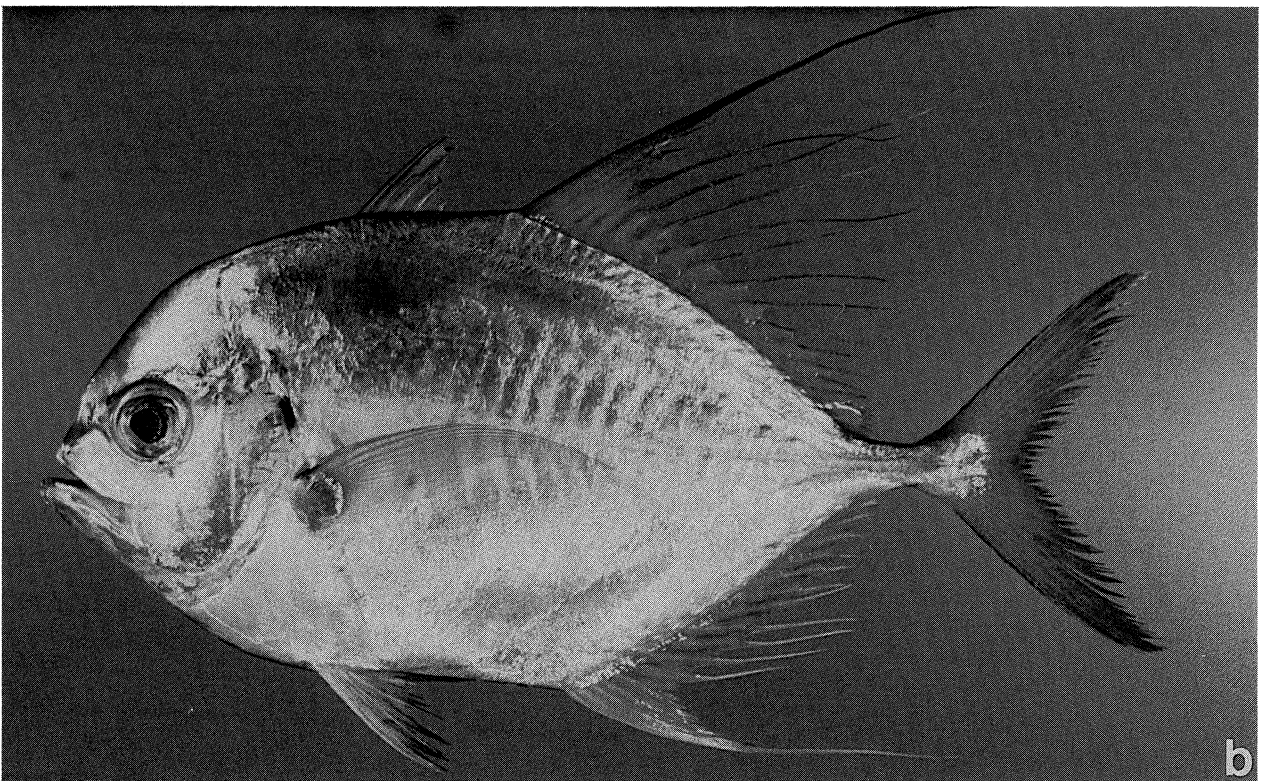
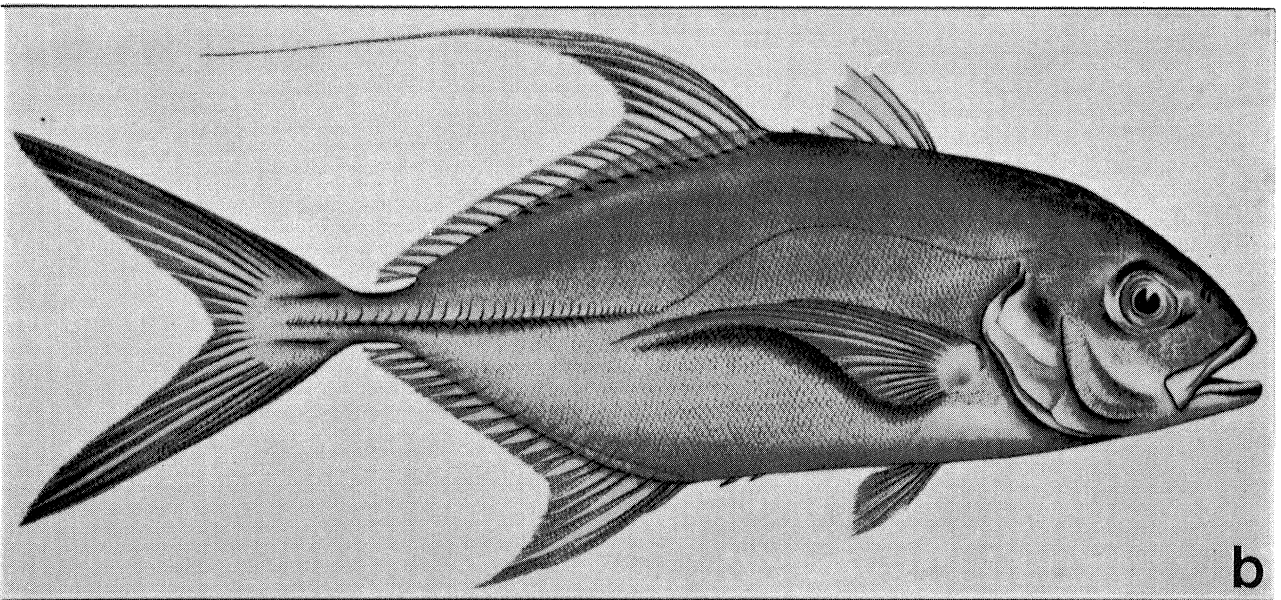
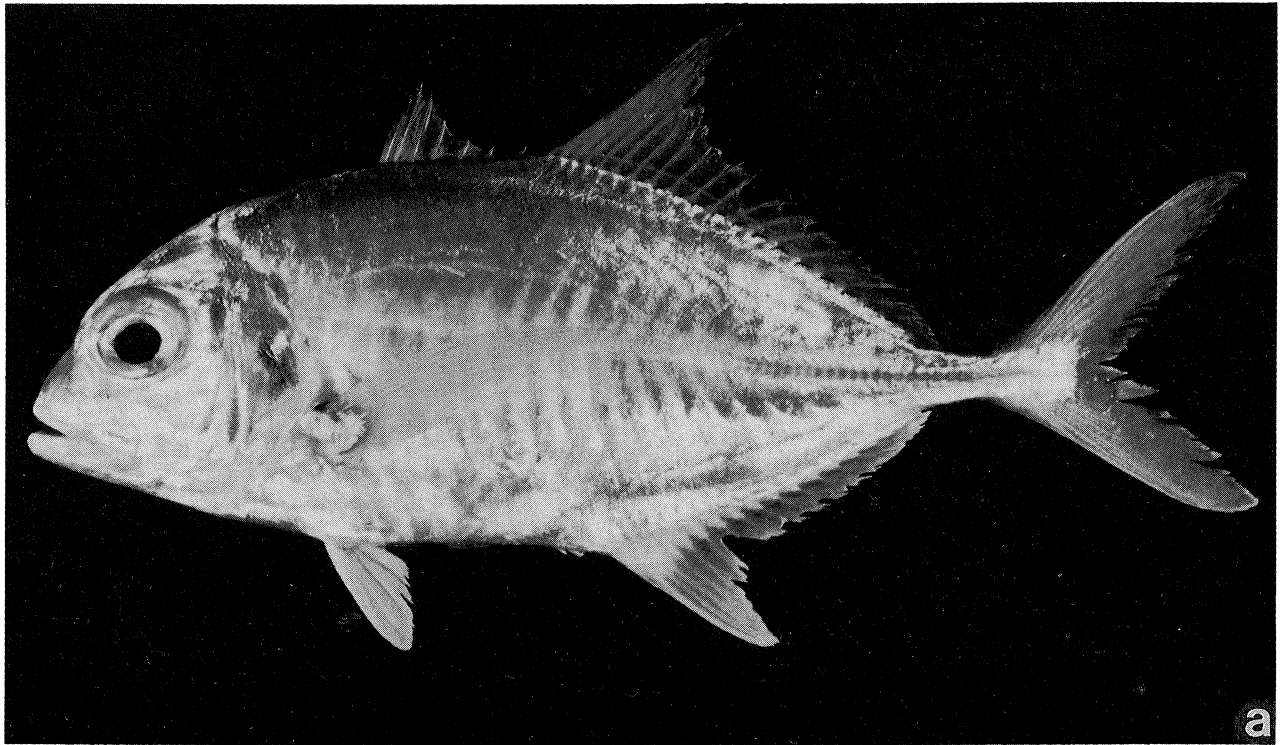


