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# Australian trevallies of the genus *Pseudocaranx* (Teleostei: Carangidae), with description of a new species from Western Australia

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**Abstract**

Smith-Vaniz W.F. and Jelks H.L. 2006. Australian trevallies of the genus *Pseudocaranx* (Teleostei: Carangidae), with description of a new species from Western Australia. *Memoirs of Museum Victoria* 63(1): 97–106.

*Pseudocaranx dinjerra* sp. nov. is described from Western Australia. It differs from the Australian endemic *Pseudocaranx wrighti* in having the posterior margin of the upper jaw nearly vertical, lachrymal without scales, 19–21 versus 24–28 lower gill rakers and 53–66 versus 37–48 scales in the curved part of the lateral line. The new species is distinguished from Australian populations of *P. georgianus* and "*dentex*" primarily by having a different combination of meristic values including 14 versus 15 caudal vertebra, 19–21 versus 21–24 segmented anal-fin rays and 58–75 versus 72–95 total lateral-line scales. Diagnoses are given for *P. wrighti* and *P. georgianus*, and specimens from Queensland and Lord Howe Island are discussed and provisionally identified as *P. dentex*.

**Keywords**

Carangidae, *Pseudocaranx*, new species, Western Australia, antitropical distribution

## Introduction

Carangid fishes of the genus *Pseudocaranx* Bleeker, 1863 occur in subtropical and warm temperate regions of the world's oceans with single species, *P. dentex* Bloch and Schneider, 1801 and *P. chilensis* Guichenot, 1848, present in the Atlantic and eastern Pacific oceans, respectively. In the Indo-west Pacific, the genus consists of a complex of species for which 13 names have been proposed, eight based on fish from Australia or New Zealand. Except for the Australian endemic *Pseudocaranx wrighti* Whitley, all of these species are very similar externally and their scientific names have been inconsistently used and frequently misapplied. Determining the taxonomic status of some disjunct and sympatric populations (e.g., Yamaoka et al., 1991; Masuda et al., 1995) will probably require both morphological and molecular data. Unraveling the evolutionary history of these carangids is also challenging because they have antitropical distributions that are not easily explained (Briggs, 1987) and is confounded by the Miocene origins of Indo-Pacific coral reef fish biodiversity, which predates Pleistocene glaciations (Read et al., 2006).

In the course of acquiring vertebral counts from a large series of *Pseudocaranx* from many localities, we observed that all specimens from both sides of the Atlantic Ocean have 15 caudal vertebrae and those from many relatively isolated locations in the Indo-Pacific consistently have either 14 or 15 caudal vertebrae. The discovery that *Pseudocaranx* species from Western Australia include taxa with either 14 or 15 caudal vertebrae and non-overlapping geographic distributions resulted in a re-evaluation of the taxonomic status of species that Paxton et al., 1989 and Smith-Vaniz, 1999 had referred to collectively as *P. dentex*. These fishes are herein recognized as *P. georgianus* Cuvier and a new species *P. dinjerra*, respectively. Identification of the *Pseudocaranx* species that occurs off southern Queensland and at Lord Howe Island is unresolved and is here tentatively referred to as *Pseudocaranx* sp. "*dentex*".

In their review of *P. georgianus* from temperate Australasian waters, James and Stephenson, 1974 concluded that only one species was represented but observed that some collections from southern Australia contained two groups of fish each having either 24 or 25 total vertebrae and different proportions (body depth, snout/head lengths and eye diameter). Re-examination of most of the specimens available for their study revealed that all of those with 24 vertebrae are *P. wrighti* (species not mentioned by them) and that those with 25 vertebrae are *P. georgianus*. Although James and Stephenson, 1974 failed to appreciate a number of additional characters that distinguish these two species, they correctly reported that specimens from Norfolk and Kermadec (Raoul) Is. consistently have 14 caudal (24 total) vertebrae, as do most of those from North Cape, New Zealand. Determination of the taxonomic status of these extralimital fish is beyond the scope of the present study; however, they definitely are neither *P. dinjerra* nor *P. wrighti*.

## Material and methods

Museum abbreviations follow Leviton et al., 1985. In the material examined sections, specimen sizes are given as mm fork length (FL) and cleared and stained specimens are indicated as "C&S"; parenthetical expressions present number of specimens, if more than one, followed by size range. Localities are abbreviated and listed by major geographic areas. Scutes are defined as scales that have a raised horizontal ridge on their posterior margin with a small to moderate projecting spine ending in a point not exceeding a 120° angle. All scutes are counted, including those on the caudal-fin base. Pectoral-ray counts do not include the dorsal-most spine-like element. Gill-raker counts are from the first gill arch (usually on the right side), with the raker at the angle included in the lower-limb count; rudimentary gill rakers are defined as tubercles or short rakers with the diameter of their bases greater than their height. Measurements were analyzed using a sheared principal component analysis (PCA) following Rohlf and Bookstein, 1987. The following 22 point-to-point measurements were taken for the relatively few specimens ≥ 200 mm FL: fork length (FL) from tip of snout to tip of shortest median caudal-fin ray; snout to origin of first dorsal fin (D1O); snout to origin of second dorsal fin (D2O); snout to origin of pelvic fin (P2O); snout to origin of first anal-fin spine (A1O); length of dorsal-fin base; length of anal-fin base; D1O to P2O; D1O to origin of second dorsal fin (A2O); D2O to A2O; D2O to A1O; height of dorsal-fin lobe; height of anal-fin lobe; pelvic fin length; pectoral fin length; length of curved part of lateral line (CLL), measured as a cord (straight-line distance) of the arch extending from the upper edge of the opercle to its junction with the straight part; length of straight part of lateral line (SLL), measured from its junction with the curved part to its termination on the caudal-fin base (end of last scute); head length from tip of snout to posterior margin of the opercular flap; postorbital head length from posterior margin of orbit to posterior margin of the opercular flap; upper jaw length is from the snout tip to posterior end of maxilla; eye diameter is the horizontal diameter of the orbit.

### *Pseudocaranx* Bleeker

*Pseudocaranx* Bleeker, 1863: 82.

Type species. *Scomber dentex* Bloch and Schneider, 1801, by subsequent designation of Fowler, 1936: 692.

