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IDENTIFICATION OF THE TAXA XENOCEPHALIDAE, *XENOCEPHALUS,* AND *X. ARMATUS* (OSTEICHTHYES: URANOSCOPIDAE)

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Abstract.—Xenocephalinae Kaup, 1858 (currently recognized as a valid family), is a junior synonym of Uranoscopidae (dating from at least 1832; no subfamilies recognized). *Xenocephalus* Kaup, 1858, is a senior synonym of the currently recognized genus *Gnathagnus* Gill, 1861. *Xenocephalus armatus* Kaup, 1858, is a senior synonym of the currently recognized species *Gnathagnus innotabilis* Waite, 1904. A neotype is designated for *Xenocephalus armatus,* which was erroneously described from New Ireland, but in fact was based on a specimen from New Zealand.

Kaup (1858) described a new subfamily, genus, and species of fish (Xenocephalinae, *Xenocephalus armatus*), which he included in the family Gadidae. Kaup's taxa have been carried along in the systematic ichthyological literature ever since, but their identities and affinities have remained enigmatic. It is the purpose of our study to clarify and fix the systematic status of Kaup's three taxa.

Taxonomic History of Kaup's Taxa

Kaup (1858) stated that *Xenocephalus armatus* was distantly related to the Macrurinae, one of the four subfamilies he recognized in the Gadidae (the others, Gadinae, Brotulinae). Subsequent mention of Kaup's taxa followed soon after their original descriptions, but most authors had nothing substantive to add to his description. We include here, with minimal comment, all references we have encountered in an intensive search of the scientific literature for mention of Xenocephalinae (or a family-group based on it), *Xenocephalus,* or *X. armatus.* Our purpose in doing so is to demonstrate that Kaup's taxa cannot be considered as nomina oblita, and the genus and species, at least (and the family group, usually) have always, been considered as senior synonyms, albeit of questionable affinities (authors listed chronologically by earliest publication):

Bleeker (1859) essentially followed Kaup by listing *Xenocephalus* in a subfamily Xenocephaliformes of a family Gadoidei. Günther (1862) included *Xenocephalus armatus,* with no mention of Xenocephalinae, as an "Appendix to the Anacanthini gadoidei," and (1880) stated that *Xenocephalus* was "a gadoid anacanth," but (1909) presciently opined that it appeared to be a larval form of a fish that is unrelated to the anacanthin gadoids; Gill (1872, 1884, family listed essentially according to Günther, 1862); Gill (1888, family "approximated to Ophidioidea"; 1893, family listed under Ophidioidea); Scudder (1882, genus listed); Perrier (1903, genus in Macruridae); Jordan (1905, 1907, 1925, genus included in Zoarcidae under "the great family Blenniidae"; 1919, genus listed; 1923, family included in Blenniiformes); Fowler (1928, family, genus, species recognized); Berg (1940, 1947, 1955, family and genus listed in Blennioidei); Neave (1940, genus listed); Schultz (1948, family listed in Blennioidea); Munro (1956, family, genus, species listed; 1967, family, genus, species questionably includ-

ed in Blennioidei); Golvan (1962, genus included in Macrouridae; 1965, genus listed in Macrouridae, and family and genus listed in Blennioidei); Greenwood et al. (1966, family listed in Blennioidei); Norman (1966), genus and species doubtfully referred to Blennioidea; this long-delayed posthumous publication was essentially complete by 1938 and contains no references more recent than 1944; Norman included the statement, erroneous even in 1938, that *Xenocephalus* had not been recognized since its original description); Romer (1966, family listed in Blennioidei); Gosline (1968, family listed, affinities questionable); McAllister (1968, family listed in Blennioidei); Lindberg (1971, 1974, family included in Blennioidei); Wheeler (1975, 1979, remarks on family, genus, species, "There is every possibility that the only known specimen was a damaged or aberrant specimen of some other fish . . . Validity of family doubtful."); Nelson (1976, family, genus, species, questionably included in Blennioidea; 1984, family, genus, species listed; quotes V. G. Springer's opinion that species is possibly larval form of dactylopterid, chaetodontid, or scatophagid); Bond (1979, family listed in Blennioidea); Matarese et al. (1984, family listed in Blennioidea); Kailola (1987, family, genus, species incertae sedis); Eschmeyer (1990: 425, family, genus, species, species, "family placement uncertain, based on young"; page 484, family, genus listed under Suborder Trachinoidei); Springer (1993, family, genus, species probably a dactylopterid).