Plate 8. a: *Carangoides hedlandensis* (juvenile) — 9.6 cm LCF. b: *Carangoides hedlandensis* (male) — 17.7 cm LCF.



Phyllis Clarke, del.

CITULA GRACILIS Ogilby. $\frac{2}{3}$ Nat. Size.

Plate 9. a: *Carangoides humerosus* — 16.7 cm LCF. b: *Carangoides oblongus* — 29.0 cm SL. (Plate 9b is a copy of an original plate presented in Ogilby, 1915, pl. 23).

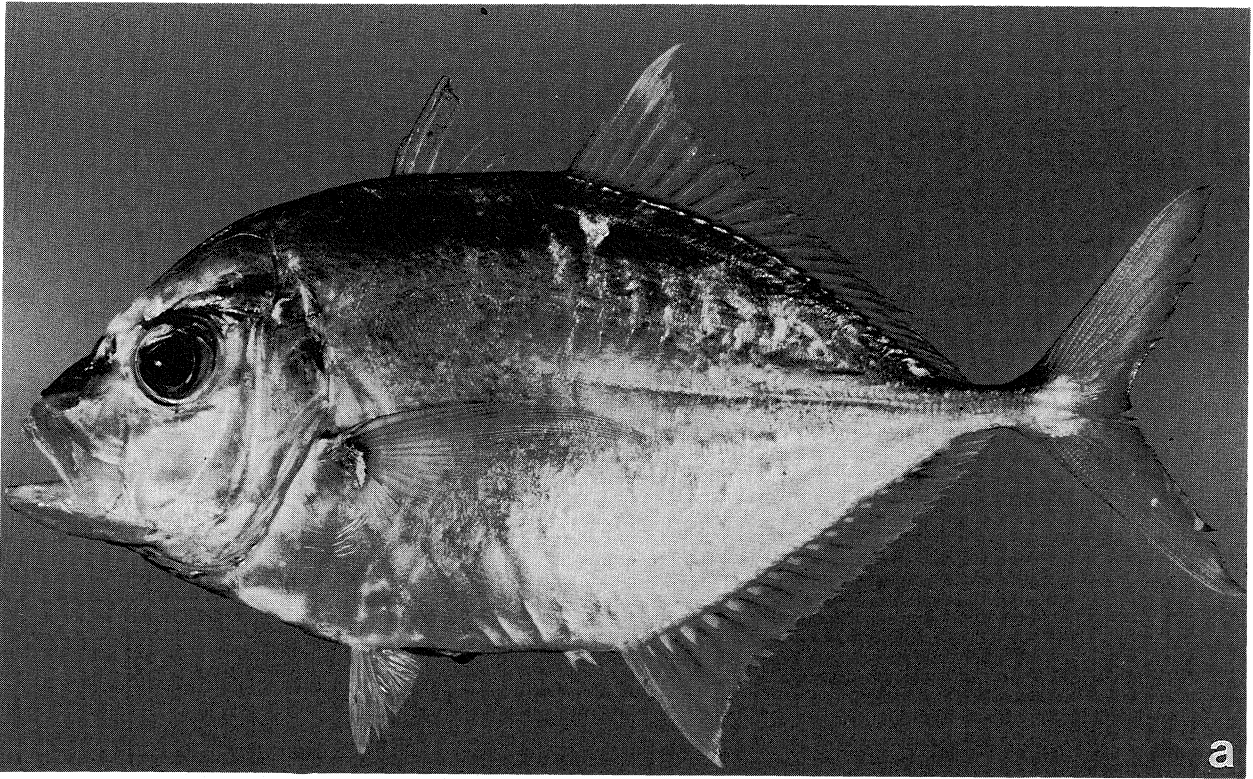


Plate 10. a: *Carangoides malabaricus* — 18.3 cm LCF. b: *Carangoides talamparoides* — 19.7 cm LCF.