*Remarks.* These fishes are presumed to comprise a monophyletic group, but the most appropriate generic classification for them is uncertain pending a well collaborated phylogeny of carangines. *Citula* Cuvier, 1816 (type species *Citula banksii* Risso, 1820 [= *P. dentex*] by subsequent monotypy) is an available senior synonym of *Pseudocaranx* (type species *Scomber dentex*) but this generic name has not been used for a nominal species of the group since Risso's description. In the interest of nomenclatural stability, the junior name should continue to be used pending a petition to the International Commission of Zoological Nomenclature to conserve the more familiar generic name. Other more recent synonyms of *Pseudocaranx* are *Longirostrum* Wakiya, 1924, *Usa* (as a subgenus of *Caranx*) Whitley, 1927, and *Usacaranx* Whitley, 1931. Within the Caranginae, *Pseudocaranx* and *Caranx equula* Temminck and Schlegel, 1844, which Kijima et al., 1986 and Gushiken, 1988 assign to the monotypic genus *Kaiwarinus* Suzuki, 1962, are exceptional in having very poorly developed inferior vertebral foramina, and may be a sister taxa.

### Key to Australian species of *Pseudocaranx*

1. Posterior margin of upper jaw canted posteroventrally (fig. 1A); scales present on lachrymal; lower limb gill rakers 24–28; scales in curved portion of lateral line 37–48 (eastern Bass Strait to Exmouth Gulf, WA) ..... *P. wrighti*
— Posterior margin of upper jaw nearly vertical (fig. 1B); no scales on lachrymal; lower limb gill rakers 19–23 (except 24–27 in fish from Qld and Lord Howe I., where *P. wrighti* does not occur); scales in curved portion of lateral line 53–80 ..... 2
2. Segmented anal-fin rays 19–21; total lateral-line scales 58–75, rarely >71; caudal vertebrae 14 (Houtman Abrolhos to North West Cape, WA) ..... *P. dinjerra*
— Segmented anal-fin rays 21–24 (rarely 21); total lateral-line scales 72–95, rarely <74; caudal vertebrae 15 ..... 3
3. Lower limb and total gill rakers 19–23 and 28–35 (rarely 35), respectively (New Zealand and NSW to Lancelin I., WA) ..... *P. georgianus*
— Lower limb and total gill rakers 24–27 and 36–41 (rarely 36), respectively (southern Qld, Australia and Lord Howe I.) ..... *P.* sp. *"dentex"*

### *Pseudocaranx dinjerra* sp. nov.

Figures 2, 3A, 4, 5; Tables 1–3

*Pseudocaranx dentex* (non Bloch and Schneider) in: Allen and Swainston, 1988: 74, fig. 447 (misident., in part, brief descr.) in: Hutchins, 1990: 270 (listed; Shark Bay); Hutchins, 1997: 247 (listed; Houtman Abrolhos).

*Material examined.* Holotype. NMV A.1962 (245), SW of Shark Bay, 25°28'S, 112°27'E, 25°19'S, 112°17'E; trawled in 131–139 m; M.F. Gomon; sta. MFG-71; 4 Mar 1981.

Paratypes. 38 specimens, 77–230 mm FL. ANSP 148695 (2, 221–230), off Cape Farquhar, 23°42'S, 113°01'E, 23°48'S, 112°58'E; trawled in 156–160 m; M/V TM 71; 13 Sep 1979. WAM P.22338 (217), Cape Cuvier, 24°13'S, 113°23'E; J. Penn; 29 Jul 1972. ANSP 148696 (20, 77–92) and USNM 385866 (15, 81–95.5), Houtman Abrolhos, Hummock I., 28°48'S, 114°02'E, trawled in 43 m; Nov 1980.

*Diagnosis.* A species of *Pseudocaranx* with posterior margin of upper jaw nearly vertical; lachrymal naked and expanded part of maxilla only partially covered with scales; caudal vertebra 14; gill rakers 7–10 upper, 19–21 lower, 27–31 total; scales in curved part of lateral line 53–66.

*Description* (values for holotype in parentheses). Dorsal fin rays VIII-I, (25) 23–25; anal-fin rays II-I, (21) 19–21; pectoral-fin rays (19) 18–20; vertebra 10 precaudal + 14 caudal; inferior vertebral foramina on caudal vertebra 7 or 8–10; scales in curved lateral line (61) 53–66; scales in straight LL (2) 2–11; scutes in straight LL (30) 19–31; total scales in LL (63) 58–74; total scales + scutes in LL (93) 86–99; developed gill rakers (8) 7–10 upper, (20) 19–21 lower, (28) 27–31 total, a single rudimentary raker rarely present on either end of gill arch.

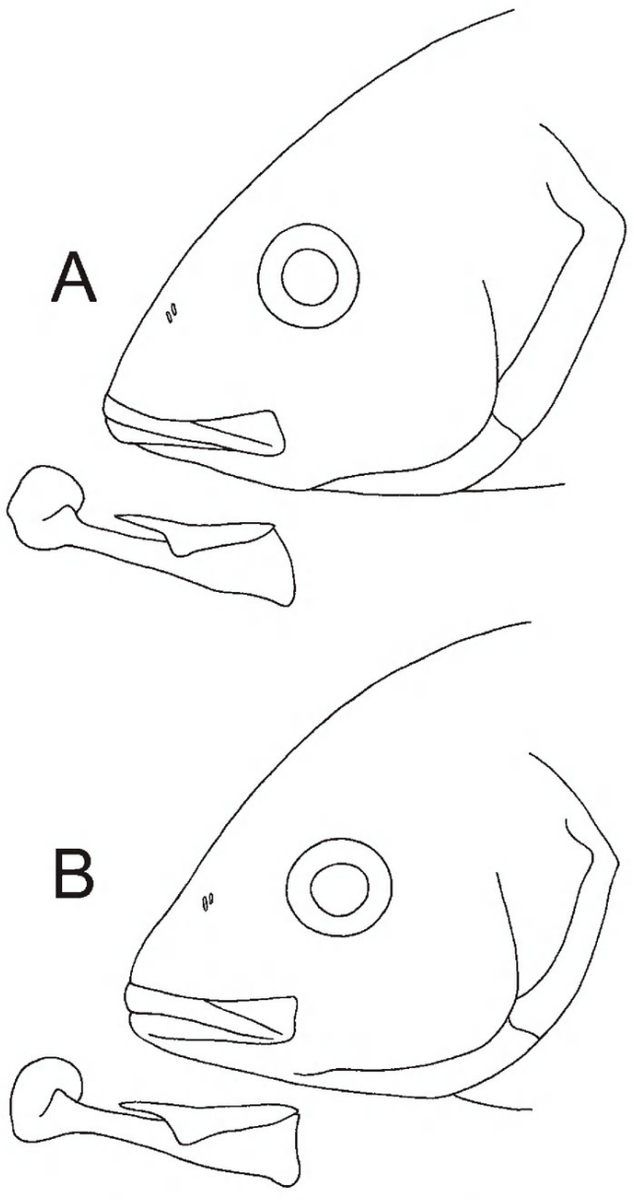


Figure 1. Head profiles and upper jaw shapes of *Pseudocaranx*: A, *P. wrighti*, ANSP 135418, 169 mm FL, Cockburn Sound, WA; B, *P. georgianus*, ANSP 138196, 200 mm FL, Cape Arid, WA.