During the course of our literature search, we encountered the descriptions of *Xenocephalus* Wasmann (1887), based on a beetle, and *Xenocephalus* Leakey (1965), based on a partial skull of a fossil mammal. Both are clearly junior homonyms of *Xenocephalus* Kaup, and have been provided with replacement names (see Gentry & Gentry 1978:359). Except for Wasmann (1887), Leakey (1965), Romer (1966), and Gentry & Gentry (1978), we excluded consideration of literature bearing on the junior homonyms of *Xenocephalus* Kaup.

Disposition of the Holotype of *Xenocephalus armatus*

Prior to the 1990s, there is no indication that anyone made an attempt to locate the holotype of *Xenocephalus armatus* or an illustration of it, which Kaup (1858) indicated he had published elsewhere. Kaup stated that the specimen was in the Paris Museum and had been sent there by [J.-R.-C.] Quoy and [P.] Gaimard, who had obtained it during the d'Urville Expedition [= Astrolabe expedition of 1826–1829 under the command of J. S. C. Dumont d'Urville]. Springer (1993) reported that, at his request, M.-L. Bauchot and M. Desoutter of the Muséum National d'Histoire Naturelle (MNHN) had searched [during January, 1991] the MNHN collection unsuccessfully for the holotype and for information about it among the unpublished plates and records of the Astrolabe expedition [not all of which were known to them in 1991]. A second search of the MNHN collection in January, 1993, also was unsuccessful, although many other specimens referred to in an unpublished Quoy manuscript have been located. As we will discuss, information on the specimen was found in the Bibliothèque Centrale, MNHN, among the unpublished descriptions (file MS 104), drawings (MS 840), and plates (MS 106) of the Astrolabe fishes.

Even though Kaup (1858) stated that the holotype was in the Paris Museum, and he had spent three months working in the fish collection at the museum on two visits during 1855 and 1856 (Heldmann 1955), he may have actually studied the specimen in London. In J. E. Gray's preface to Kaup (1856), it is noted that Kaup had specimens from the French, Leyden, Vienna, Frankfurt, Berlin, and Stuttgart museums sent to the British Museum, which Kaup visited several times between 1846 and 1854, so that he could compare them directly with

British Museum specimens. If the specimen was sent to the British Museum, it apparently is not there now (search made of several parts of the collection by D. Siebert at our request).

Under the circumstances we consider the holotype lost. A fortuitous circumstance, discussed later in our study, allows us to replace it with a neotype that conforms in many ways with Kaup's holotype.

Historical Background of Kaup's Description

Kaup (1858) wrote, in German, "This strange form, of which I give a twice-size illustration in my large work, was transmitted by Messrs. Quoy & Gaimard, Expedition d'Urville, to the Paris Museum, where it is found under the name of Grenadier from New Ireland."

Kaup's memory must have deceived him. He had never published an illustration of the New Ireland grenadier. The large work, to which he referred, was undoubtedly his extensive Das Tierreich (Kaup 1835–1837). In it, he mentioned, but did not illustrate, a species of macrourid to which he gave "grenadiere" as part of its common name. It is also possible that Kaup was thinking about the extensive unpublished portion of the manuscript and plates of the Astrolabe expedition. Quoy & Gaimard (1834) published a study of the fishes obtained by that expedition, but their report, for reasons unknown, includes the descriptions of only 49 species, accompanied by only 12 colored plates, of the large number actually prepared: almost 300 species descriptions and at least 120 plates. Although the unpublished portions were apparently known to Kaup and other of his contemporaries, their existence has been generally unrecognized for more than 100 years, until recently, when one of us (Bauchot) located them among the archives of the MNHN central library. There is, perhaps, evidence that Kaup derived part of his description from the unpublished Quoy & Gaimard manuscript. In addition to the unpublished finished plates, there are numerous preliminary colored drawings, presumably prepared in the field, upon which the finished illustrations for the plates are based.