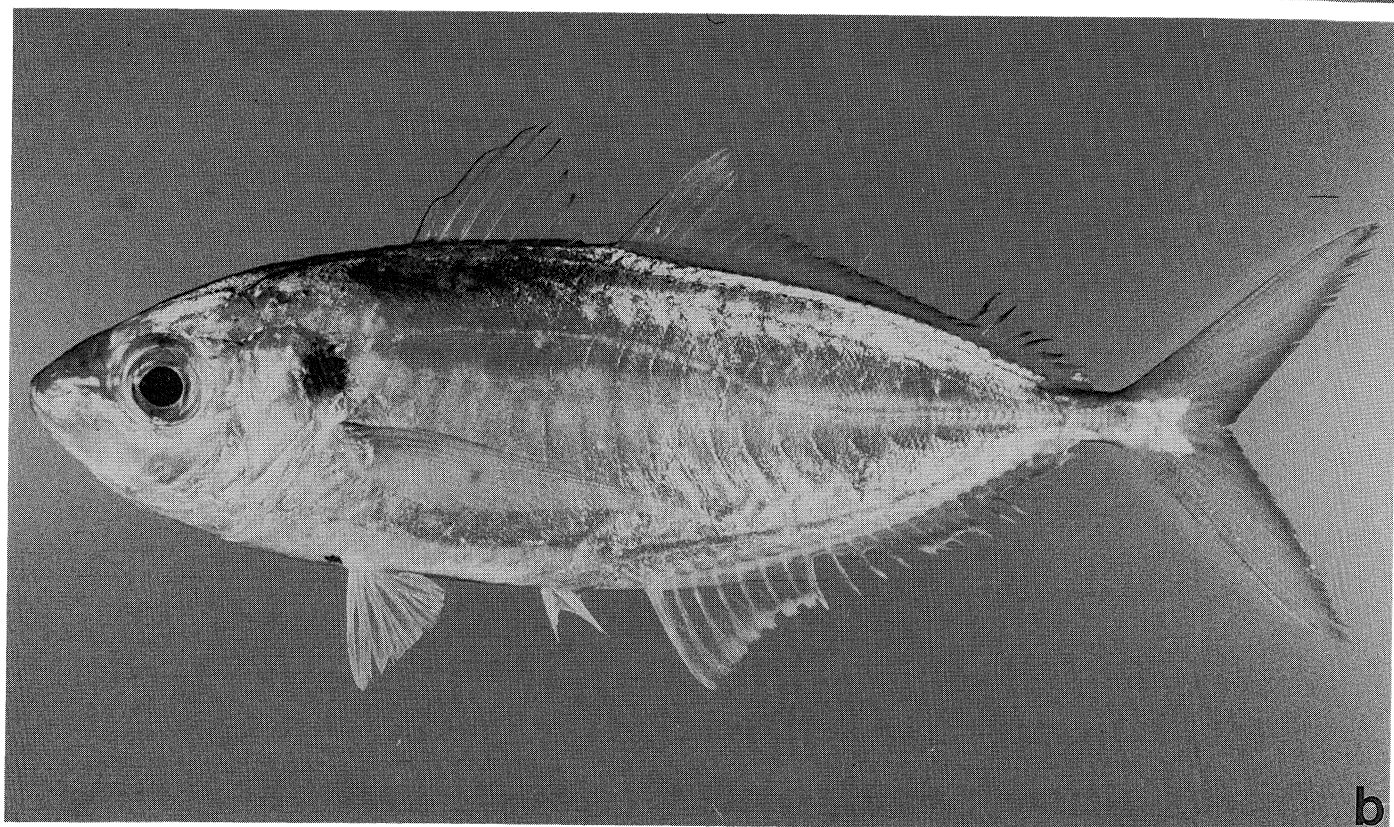
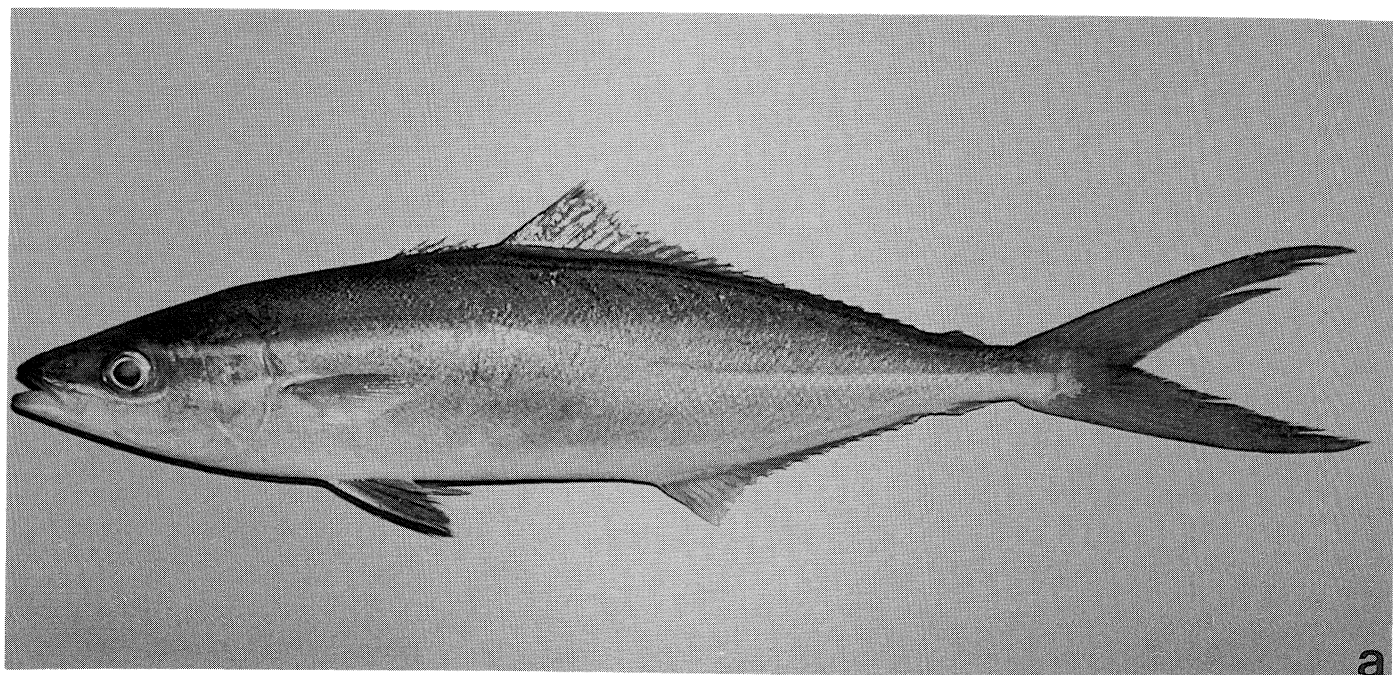


Plate 11. a: *Elagatis bipinnulata* — 26.5 cm LCF. b: *Selaroides leptolepis* — 15.9 cm LCF.

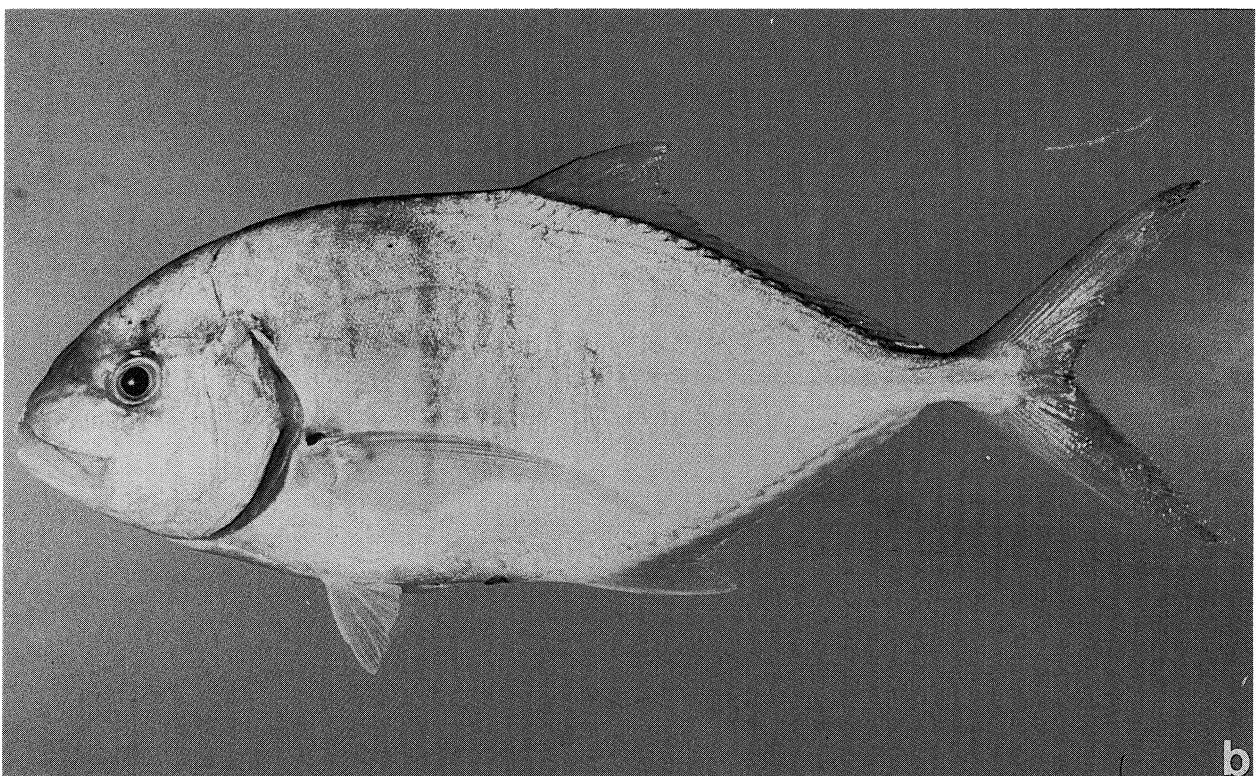
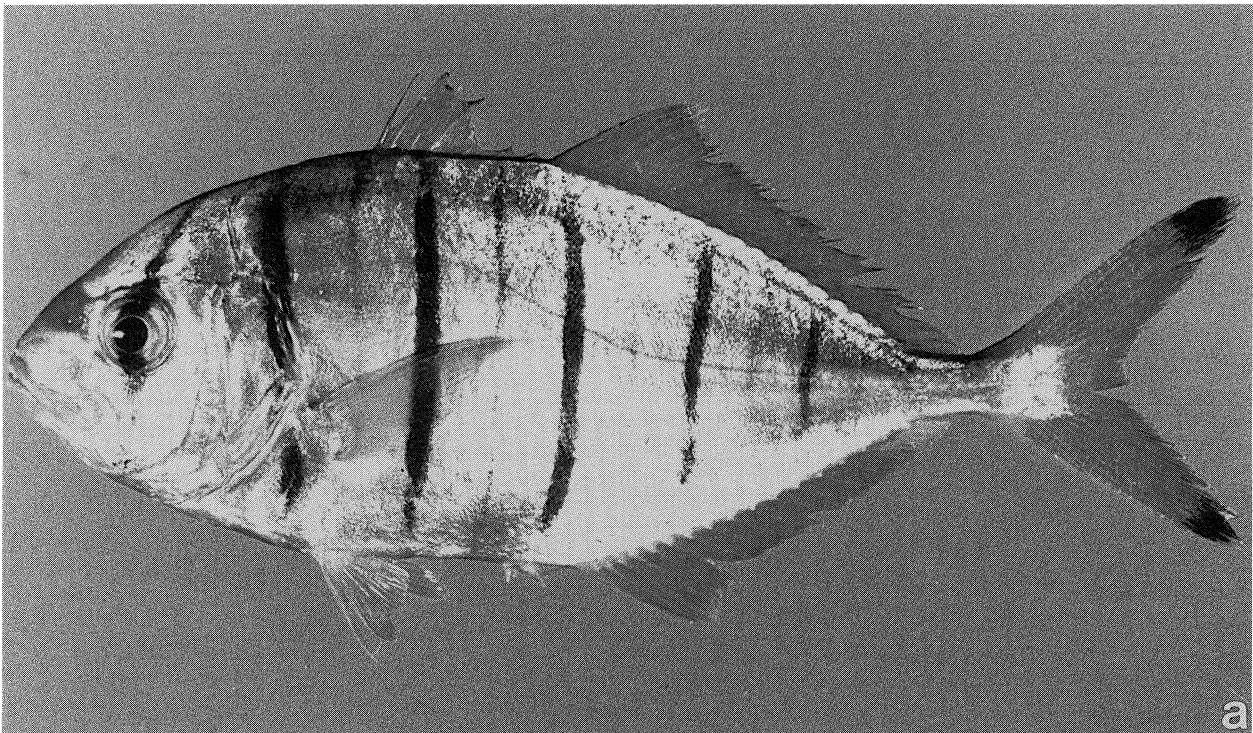