Chest completely scaly; bases of dorsal and anal fins with a wide scaly sheath anteriorly; lachrymal naked; dorsal 3rd to half of expanded part of maxilla with a few embedded scales; cheeks, preopercle, opercle and interopercle covered with scales. Junction of curved and straight parts of lateral line below segmented dorsal-fin rays (13) 12–13; length of curved LL (0.57) 0.62–0.65 in straight LL; 1st dorsal-fin spines weak, the 3rd spine longest and slightly longer than height of 2nd dorsal-fin lobe; last dorsal- and anal-fin rays slightly longer and more widely spaced than adjacent rays; 1st anal-fin pterygiophore with anteroventral end short and bluntly rounded; 2nd dorsal-fin lobe (3.1) 2.8–3.1 in head length; pectoral fin of holotype and larger paratypes (0.94) 0.91–0.94 in head length. Upper jaw (2.7) 2.8–2.9 in head length, ending slightly in front of anterior margin of eye (fig. 3A); adipose eyelid weakly developed; lips slightly thickened and finely papillose. Jaw teeth (difficult to see clearly without dissection) in the holotype and 2 largest paratypes: upper jaw with a single row (21 left, 22 right) 19–22 of small conical teeth and (0) 1 inner tooth near symphysis; lower jaw with an outer row (21 left, 22 right) 25–27 of small conical teeth and an irregular inner row (11 left, 8 right) 13–18 of conical teeth on posterior half of jaw. (Based on observed changes in dentition with growth in other *Pseudocaranx* species, it is likely that an inner row of dentary teeth is absent in individuals of *P. dinjerra* larger than the holotype.) Vomerine tooth patch triangular-shaped, without a median posterior extension, and sparsely covered with small teeth.

Measurements of the holotype (in parentheses) and 2 paratypes, 221–230 mm, as percentages of FL: snout to D1O (39) 41–42; snout to D2O (54) 56; snout to P2O (35) 34–35; snout to A2O (57) 57; D1O to P2O (30) 30; D1O to A2O (39) 39–41; D2O to A1O (32) 33–35; D2O to A2O (32) 33–35; D2 base (35) 35–37; A2 base (31) 30–31; height dorsal-fin lobe (10) 10–11; height anal-fin lobe (10) 9–10; pelvic-fin length (15) 14–15; pectoral-fin length (33) 34; head length (31) 31–32; postorbital head length (12) 12–13; snout length (12) 12; upper jaw length (11) 11; eye diameter (7) 7–8; curved lateral-line length (24) 24–25; and straight lateral-line length (24) 24–25.

*Preserved coloration.* Holotype and larger paratypes uniformly pigmented, except spinous dorsal fin slightly dusky and opercle with a prominent dark pupil-sized spot at level of pupil. Juveniles with 7–9 dusky bands on body, extending ventrally from dorsum and fading out on ventral half of sides. Bands widest dorsally and equal or slightly wider than pale interspaces at mid-level of side. Dark opercular spot, intense, smaller than pupil and slightly vertically elongate. Inter-radial membranes of 1st dorsal fin dusky, densely peppered with small melanophores.

Life coloration (from an underwater photograph, probably of a subadult, from Shark Bay provided by J.B. Hutchins). Silvery blue-green dorsally, fading to silvery with iridescence below, faint mid-lateral yellow stripe from opercle to base of caudal fin; faint yellow stripe on base of dorsal fin extending slightly onto dorsum; prominent black spot on opercle at level of the pupil, approximately diameter of pupil and vertically elongate.

*Distribution.* Endemic to WA (fig. 4). Definitely known from Houtman Abrolhos (28°48'S) to off Cape Farquhar (23°42'S), and reported (Allen and Swainston, 1988) to North-West Cape (~21°47'S), but rare north of Shark Bay. Several photographs of *Pseudocaranx* taken by J.B. Hutchins off Green Head, WA (30°04'S) are tentatively identified as *P. dinjerra* based on the tiny size of the opercular spot. We know of no collections of *P. dinjerra* from well-sampled Rottnest I. (Hutchins and Pearce, 1994), located at 32°S, where both *P. wrighti* and *georgianus* occur; but its occurrence there might be expected.

Dispersal of temperate and subtropical species along the north-west coast of Australia is believed to be aided by counter-currents flowing inshore of the southward-flowing warm Leeuwin

Figure 2. *Pseudocaranx dinjerra*, Shark Bay, WA; photograph by J. B. Hutchins.

Current. Fluctuations of this current regimen – associated with glacial and interglacial periods may have contributed to reproductive isolation and eventual speciation of Western Australian endemic subtropical species (Hutchins, 1994; Hutchins, 2001a), presumably including the new *Pseudocaranx*.

*Etymology*. The trivial name dinjerra (west) is an Aboriginal word (Anon, 1969), in reference to the Western Australian endemic status of the species, and should be treated as an appositional noun.

*Remarks*. This species is most similar to *Pseudocaranx georgianus* but differs in having 14 caudal vertebra, and little overlap in number of anal-fin rays (Table 1) and total lateral-line scales (Table 3). Sheared PCA (fig. 5) revealed good separation of the three analyzed taxa. Although 11 of the 15 specimens of *P. georgianus* used in the analysis were obtained from the Sydney Fish Market, according to Kailola et al., 1993 the main commercial fishery is located in New South Wales waters where this species appears to be resident and non-migratory. *Pseudocaranx dinjerra* has a relatively longer snout and upper jaw (PC2) and shorter straight lateral line (PC3) than *P. georgianus* and *P.* sp. "*dentex*". However, fork length (PC1) accounted for 97.5% of the variation, while only 1.7% was associated with PC2 and PC3. Differences were subtle, yet consistent in the three groups.