Identity of *Xenocephalus armatus*

It is important for the determination of the identity of *Xenocephalus armatus* to demonstrate that Kaup's description referred to a specimen that was also described and figured earlier by Quoy & Gaimard in their unpublished manuscript. We believe we have located such a description and here present a translation of it followed by a translation of Kaup's (1858) description.

Translation of Quoy & Gaimard [MS 104 (3$^{\text{éme}}$ mémoir:412–413)]; new scientific name here disclaimed and not to be considered available for permanent scientific record or taxonomic purposes [see ICZN Article 8(b)]:

Spotted Grenadier
Lepidolepous punctatus N.
Plate 223, figures 2–3

[Both the preliminary sketches and final figures for Plate 223, figures 2–3 are in color. We present herein, as our Fig. 1, black-and-white reproductions of the preliminary sketches, which we believe are more accurate than the final figures.]

This fish has an excessively large, bony, boxlike head, quite truncate in front; the mouth is quite large, almost vertical, situated but little on the ventral part of the head; the teeth large and like a card [= fine and set closely in rows]; the large eye of gold color, with a very prominent [bony] orbit dorsally, which has a notch anteriorly. The opercle consists of a movable triangular piece. The preopercle has a very prominent posteriorly directed spine, below the opercle, and two other smaller spines more ventrally. One sees four ridges on top of the head. The belly