Plate 12. a: *Gnathanodon speciosus* (juvenile) — 14.2 cm LCF. b: *Gnathanodon speciosus* (adult) — 38.3 cm LCF.

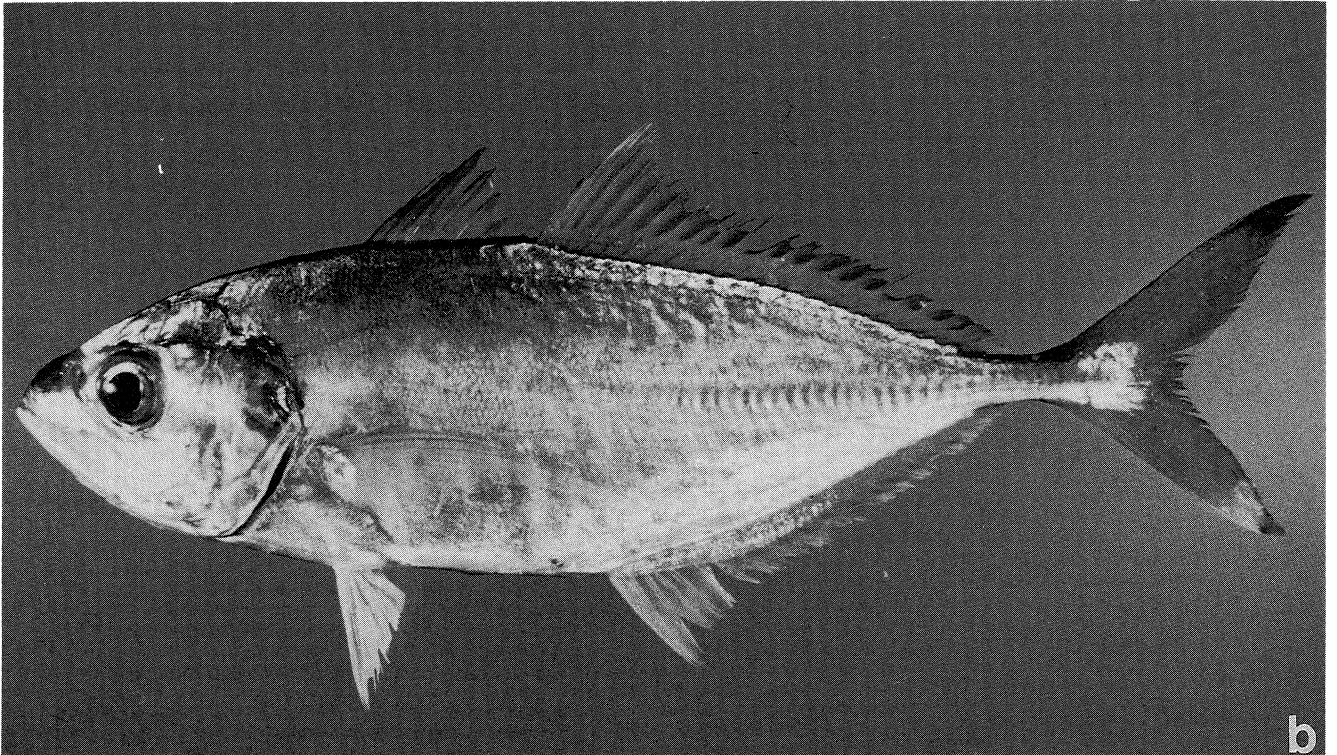
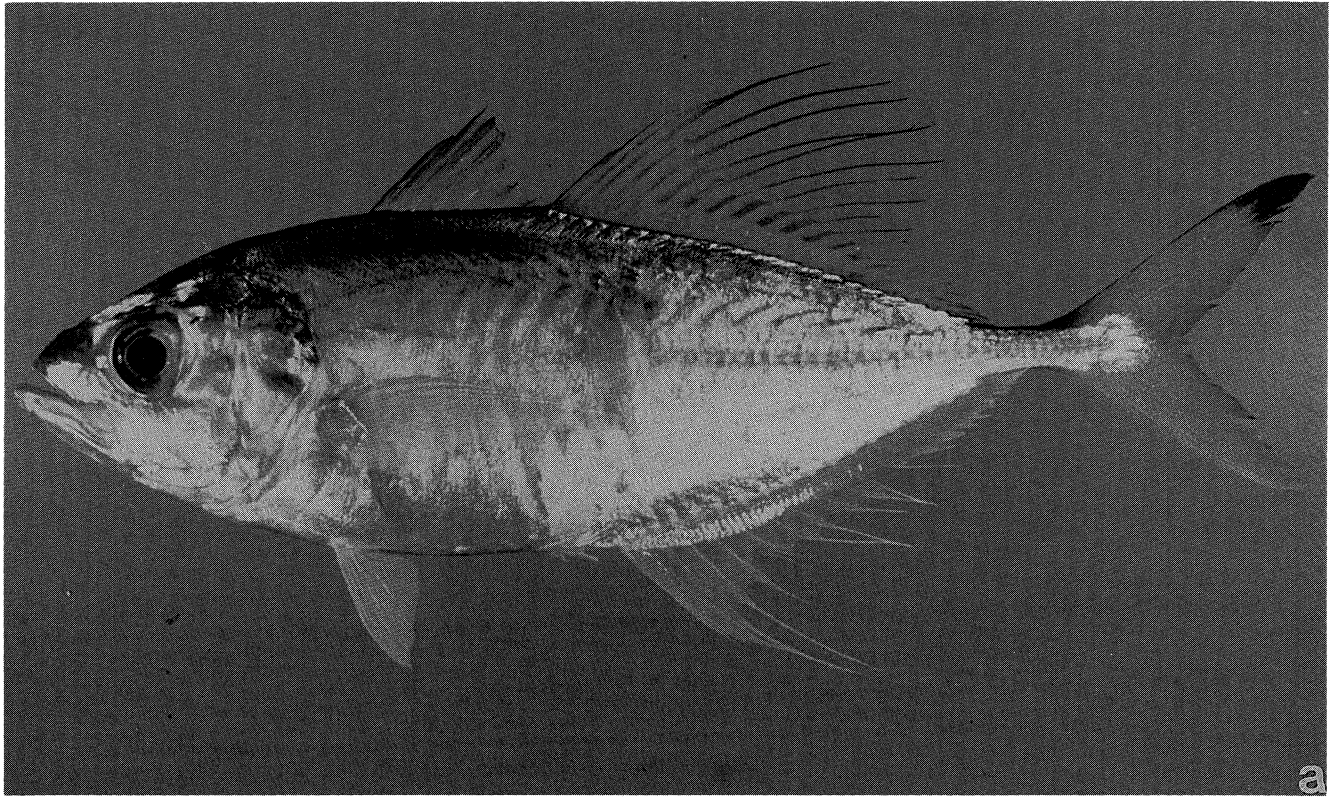