Other than *P. wrighti*, the only other previously described Indo-Pacific *Pseudocaranx* with 14 caudal vertebra is *P. cheilio* Snyder, 1904, described from Honolulu, Hawaii. As mentioned in the introduction, at many locations in the Indo-west Pacific (including Hawaii and Easter Island) *Pseudocaranx* spp. invariably have either 14 or 15 precaudal vertebrae. In contrast, Yamaoka et al., 1991 found two distinct genetic morphs (identified by electrophoretic analysis) of "*P. dentex*" in Tosa Bay, Japan, each with different vertebral counts. The two morphs had strongly bimodal dorsal ray counts and the juveniles of one morph also appeared to have more distinct narrow bands on the body, leading these authors to strongly suspect that two species were involved. Masuda et al., 1995 also found significant mtDNA differences between the same two sympatric Japanese *Pseudocaranx* morphs. They implied that differences in spawning and recruitment locations and associated water temperatures may have affected the number of vertebrae. Vertebral counts are intraspecifically very constant in all other carangid genera (including 130+ species), so the situation in *Pseudocaranx* is very interesting if these morphs are not different species. Neither of the Japanese studies considered gill raker numbers, but our limited data indicate that they also differ between these two morphs. *Pseudocaranx cheilio* from Hawaii and the Japanese morph with 14 caudal vertebrae have higher numbers of lower gill rakers, 27–30 versus 19–21 in *P. dinjerra*.

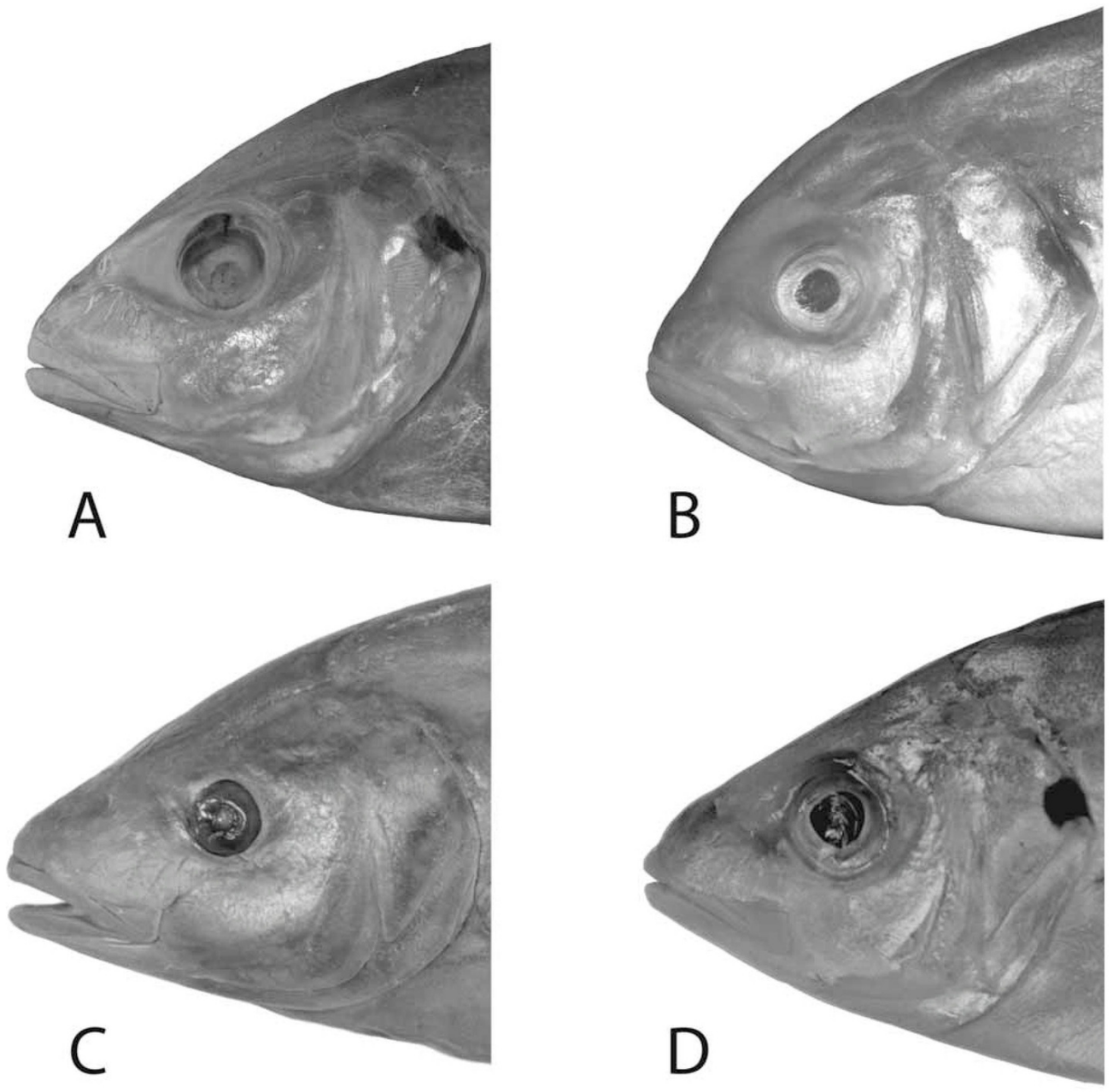


Figure 3. Heads of *Pseudocaranx* species: A, *P. dinjerra*, ANSP 148695, 230 mm FL, Cape Farquhar, WA; B, *P. georgianus*, USNM 385513, 275 mm FL, Sydney Fish Market; C, *P.* "*dentex*", CAS 16472, 404 mm FL, One Tree I.; D, *P. wrighti*, WAM P.14007-18, 124 mm FL, Rottnest I.

***Pseudocaranx georgianus*** Cuvier, 1833

Figures 1B, 3B, 4, 5; Tables 1–3

*Caranx georgianus* Cuvier in Cuvier and Valenciennes, 1833: 85 (orig. descr. King George Sound, WA; syntypes MNHN 5854); Ogilby, 1893: 80, pl. 24 (descr.; biology; fisheries; edibility); James and Stephenson, 1974: 402, fig. 2 (taxonomic status; synonymy; descr. based, in part, on *Pseudocaranx wrighti*); Hutchins, 1979: 38, color pl. 21 (Rottnest I.; behaviour; distrib.); Smith-Vaniz et al., 1979: 12 (syntypes listed).