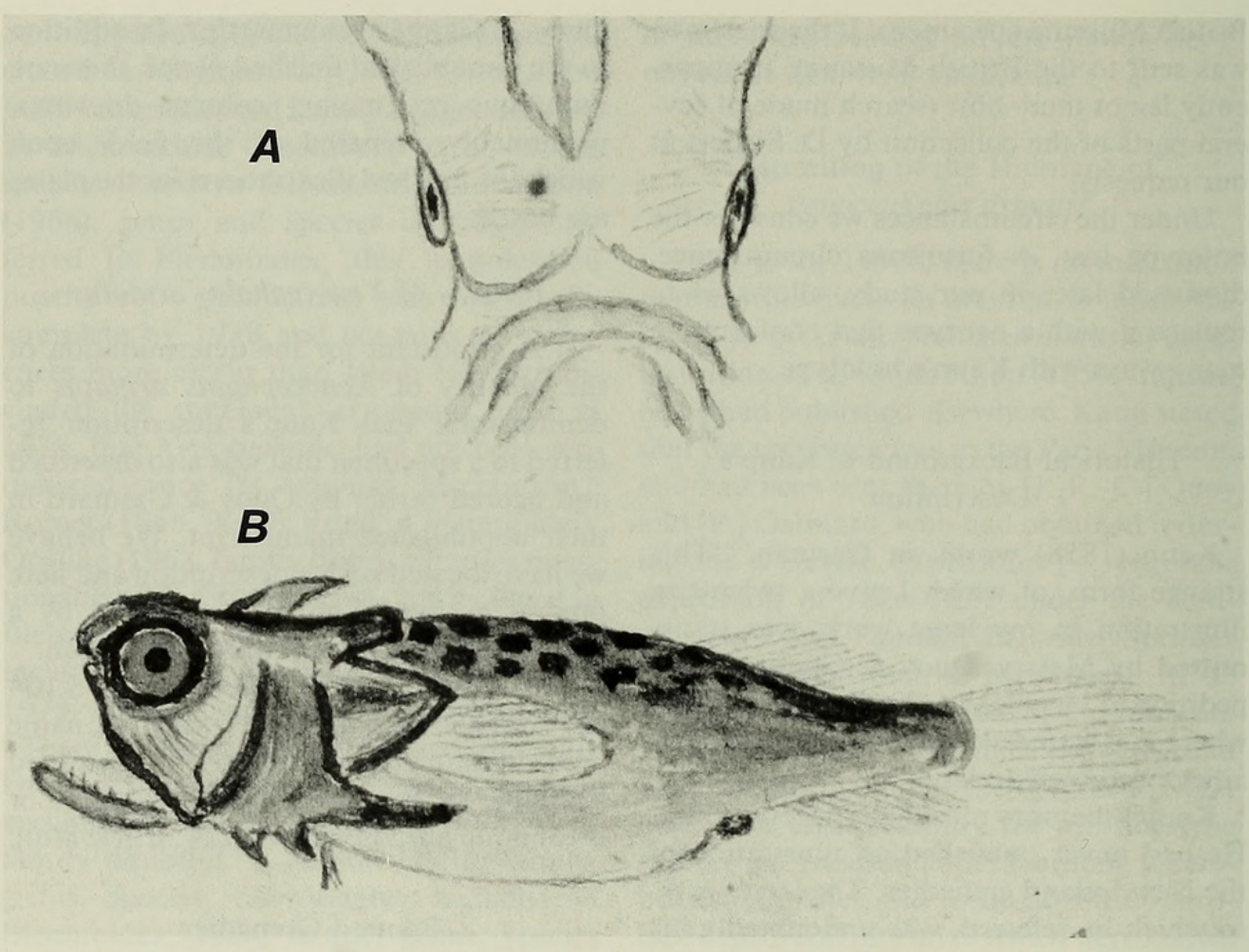

Fig. 1. Original preliminary manuscript illustrations of holotype of *Xenocephalus armatus*: A, dorsal view of head, mouth at bottom of figure; B, lateral view (original is in color).

is prominent, round and soft. The rest of the body ends as a point while becoming compressed. A single dorsal fin placed posteriorly, reaches the origin of the caudal. The anal fin has the same placement [opposite to the dorsal fin]. The pectoral fins are large and round, as [is] the caudal, which appears, however, pointed when it is collapsed [not displayed]. The lateral line is slightly curved. The ventral fins are exceptionally small, placed very anteriorly, and almost covered by the gill membrane covers, which are exceptionally broad.

The general color is deep blue dorsally with some spots of the same color, but slightly darker. The cheeks are a very clear blue, just as the sides. The belly is silver and the fins are whitish.

This fish, 14 lines long [= 31.6 mm; according to Grand Dictionnaire Encyclopédique Larousse, 1984, Tome 6, p. 6295, 1 ligne = 2.2558 mm; American dictionaries indicate that a line is one-twelfth of an inch, or 2.117 mm], was collected 18 Feb 1827, near the island of Mayor in the bay of Abundance [Bay of Plenty] on the coast of New Zealand [emphasis ours].

Translation of Kaup.—First Subfamily Xenocephalinae Kp.

The abnormally large head is armed with shields and spines. First dorsal fin missing. Second dorsal fin and anal fin slightly separated from caudal. One genus.

I. *Xenocephalus* Kaup. With truncated head to which the body is joined as an

appendage; head and operculum armed. Pectoral and caudal developed. Anus on the posterior half of the body. Tiny teeth in both jaws, none on vomer and palatines. Tongue free, thick, almost filling the entire mouth, blunt in front with short tip. Lateral line on the dorsal half of the body and slightly arched [just] following the head.

1) *Xenocephalus armatus* Kp. The moderately large eye golden yellow, dark spotted below the eyelid [?]. Head shields yellowish brown; the naked skin between them blackish. Body blackish brown with black spots on the dorsum. Belly gold yellow with gloss. Fins yellowish white. 2nd D. 7, A. 10, P. 21, V. 5, C. 20.

This strange form, of which I give a twice-size illustration in my larger work, was transmitted by Messrs. Quoy & Gaimard, Exped. d'Urville to the Paris Museum, where it is found under the name Grenadier from New Ireland [emphasis ours]. This subfamily is so far very poor in species and other than the one above I know of no species that belongs to this animal group. It is distantly related to the Macrurinae. [Length of specimen not provided.]

Aside from certain differences, which we will discuss, we believe that the similarities between the Quoy & Gaimard and Kaup descriptions, and Kaup's indication that his specimen was received from Quoy & Gaimard, are sufficient evidence to conclude that the descriptions were based on the same specimen.

We believe that the most important difference between the two descriptions is in the designation of the type localities. Kaup either made a mistake in reporting the type locality as New Ireland (one of the islands in the Bismarck Archipelago northeast of eastern New Guinea) or he was misinformed about the locality by whoever was responsible for providing him with the information.