Plate 13. a: *Pantolabus radiatus* (male) — 16.7 cm LCF. b: *Pantolabus radiatus* (female) — 14.4 CM LCF.

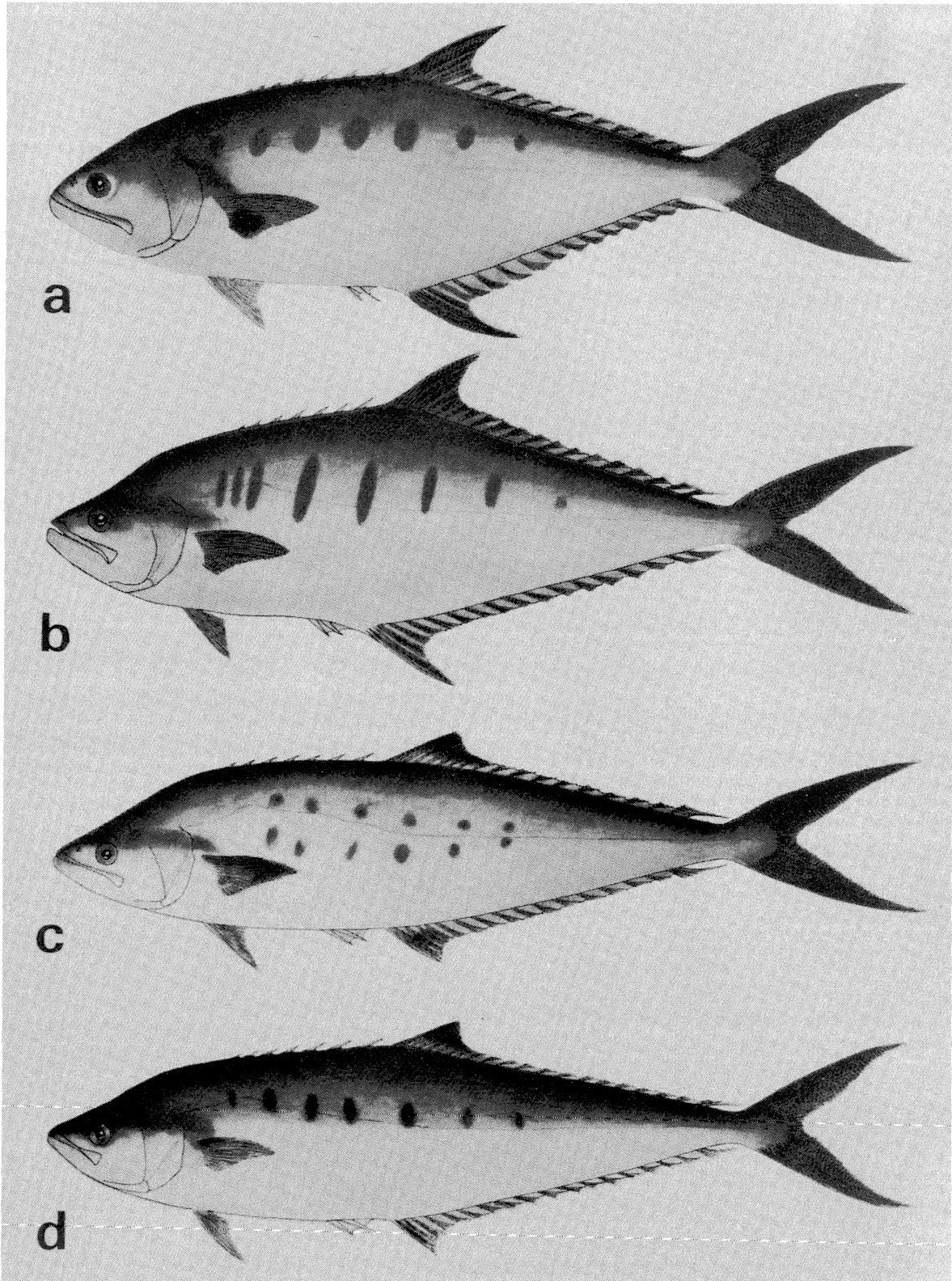


Plate 14. a: *Scomberoides commersonnianus* — 46.8 cm LCF. b: *Scomberoides tala* — 46.4 cm LCF. c: *Scomberoides lysan* — 52.3 cm LCF. d: *Scomberoides tol* — 45.0 cm LCF. (Plate 14 is a copy of original figures presented in Smith-Vaniz *et al.*, 1973, fig. 1).