*Caranx platessa* Cuvier in Cuvier and Valenciennes, 1833: 84 (orig. descr. "La mer des Indes;" holotype MNHN 5856); Günther, 1860: 440 (as first reviser, listed in synonymy of *C. georgianus*); James and Stephenson, 1974: 402, fig. 3 (discussion of type locality, probably Geographe Bay, WA; considered to be a synonym of *C. georgianus*); Smith-Vaniz et al., 1979: 17 (holotype listed).

*Caranx nobilis* Macleay, 1881: 532 (orig. descr. Port Jackson, NSW, Australia; holotype MAMU, apparently lost).

*Usacaranx archeyi* Griffin, 1932: 130, pl. 22 (orig. descr. North side of Motuihi I., Hauraki Gulf, New Zealand; Holotype AIM 262).

*Usacaranx georgianus*. Roughley, 1951: 57, color pl. 22 (biology and fisheries); Scott et al., 1974: 201, unnumb. fig. (desc.; distrib.).

*Pseudocaranx dentex* (non Bloch and Schneider). May and Maxwell, 1986: 300, unnumb. color photo. (descr.; common name;

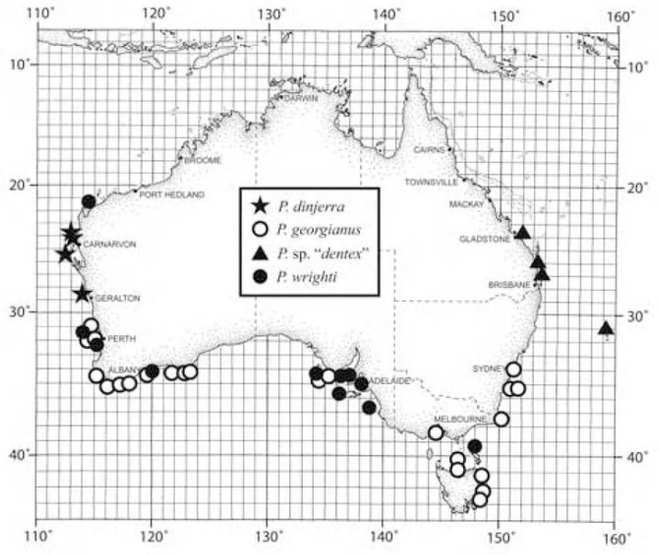


Figure 4. Australian distributions of *Pseudocaranx* species based on material examined.

distrib.); Okiyama, 1988: 474, unnumb. pl. (descr.; early stage); Paxton et al., 1989: 582 (partial synonymy; distrib. in part, includes range of *P. dinjerra*); Kuiter, 1993: 176, unnumb. color photos (descr.; distrib.; in part, includes ranges of other spp.); Gomon et al., 1994: 584, unnumb. color photos (descr.; distrib.; partial synonymy); Smith-Vaniz, 1999: 2730 (descr.; synonymy; distrib. in part, includes ranges of other spp.); Hutchins, 2001b: 33 (listed).

*Material examined.* 111 specimens, 45–495 mm FL. WAM P.14755 (170), 0.8 km E. Lancelin I., 31°33'S, 115°19'E. WAM P.14054 (187) and WAM P.14762-3 (2, 122–132), Rottnest I. ANSP 148694 (234) and ANSP 178913 (3, 170–186) Perth vicinity. AMNH 55688 (2, 187–200) and ANSP 135419 (2, 145–139), Fremantle, Cockburn Sound. MNHN 5856 (217), holotype of *Caranx platessa*, "mer des Indies," probably Geographe Bay. WAM P.25064-004 (4, 45–90), Hardy Inlet. WAM P.20253 (193), Broke Inlet. WAM P.21824-25 (2, 160–162), Cherryup, 34°58'S, 117°26'E. WAM P.20026 (219), Wilson Inlet. MNHN 5854 (2, 142–166), syntypes of *Caranx georgianus*, King George Sound. AMS IA.653 (210), Albany, King George Sound. WAM P.21673 (193), Brewer Bay, 34°24'S, 119°26'E. WAM P.21681 (153), Stokes Inlet. ANSP 148693 (2, 102–174) and ANSP 148697 (7, 72–132), Duke of Orleans Bay. ANSP 138196 (2, 193–200), Cape Arid. ANSP 138194 (189) and ANSP 138195 (2, 114–170), Isralite Bay. ANSP 138197 (192), Coffin Bay. ANSP 49316-18 (3, 181–185), Melbourne. ANSP 135420 (82 C&S), TMH D.197 (132), TMH D.530 (4, 90–108), TMH D.531 (189), TMH D.774 (272), TMH D.830 (187), TMH D.1029 (67), USNM 222104 (15, 140–227), Tasmania. BMNH 1896.6.17.49-52 (4, 135–495), Flinders I., 33°43'S, 134°31'E. AMS I.19890-002 (3, 201–263), Nadgee Nature Reserve, 37°26'S, 149°54'E. AMS I.28734-002 (4, 191–210), Green Cape, Bittangabee Bay. ANSP 153525 (8, 156–180) Jervis Bay. USNM 177016 (2, 255–294), New South Wales, no specific locality. ANSP 138198 (2, 220–246), ANSP 147861 (2, 265–276), ANSP 153773 (6, 315–378), USNM 385513 (275), Sydney Fish Market. ANSP 135421 (2, 94–95 C&S), CAS-SU 7433 (2, 149–150), CAS-SU 8321 (163) Sydney. ANSP 147826 (2, 144–162) 24 km E. Sydney Harbour. AIM 262 (88), holotype of *Usacaranx archeyi*, N side of Motuihi I., Hauraki Gulf, New Zealand.

*Diagnosis.* A species of *Pseudocaranx* with posterior margin of upper jaw nearly vertical (fig. 1B); lachrymal naked and expanded part of maxilla naked or with a few partially embedded scales; caudal vertebra 15; gill rakers 8–13 upper, 19–23 lower, 28–35 total; scales in curved part of lateral line 55–78.

*Distribution.* Known from New Zealand and the southern half of Australia from NSW to just north of Perth, WA, including Rottnest I.