Other differences between the two descriptions are mainly additional characters given by Kaup: the fin-ray counts, lack of vomerine and palatine dentition, shape of the tongue, and position of anus (the last is in agreement with its indication on Quoy & Gaimard's illustration). Except for the fin-ray counts and putative lack of vomerine and palatine teeth, these characters indicate that Kaup did examine the holotype of *Xenocephalus armatus.*

After concluding that the holotype of *Xenocephalus armatus* is the species described and figured by Quoy & Gaimard from New Zealand, we searched among the species of fishes known from New Zealand for clues to the identity of *X. armatus.* Considering the general gestalt of Quoy & Gaimard's illustration, and particularly the armored head and lack of a spinous dorsal fin, we quickly narrowed the possibilities to the Uranoscopidae. No other family of New Zealand fishes contains species that approach the appearance or description of *X. armatus.*

There are five genera and seven species of uranoscopids reported from New Zealand (Paulin et al. 1989, Kishimoto 1990, Okamura & Kishimoto 1993): 1—*Pleuroscopus pseudodorsalis* Barnard, a deep-dwelling species that also occurs around southern Australia, the southwestern Indian Ocean, and the southeastern Atlantic (Kishimoto et al. 1988); 2—*Genyagnus monopterygius* (Schneider *in* Bloch & Schneider 1801 [Forster MS]), which is endemic to New Zealand (although originally and undoubtedly erroneously, also reported to occur in Tahiti; see Fowler 1928: 428, as *Anema monopterygium,* for comment); 3—*Gnathagnus innotabilis* (Waite), which also occurs in Australia (Kishimoto 1989); 4—*Kathetostoma giganteum* Haast, which is endemic to New Zealand; 5—*Kathetostoma laeve* (Schneider *in* Bloch & Schneider), a deep-water species that is known from the Norfolk Ridge to southern New Zealand, and southern Australia (Kishimoto 1990);