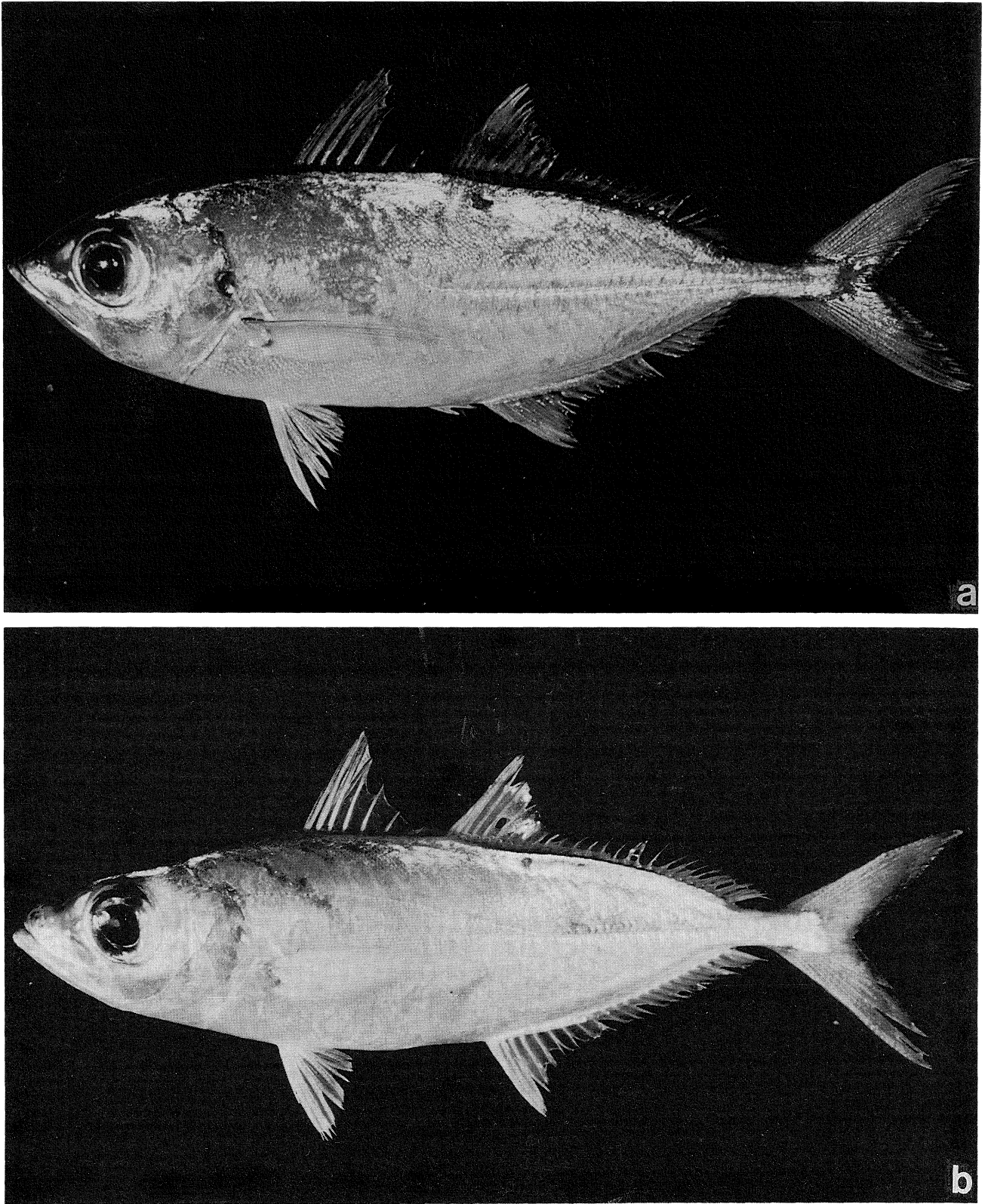


Plate 15. a: *Selar boops* — 15.6 cm LCF. b: *Selar crumenophthalmus* — 14.7 cm LCF.

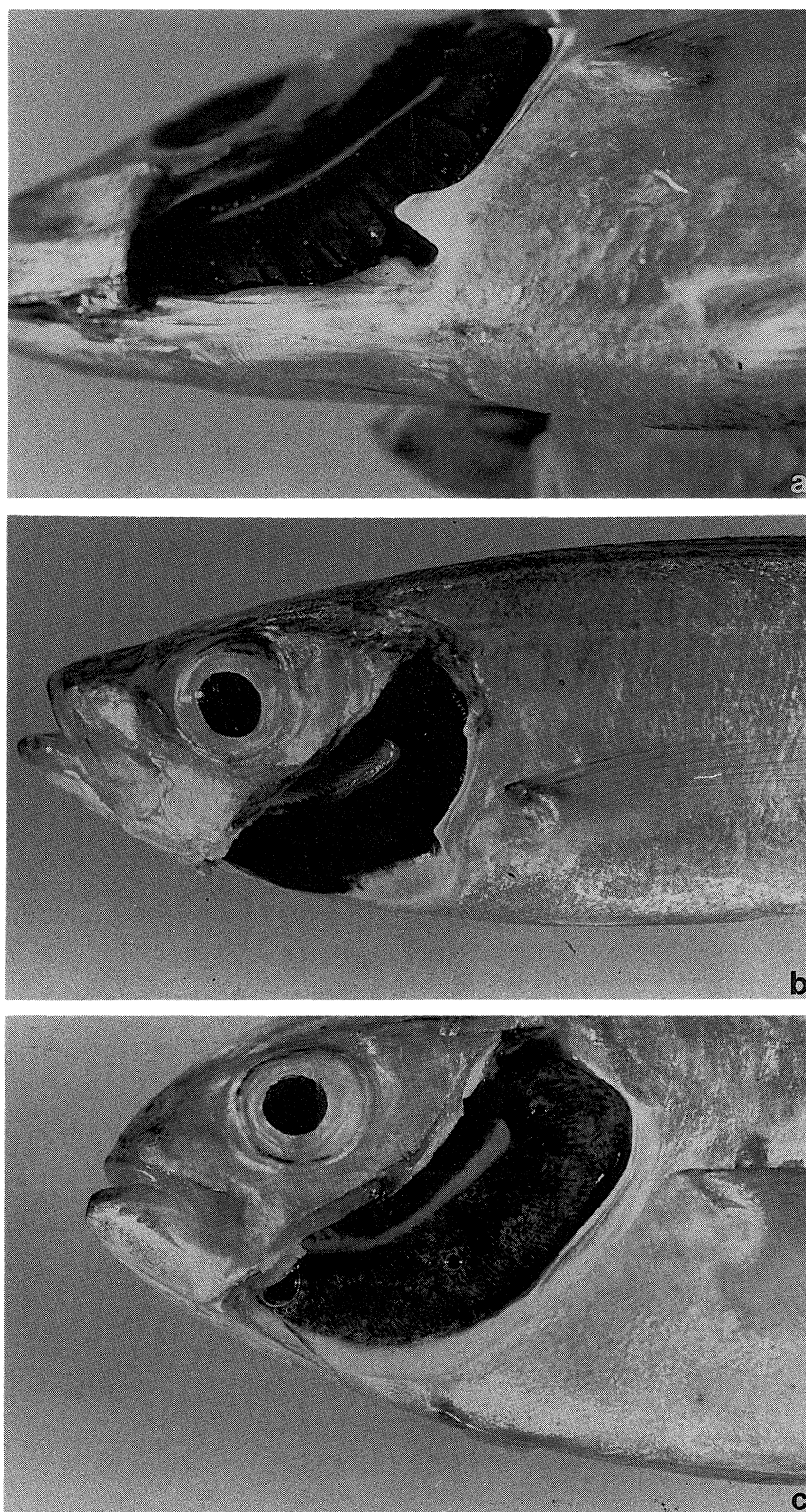


Plate 16. a: *Selar crumenophthalmus* gill opening. b: *Decapterus russellii* gill opening. c: *Alepes* sp. gill opening.