*Remarks. Pseudocaranx dentex,* described from Brazil, is the oldest available name for any species of *Pseudocaranx* while *P. georgianus* is the oldest name for a nominal species with an Indo-Pacific type locality. The type specimens of both species have 15 caudal vertebrae, as do all specimens from the Atlantic and western Indian Oceans and some from Japan. Australian specimens with the same vertebral count have fewer total gill rakers (except those from Queensland and Lord Howe Island, see Table 2) than do specimens from the latter localities, which have 35–42 gill rakers. Unlike similarly sized specimens of *P. dentex* from widely separate Atlantic localities, large adults (>350 mm FL) from southern Australia and New Zealand usually have a pronounced hump on their foreheads that is correlated with hyperostosis of the supraoccipital bone, do not have blunt snouts (see following remarks), and the dark opercular spot, although variable in size and shape, is also usually diffuse and noticeably larger than the pupil diameter. Because of these differences, *P. georgianus* is here recognized as a valid species.

***Pseudocaranx*** sp. "dentex"

Figures 3C, 4, 5; Tables 1–3

? *Scomber dentex* Bloch and Schneider, 1801: 30 (orig. descr.; Rio de Janeiro, Brazil; holotype ZMB 14112).

? *Usacaranx insulanorum* Whitley, 1937: 223, pl. 13, fig. 2 (orig. descr.; Elizabeth Reef; holotype lost).

*Caranx nobilis*. Grant, 1982: 302, color pl. 147 (brief descr., Qld).

*Pseudocaranx dentex*. Randall et al., 1990: 164 (misident. in part; brief descr.).

*Material examined.* 38 specimens, 162–860 mm FL. Qld, Australia: CAS 16472 (7, 404–432), One Tree I.; QMB I.13732 (321), Noosa, 26°23'S, 153°07'E; QMB I.19416 (296), Cape Moreton. Lord Howe I.: AMS I.5761-001 (673); AMS I.7395-006 (18, 162–199); AMS I.17178-045 (195); AMS I.17395-015 (2, 181–197); AMS I.23674-001 (860); CAS-SU 9158 (2, 170–198); BPBM 14833 (4, 145–210).

*Remarks.* Unlike *P. georgianus* from southern Australia and New Zealand, no evidence of hyperostosis of the supraoccipital is apparent in any of the large specimens available from One Tree I. In addition to having more gill rakers (Table 2), adults from off Queensland and Lord Howe Island do not have the blunt snouts (fig. 3B) that are characteristic of many large individuals from New Zealand (Ayling and Cox, 1982, pl. 19) and southern Australia (Ogilby, 1893, pl. 24). As discussed under "Remarks" for *P. dinjerra*, sheared PCA analysis revealed consistent but subtle differences between all three *Pseudocaranx* groupings (fig. 5).

The fish from Queensland and Lord Howe Island listed above likely represent a fourth Australian *Pseudocaranx* species but final determination requires additional study, especially

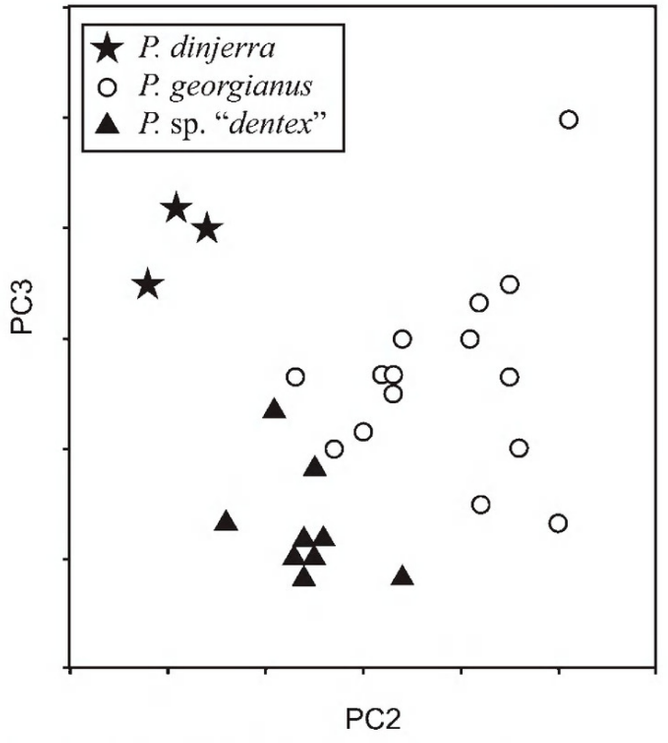


Figure 5. Sheared principal component analysis of 22 measurements for 3 *Pseudocaranx* taxa. PC2 loadings were associated with snout and upper jaw lengths, while PC3 was associated with straight lateral line and anal-fin base lengths; see Material and methods section for discussion of measurements used.

mitochondrial DNA analyses. James, 1980 reported limited movement of tagged *Pseudocaranx* off north-east New Zealand, so it is possible that fish from Queensland and Lord Howe Island are isolated from those in southern Australia and New Zealand. We are currently unable to distinguish them from *P. dentex* from the Atlantic Ocean and South Africa, or from Japan *Pseudocaranx* sp. with 15 caudal vertebra. Two other antitropical Indo-Pacific carangids, *Seriola lalandi* Valenciennes and "*Caranx*" *equula*, also have similarly wide disjunct distributions, so this zoogeographic pattern is not unique. If Atlantic *Pseudocaranx* are indeed conspecific with those from Queensland offshore reefs and Lord Howe Island, then the oldest available name for them is *P. dentex*. If a different scientific name is required, one possibility is *Usacaranx insulanorum* Whitley. That nominal species was described (Whitley, 1937) from Elizabeth Reef based on a single individual. Unfortunately, the holotype is not extant (Eschmeyer, 1998) and no additional specimens are available from the type locality that would allow detailed comparisons. The original description included no vertebral count but the reported high number of gill rakers (14+25) agrees with specimens from One Tree and Lord Howe Islands.

Grant's, 1982 photograph (colour pl. 147) of a postmortem specimen from Noosa Heads, Queensland shows a fish with mostly yellow dorsal and anal fins and a faint yellow mid-lateral body stripe. The *Pseudocaranx* color photograph (Plate IV-19) in Randall et al., 1990 is misleading because it was taken at Easter Island (Randall, pers. comm.).

***Pseudocaranx wrighti*** Whitley, 1931

Figures 1A, 3D, 4; Tables 1–3

*Usacaranx georgianus wrighti* Whitley, 1931: 317 (orig. descr. 40 mi. west of Kingston, South Australia; Holotype AMS I.10336).