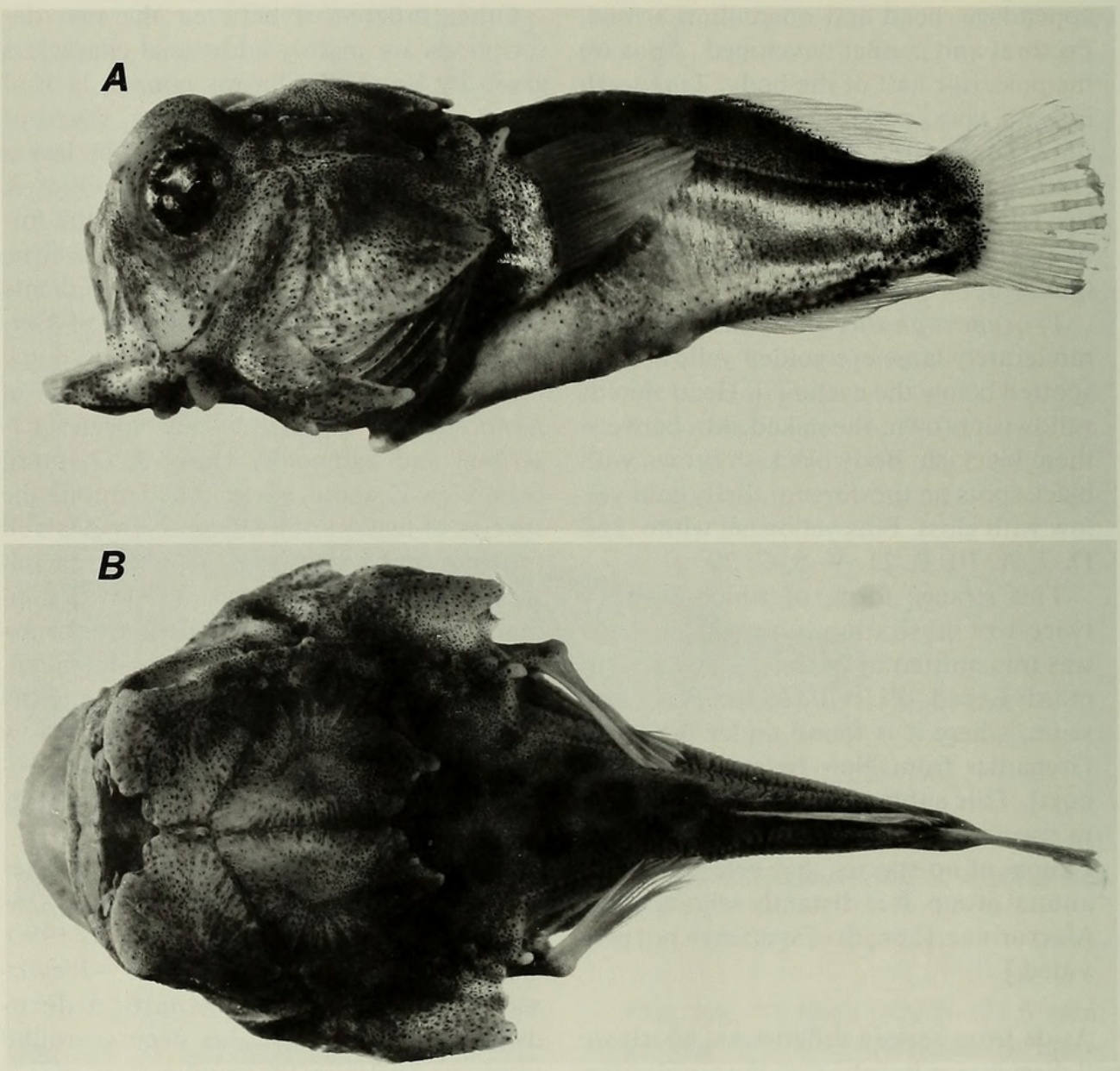

Fig. 2. Neotype of *Xenocephalus armatus,* NMNZ P.30131, 26.6 mm Sl: A, lateral view; B, dorsal view.

6—an unnamed deep-water species of *Kathetostoma* (Paulin et al. 1989, who reported two unnamed *Kathetostoma* species, one of which we assume is *K. laeve,* which they did not report), extra New Zealand distribution unknown; 7—*Selenoscopus turbisquamatus* Okamura & Kishimoto, which is known from off the Kii Peninsula, Pacific coast of central Japan, the Kyushu-Palau Ridge, and the Norfolk Ridge, at depths from 100–510 m (Okamura & Kishimoto 1993).

A detailed descriptive account of all New Zealand uranoscopids, including at least fin-ray counts, has not appeared, but we believe that we can narrow our search among those present to the single species identifiable with *Xenocephalus armatus.*

Among all uranoscopids, the deep-dwelling genus *Pleuroscopus* has segmented dorsal- and anal-fin ray counts closest to those reported by Kaup for *Xenocephalus armatus* (as few as 9 and 10, respectively, in *Pleuroscopus,* Kishimoto et al. 1988). Even so, *Pleuroscopus* can be excluded from consideration because it has a series of 8 to 11 tubercule-like spines preceding the seg-

mented-ray portion of the dorsal fin. It is also notable that very small specimens of *Pleuroscopus* are unknown. Kishimoto et al. (1988) reported that specimens smaller than 242 mm SL are "currently unobtainable." In view of the absence of small specimens, and the apparently restricted deep-water habitat of the species, it seems unlikely that the Astrolabe would have acquired a juvenile 31 mm TL.

Genyagnus monopterygius, although commonly available at small sizes, can be excluded from consideration for several reasons: it has an obvious mental barbel and lingual lure (both noticeable in specimens at least as small as 27 mm TL); the head is not noticeably enlarged nor heavily armored in specimens within the size range of the holotype of *Xenocephalus* (no large preopercular spines as in *Xenocephalus*); its eyes are located on top of the head (on side of head dorsally in *Xenocephalus*); the color pattern dorsally on the body of small juveniles consists of a dark stripe-like marking (no large dark spots, but numerous pale spots in adults); the pectoral-fin rays number only 16–18 (21 reported by Kaup for *Xenocephalus*); and the dorsal fin rays, 18 or 19, appear to be too numerous even if mistakes in the counts were made by Kaup.