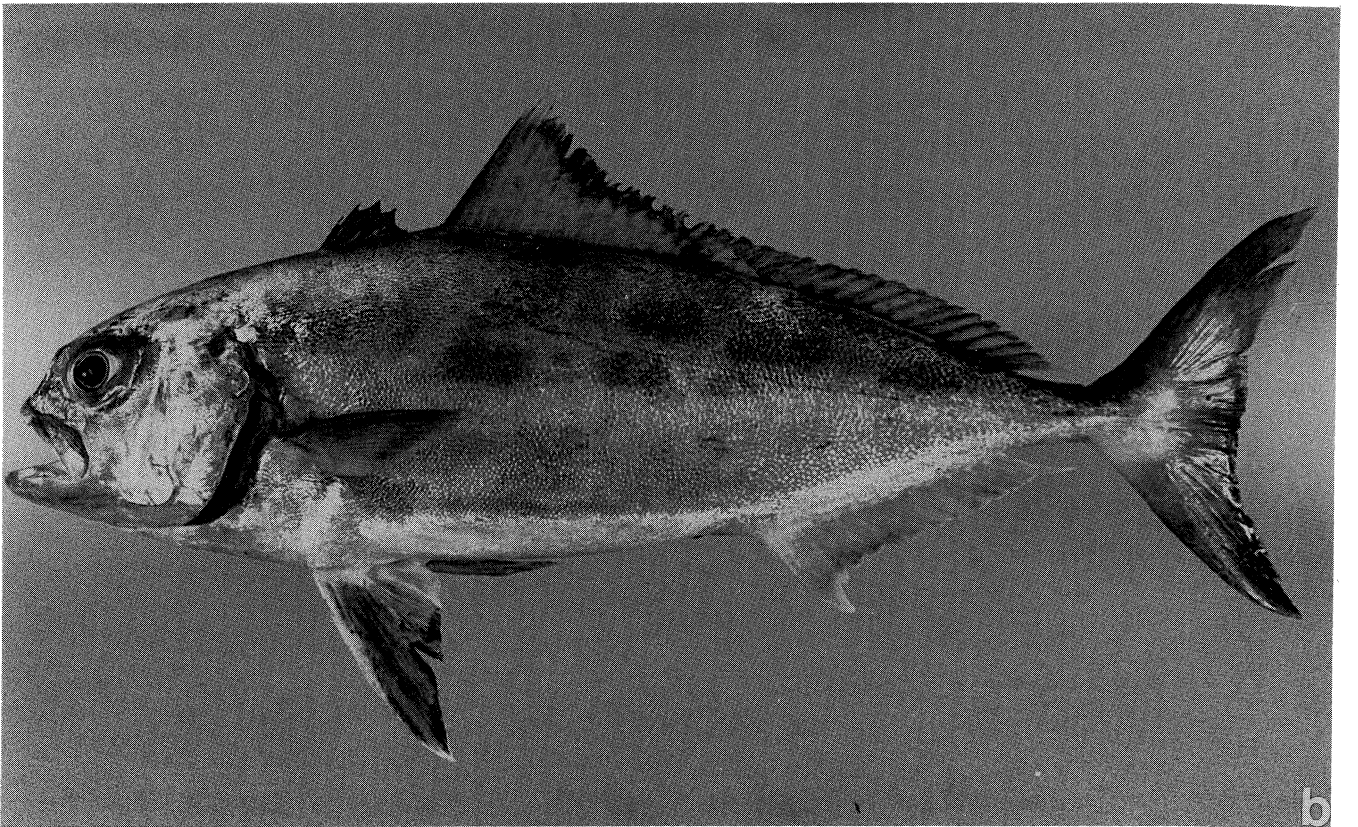
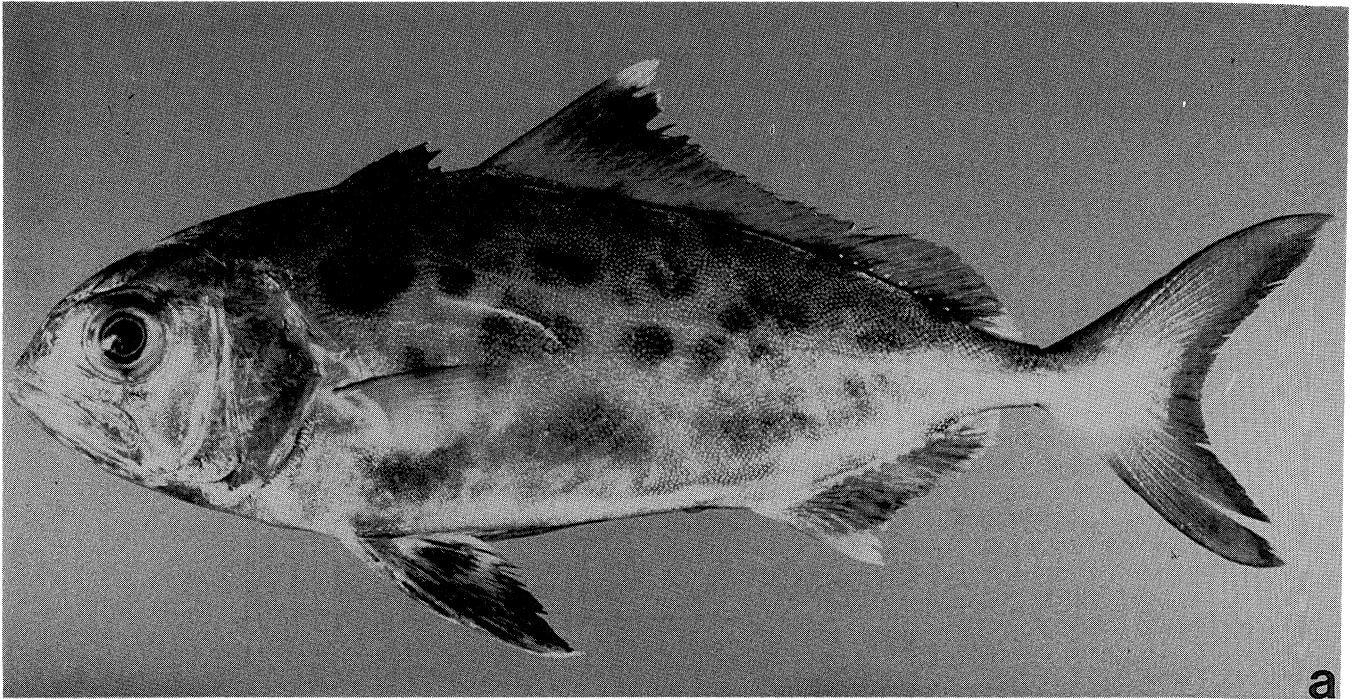


Plate 17. a: *Seriolina nigrofasciata* (juvenile) — 18.0 cm LCF. b: *Seriolina nigrofasciata* (adult) — 33.5 cm LCF.