*Pseudocaranx wrighti*. May and Maxwell, 1986: 301, unnumb. photo. (descr.; common name; distrib.); Paxton et al., 1989: 582 (synonymy; distrib.); Kuiter, 1993: 176, unnumb. color photos (descr.; distrib.); Gomon et al., 1994: 585, unnumb. color photo. (descr.; distrib.); Hutchins, 1997: 247 (listed; Houtman Abrolhos); Hutchins, 2001b: 33 (listed).

*Material examined*. 125 specimens, 46–196 mm FL. CSIRO C.2751 (119), Exmouth Gulf; ANSP 134668 (4, 105–143), ANSP 135418 (8, 141–169), WAM P.14007-18 (11, 100–135), WAM P.14019-26 (8, 110–144), WAM P.14043-53 (11, 119–150), WAM P.14055 (112), Rottnest I. vicinity; ANSP 153537 (6, 150–176), ANSP 182762 (4, 172–196), Perth vicinity; WAM P.27679 (182), Swan-Avon R.; AMS I.10336 (122.5, holotype of *Usacaranx georgianus wrighti*), W of Kingston, 36°50'S, 139°20'E; AMNH 37652 (2, 169–181), Cockburn Sound, Fremantle; ANSP 148691 (30 of 61, 46–159), Sepia Depression off Garden I., 32°08'S, 115°37'E; SAMA 196 (2, 116–139), Doubtful I. Bay; ANSP 145073 (186), Coffin Bay; SAMA 3110 (2, 120–122), SAMA 3147 (144), off Port Lincoln; SAMA 4777 (145) Adelaide outer harbour; SAMA 3930 (17, 97–125), St. Vincent Gulf; AMS I.20194-032 (9, 92–123), Investigator Strait; SAMA 3620 (164), Kangaroo I.; AMS I.10397 (125), Flinders I., 33°45'S, 134°30'E; TMH D.535 (2, 94–103), Flinders I., 39°50'S, 148°00'E.

*Diagnosis*. A species of *Pseudocaranx* with posterior margin of upper jaw canted posteroventrally (fig. 1A); lachrymal and expanded part of maxilla densely covered with scales; caudal vertebra 14; gill rakers 10–15 upper, 24–28 lower, 35–43 total; scales in curved part of lateral line 37–48.

*Distribution*. Endemic to Australia (fig. 4); eastern Bass Strait extending W at least to Rottnest I., WA. A single collection of *P. wrighti* from Exmouth Gulf (see material examined) at approximately 22°S extends its distribution well into that of *P. dinjerra*, if the record is not due to a specimen mix-up.

*Remarks*. This species differs from other Australian congeners as indicated in the identification key and Table 3. It also differs in having a well defined opercular spot that is nearly solid black and approximately the diameter of the pupil (fig. 3D), in never developing a yellow mid-lateral body stripe, and second dorsal and anal fins transparent or dusky green, never with yellow pigmentation. *Pseudocaranx wrighti* is the smallest species of *Pseudocaranx*, rarely exceeding 200 mm FL.

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Table 1. Frequency distributions of segmented fin rays and caudal vertebrae in Australian species of *Pseudocaranx*.

| | Dorsal-fin rays | | | | | | | | | | Anal-fin rays | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | X | SD | 18 | 19 | 20 | 21 | 22 | 23 | 24 | X | SD |
| *wrighti* | 4 | 31 | 52 | 25 | 3 | | | | 23.9 | 0.9 | 1 | 1 | 41 | 63 | 8 | 1 | | 20.7 | 0.7 |
| *dinjerra* | | 4 | 21 | 14 | | | | | 24.3 | 0.6 | | 1 | 15 | 23 | | | | 20.6 | 0.6 |
| *georgianus* | | | | 11 | 51 | 35 | 11 | 1 | 26.4 | 0.8 | | | | 4 | 39 | 51 | 15 | 22.7 | 0.8 |
| sp. "*dentex*" | | | | | | | | | | | | | | | | | | | |
| Queensland | | | | 2 | 7 | | | | 25.8 | 0.4 | | | | 3 | 6 | | | 21.7 | 0.5 |
| Lord Howe I. | | | 1 | 8 | 16 | 2 | | | 25.7 | 0.7 | | | | 3 | 21 | 3 | | 22.0 | 0.5 |

| | Pectoral-fin rays | | | | | | | Caudal vertebrae | |
|---|---|---|---|---|---|---|---|---|---|
| Species | 17 | 18 | 19 | 20 | 21 | X | SD | 14 | 15 |
| *wrighti* | 4 | 69 | 12 | | | 18.1 | 0.4 | 113 | |
| *dinjerra* | | 12 | 26 | 1 | | 18.7 | 0.5 | 39 | |
| *georgianus* | | 6 | 59 | 16 | | 19.1 | 0.5 | | 109 |
| sp. "*dentex*" | | | | | | | | | |
| Queensland | | | | 8 | 1 | 20.1 | 0.3 | | 9 |
| Lord Howe I. | | | | 6 | 2 | 20.3 | 0.5 | | 24 |

Table 2. Frequency distributions of developed gill rakers in Australian species of *Pseudocaranx*.

| | Upper gill rakers | | | | | | | | | | | Lower gill rakers | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | X | SD | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | X | SD |
| *wrighti* | | | | 1 | 2 | 26 | 35 | 15 | 1 | 12.8 | 0.9 | | | | | | 5 | 24 | 35 | 12 | 4 | 25.8 | 0.9 |
| *dinjerra* | 3 | 16 | 19 | 1 | | | | | | 8.5 | 0.7 | 3 | 24 | 12 | | | | | | | | 20.2 | 0.6 |
| *georgianus* | | 2 | 20 | 40 | 24 | 1 | 1 | | | 10.1 | 0.9 | 1 | 2 | 19 | 49 | 17 | | | | | | 21.9 | 0.8 |
| sp. "*dentex*" | | | | | | | | | | | | | | | | | | | | | | | |
| Queensland | | | | | | 4 | 3 | 2 | | 12.8 | 0.8 | | | | | | 2 | 3 | 4 | | | 25.2 | 0.8 |
| Lord Howe I. | | | | | 1 | 7 | 15 | 1 | | 12.7 | 0.6 | | | | | | | 7 | 15 | 2 | | 25.8 | 0.6 |

| | Total gill rakers | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | 27 | 28 | 29 | 30 | 31 | 32 | 34 | 35 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | X | SD | |
| *wrighti* | | | | | | | | 2 | 14 | 19 | 17 | 19 | 4 | 1 | 1 | 38.6 | 1.5 | |
| *dinjerra* | 4 | 12 | 16 | 6 | 1 | | | | | | | | | | | 28.7 | 1.0 | |
| *georgianus* | | 2 | 1 | 11 | 13 | 29 | 8 | 1 | | | | | | | | 32.0 | 1.4 | |
| sp. "*dentex*" | | | | | | | | | | | | | | | | | | |
| Queensland | | | | | | | | | 3 | 1 | 3 | 1 | | | | 38.0 | 1.3 | |
| Lord Howe I. | | | | | | | | | 1 | 3 | 7 | 10 | 3 | | | 38.7 | 1.0 | |

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Table 3. Frequency distributions of lateral-line scales and scutes in Australian species of *Pseudocaranx*.