Kathetostoma (generically), of which small specimens are often collected, can be excluded from consideration because even at small sizes it has a conspicuous, elongate humeral spine and all spines on the ventral border of the preopercle are relatively fine and ventrally directed; furthermore, the color pattern dorsally on the body does not consist of large dark spots in any specimens we have seen. No humeral spine is indicated in Quoy & Gaimard's figure of *Xenocephalus armatus,* and the posteriormost preopercular spine is greatly enlarged and posteriorly directed.

We believe that *Xenocephalus armatus* is conspecific with *Gnathagnus innotabilis* Waite (1904), described from New South Wales, but currently recognized as also occurring in New Zealand waters (Paulin et al. 1989). We are fortunate to have an approximately 31.0 mm TL specimen (small terminal portion of caudal fin now broken off) of *G. innotabilis* from New Zealand (Fig. 2a, b) to serve as a basis for comparison. The large and heavily armored head of the specimen, including the long posteriorly directed preopercular spine with two smaller spines ventrally on the preopercle, and large dark spots dorsally on the body strongly corroborate the conspecificity of the two species.

There are differences between the description of *X. armatus* and characters exhibited by *G. innotabilis,* particularly in the dentition and dorsal- and anal fin-ray counts given by Kaup (1858). We believe these differences are due to the inadequacy of the optical equipment available during the 1850s. Small specimens of *G. innotabilis* that we have examined have a few tiny, inconspicuous teeth on the vomer and palatines (we even overlooked these in our initial examination of our 31 mm specimen). The species has 11 or 12 dorsal-fin rays and 16 anal-fin rays, 4 and 6 rays more than reported for *Xenocephalus* (additionally, the last dorsal-fin ray may be simple or split to the base in *G. innotabilis*; we counted either condition as one ray). We can discern 11 dorsal-fin rays and 8 anal-fin rays, however, from Quoy & Gaimard's illustration, as opposed to the 7 and 10, respectively, of Kaup's description. Using a Leitz widefield stereo microscope RS (ES model has same optics), which affords the finest resolution of any dissecting scope we know, it was only with difficulty that we were able to make accurate counts of dorsal- and anal-fin rays on our 31 mm specimen. We verified these counts with counts made from radiographs of the specimen. It is because of this difficulty that we believe Kaup's dorsal- and anal-fin ray counts were in error.

All adult uranoscopids have essentially

the same number of branched caudal-fin rays (10), but branching is not evident in small specimens we examined. The number of segmented nonbranched rays appears to increase with growth, but probably not the total number of caudal-fin elements (also includes procurrent rays and spines). The dorsal- and ventralmost of the procurrent elements decrease considerably in size serially as one progresses anteriorly, and are difficult to count accurately in small specimens, unless, as we presume, the specimens are cleared and stained. We were unable to make an accurate count of the total number of caudal-fin elements in our 31 mm specimen, but a total count of 20, as given by Kaup for *Xenocephalus,* for all caudal-fin elements is probably slightly less than the number in *G. innotabilis.*

In order to eliminate the possibility that the New Ireland type locality might actually be correct, we attempted to identify *Xenocephalus armatus* with a species from that area, given the additional information provided by the Quoy & Gaimard manuscript. In that, we were unsuccessful in identifying *Xenocephalus armatus* with any fish species known from the New Guinea area, particularly political Papua New Guinea, which includes New Ireland. Additionally, only two genera of uranoscopids are known from New Guinea: *Uranoscopus* Linnaeus and *Ichthyoscopus* Swainson (Kailola 1987). *Uranoscopus* has a conspicuous spinous dorsal fin and *Ichthyoscopus* lacks spinous processes on the ventral margin of the preopercle (Pietsch 1989), characters that exclude both genera as possibly being congeneric with *Xenocephalus.*

Designation of Neotype for *Xenocephalus armatus*

In order to fix Kaup's species, we here designate our 31 mm specimen (26.6 mm SL from midtip of upper lip to caudal-fin base), NMNZ P.30131 (formerly USNM 325034) as neotype of *Xenocephalus armatus* Kaup. Dorsal-fin rays 11, last ray split to base; anal-fin rays 15, last ray split to base; pectoral-fin rays (r/1) 20/21; vertebrae 27; 7 nonelement-bearing pterygiophores (predorsals) anterior to pterygiophore supporting first dorsal-fin ray. Tiny, widely spaced teeth present on vomer and palatines.