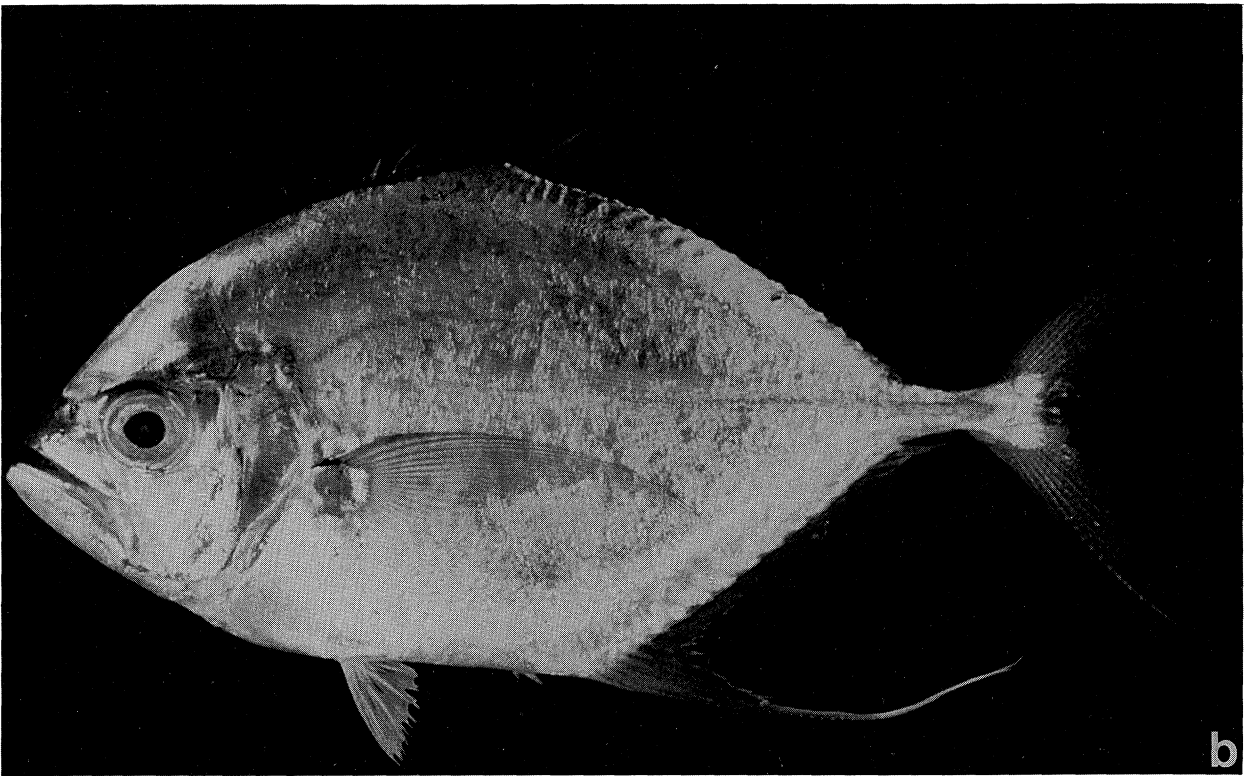
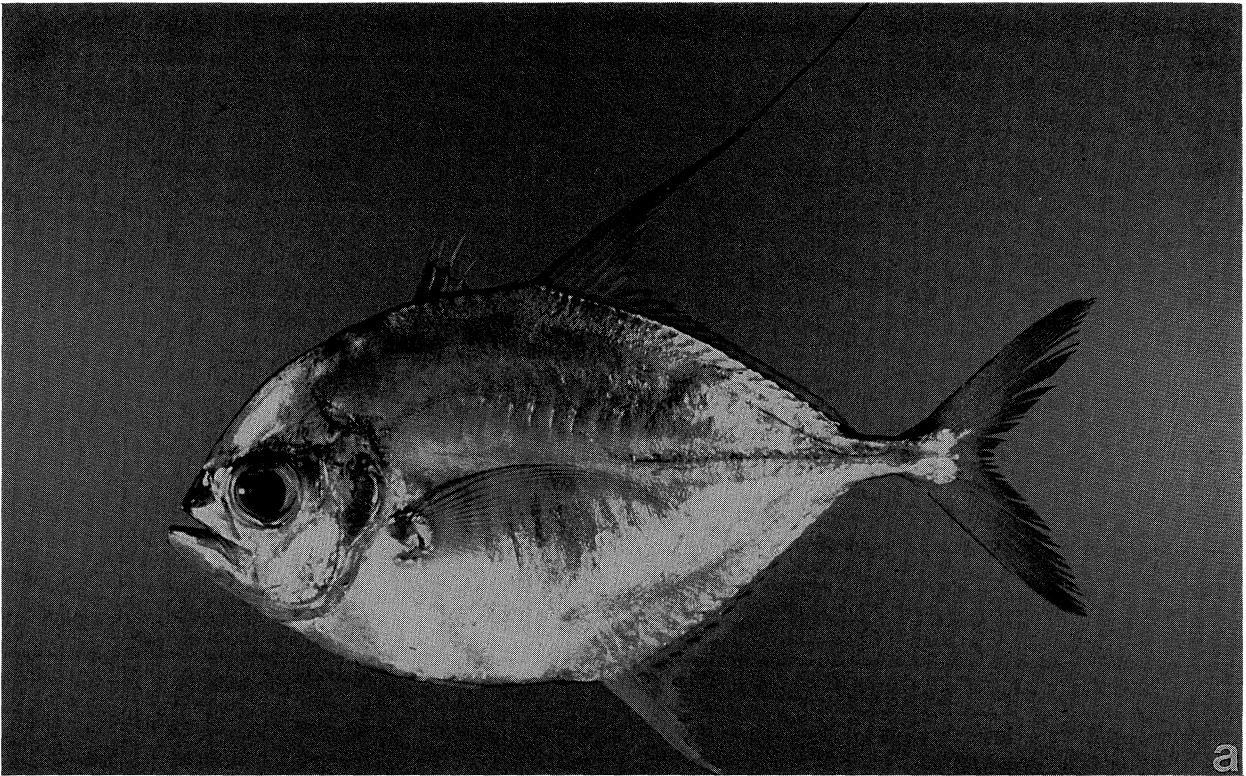


Plate 18. a: *Ulua aurochs* — 14.3 cm LCF. b: *Ulua mentalis* — 15.0 cm LCF.



Plate 19. *Uraspis secunda* — 27.9 cm LCF.

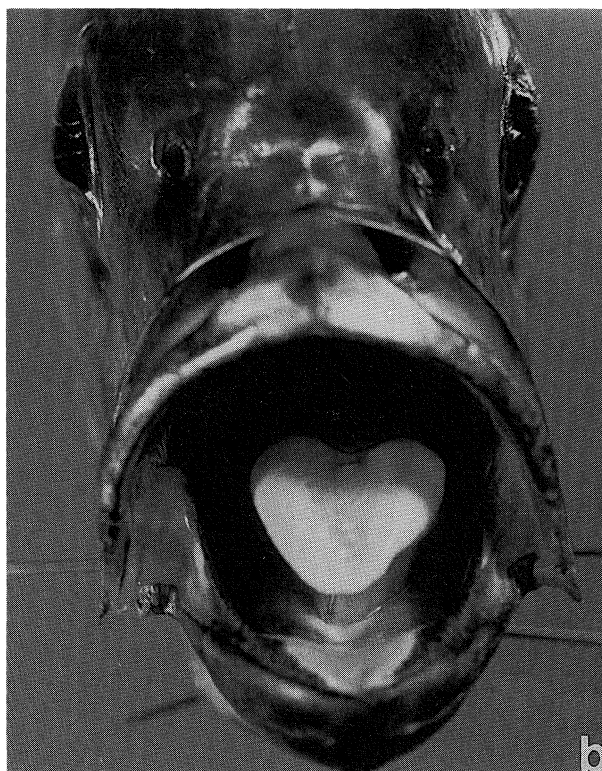
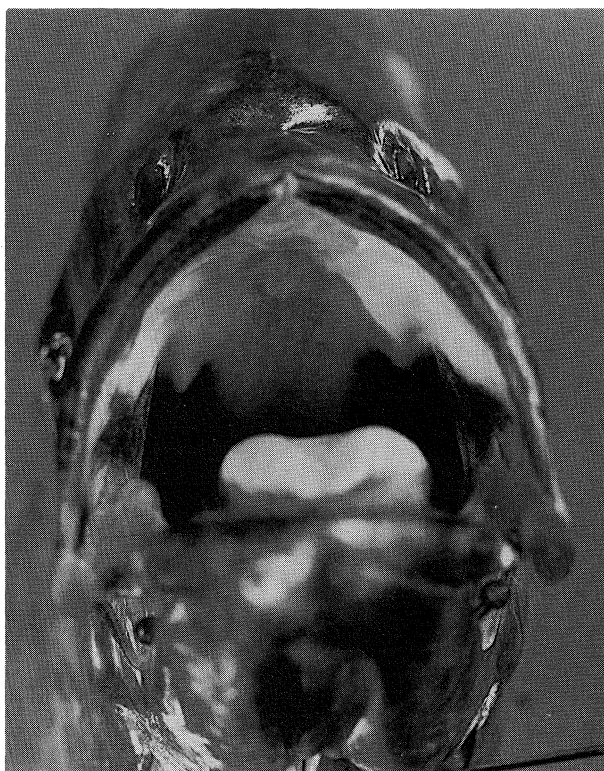


Plate 20. a: *Uraspis uraspis* — 22.2 cm LCF. b: *Uraspis uraspis* oral cavity.