Scales in curved lateral-line

| Species | 37 38 | 39 40 | 41 42 | 43 44 | 45 46 | 47 48 | 49 50 | 51 52 | 53 54 | 55 56 | 57 58 | 59 60 | 61 62 | 63 64 | 65 66 | 67 68 | 69 70 | 71 72 | 73 74 | 75 76 | 77 78 | 79 80 | X | SD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *wrighti* | 3 | 11 | 22 | 35 | 12 | 2 | | | | | | | | | | | | | | | | | 42.7 | 2.1 |
| *dinjerra* | | | | | | | | | 1 | 2 | 9 | 10 | 9 | 3 | 5 | | | | | | | | 60.2 | 3.0 |
| *georgianus* | | | | | | | | | | 1 | 3 | – | 10 | 10 | 12 | 16 | 13 | 8 | 1 | 3 | 1 | | 66.6 | 4.4 |
| sp. "*dentex*" | | | | | | | | | | | | | | | | | | | | | | | | |
| Queensland | | | | | | | | | | | | | | | | | 2 | 2 | – | 3 | 2 | | 73.6 | 3.5 |
| Lord Howe I. | | | | | | | | | | | | | | 1 | – | 1 | 3 | 4 | 2 | – | 2 | 1 | 72.1 | 4.1 |

| | Scales in straight lateral-line | | | | | | | | | | | | | | | Scutes in straight lateral-line | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | | | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | | |
| Species | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 | X | SD | 17 | 19 | 21 | 23 | 25 | 27 | 29 | 31 | 33 | X | SD |
| *wrighti* | 1 | 6 | 20 | 29 | 17 | 9 | 3 | | | | | | | 8.6 | 2.5 | 5 | 12 | 22 | 25 | 17 | 4 | | | | 21.7 | 2.5 |
| *dinjerra* | 1 | 10 | 18 | 8 | 2 | | | | | | | | | 6.5 | 1.8 | | 1 | 2 | 8 | 8 | 11 | 6 | 3 | | 25.3 | 2.9 |
| *georgianus* | | | | 5 | 7 | 16 | 13 | 15 | 15 | 4 | 2 | – | 1 | 15.2 | 3.6 | 3 | 12 | 20 | 25 | 9 | 8 | 1 | | | 22.0 | 2.6 |
| sp. "*dentex*" | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Queensland | | | 1 | 4 | 3 | 1 | | | | | | | | 9.6 | 1.6 | | | | | 1 | 2 | 3 | 2 | 1 | 28.2 | 2.2 |
| Lord Howe I. | | | | 1 | 3 | 3 | 3 | 3 | 1 | | | | | 13.3 | 2.9 | | | | | 5 | 2 | 6 | 1 | | 27.0 | 2.0 |

| | Total scales in lateral-line | | | | | | | | | | | | | | | | | | | | | | | | | | X | SD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 44 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 60 | 62 | 64 | 66 | 68 | 70 | 72 | 74 | 76 | 78 | 80 | 82 | 84 | 86 | 88 | 90 | 92 | 94 | | |
| Species | 45 | 47 | 49 | 51 | 53 | 55 | 57 | 59 | 61 | 63 | 65 | 67 | 69 | 71 | 73 | 75 | 77 | 79 | 81 | 83 | 85 | 87 | 89 | 91 | 93 | 95 | | |
| *wrighti* | 4 | 6 | 12 | 20 | 23 | 13 | 5 | 2 | | | | | | | | | | | | | | | | | | | 51.4 | 3.1 |
| *dinjerra* | | | | | | | | 1 | 1 | 4 | 8 | 11 | 5 | 6 | 2 | 1 | | | | | | | | | | | 66.7 | 3.5 |
| *georgianus* | | | | | | | | | | | | | | | 2 | 5 | 9 | 7 | 14 | 18 | 9 | 5 | 2 | 4 | 1 | 2 | 81.8 | 4.9 |
| sp. "*dentex*" | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Queensland | | | | | | | | | | | | | | | | | | 2 | 2 | – | 2 | 3 | | | | | 83.1 | 3.4 |
| Lord Howe I. | | | | | | | | | | | | | | | | | | | 1 | – | 9 | 1 | 2 | – | 1 | | 85.4 | 2.9 |

| | Total scales + scutes in lateral-line | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 68 | 71 | 74 | 77 | 80 | 83 | 86 | 89 | 92 | 95 | 98 | 101 | 104 | 107 | 110 | 113 | 116 | 119 | | | | |
| Species | 67 | 70 | 73 | 76 | 79 | 82 | 85 | 88 | 91 | 94 | 97 | 100 | 103 | 106 | 109 | 112 | 115 | 118 | | | X | SD | |
| *wrighti* | 3 | 9 | 36 | 24 | 13 | | | | | | | | | | | | | | | | 73.1 | 2.7 | |
| *dinjerra* | | | | | | | | 5 | 10 | 18 | 3 | 3 | | | | | | | | | 92.0 | 3.0 | |
| *georgianus* | | | | | | | | | | 2 | 5 | 16 | 17 | 14 | 11 | 8 | 5 | | | | 103.8 | 5.2 | |
| sp. "*dentex*" | | | | | | | | | | | | | | | | | | | | | | | |
| Queensland | | | | | | | | | | | 1 | – | – | 1 | 3 | 2 | 2 | – | 1 | | 111.3 | 4.3 | |
| Lord Howe I. | | | | | | | | | | | | | | | 3 | 6 | 2 | 3 | | | 112.4 | 3.2 | |

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