The posteriorly projecting preopercle spine on each side of the head is broken, but the ends are still attached.

The neotype was obtained from the collection of the Fisheries Laboratory in Wellington, New Zealand, by G. D. Johnson, who brought the specimen to our attention and informed us that there was no other data associated with the specimen.

Taxonomic Consequences of the Identity of *Xenocephalus armatus*

The identification of *Xenocephalus armatus* Kaup, 1858, has the following consequences: Xenocephalinae Kaup, 1858, becomes a junior synonym of Uranoscopidae (dating at least as early as Bonaparte 1832—as Uranoscopini—and Richardson 1848:iv—as Uranoscopidae); *Xenocephalus* Kaup, 1858, is a valid senior synonym for a genus of Uranoscopidae, taking priority over *Gnathagnus* Gill, 1861, and its junior synonyms (see Pietsch 1989:294); and *X. armatus* Kaup, 1858, is a valid senior synonym for a species of *Xenocephalus,* taking priority over *Gnathagnus innotabilis* Waite, 1904.

Comparative Material

(Institutional abbreviations follow those in Leviton et al., 1985.)

Astroscopus y-graecum.—Louisiana: Four Bayou Pass, USNM 185647 (1 specimen: ca. 41 mm SL); Barataria Bay, USNM 187947 (2: 30.9–35.2); off coast, USNM 156863 (1: 38.4).

Genyagnus monopterygius.—New Zealand: Nukumaru Reef, Wanganui, NMNZ

P.10463 (3 specimens: ca. 40–48 mm SL); Mangakino Channel, Pourerere, NMNZ P.26278 (2: 22.2–28.2); Hauraki Gulf, NMNZ P.21876 (2: 34.8–59.1); Castlepoint, NMNZ P.17311 (1: 22.1); Manakau Harbour, NMNZ P.2457 (1: 16.6); Tokomaru Bay, NMNZ P.2038 (2: 24.3–24.7); Old Wharf, Kaikoura, NMNZ P.25700 (1: 29.6); Port Hardy, D'Urville Island, NMNZ P.5332 (1: 21.4).

Ichthyoscopus lebeck?.—Indonesia: Ambon, USNM 325474 (1 specimens: 117 mm SL).

Kathetostoma giganteum.—New Zealand: off Cape Farewell, NMNZ P.16605 (1 specimen: 54.8 mm SL); Oamaru, NMNZ P.10684 (1: 78.5); Dunedin, USNM 318371 (1: 84.9)

Kathetostoma sp.—Off Caribbean Panama: 9°18′N, 80°35′W, USNM 187907 (2 specimens: 41.0–64.4 mm SL).

Pleuroscopus pseudodorsalis.—New Zealand: NMNZ P.19668 (1 specimen: ca. 325 mm SL), P.20151 (2: ca. 335, 350), P.22102 (1: ca. 295), P.27963 (1: ca. 270).

Uranoscopus spp.—Australia: New South Wales: off Clarence River Country, AMS I.32120005 (1 specimen: 54.7 mm SL); Collaroy Beach, Sydney, AMS IB.4119 (1: 17.5); off Newcastle, AMS I.33445004 (1: 53.1); Tweeds Head Country, AMS I.23687009 (1: ca. 29). Queensland: N of Townsville, AMS I.25837002 (3:52.3–52.5).

Xenocephalus armatus (as *Gnathagnus innotabilis*).—Australia: New South Wales, Montague Island, AMS IB.1298 (4 specimens: 12.8–16.0 mm SL). New Zealand: NMNZ P.23224 (1: 57.8 mm SL); Bay of Plenty, NMNZ P.11115 (1:48.2); off Tauraga Harbor, NMNZ 16118 (1: 104). Stomach of bluefin tuna, AMS I.B1297 (1: 30.3).

Xenocephalus elongatus.—Japan: Suruga Bay, USNM 296634 (1: 105 mm SL). Philippines: Romblon Island, USNM 122528 (1: 75.9).

Xenocephalus egregius.—Texas: Gulf of Mexico off Padre Island, USNM 268445 (1 specimen: 72.0 mm SL).

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