



## A second New Zealand species of the stargazer genus *Kathetostoma* (Trachinoidei: Uranoscopidae)

MARTIN F. GOMON<sup>1</sup> & CLIVE D. ROBERTS<sup>2</sup>

<sup>1</sup>Sciences Department, Museum Victoria, GPO Box 666, Melbourne VIC 3001, Australia. E-mail: mgomon@museum.vic.gov.au

<sup>2</sup>Museum of New Zealand Te Papa Tongarewa, PO Box 467, Wellington, New Zealand. E-mail cliver@tepapa.govt.nz

### Abstract

A new species of the uranoscopid genus *Kathetostoma* Günther, 1860, is described from New Zealand waters, where it is broadly sympatric with its sole local congener *K. giganteum* Haast, 1873. The new species is readily recognised by its broad, saddle-like dark bands that cross the body dorsally (versus bands absent or only faintly developed), rather robust and short body (vs slender and elongate), and fewer numbers of vertebrae (30–31 versus 33–34), dorsal fin rays (15–17 versus 17–19) and anal fin rays (15–16 versus 17–18). Although both species have extremely broad depth distributions, the new species appears to be restricted to less than about 500 m, with its greatest abundance at 100–300 m, while *K. giganteum* reaches over 1000 m, and has its greatest abundance at 200–400 m. A brief redescription of *K. giganteum* is also provided. *Kathetostoma fluviatilis* Hutton, 1972, the oldest New Zealand name that applies to this genus, is regarded as a *nomen dubium*.

**Key words:** Uranoscopidae, stargazer, *Kathetostoma*, new species, New Zealand

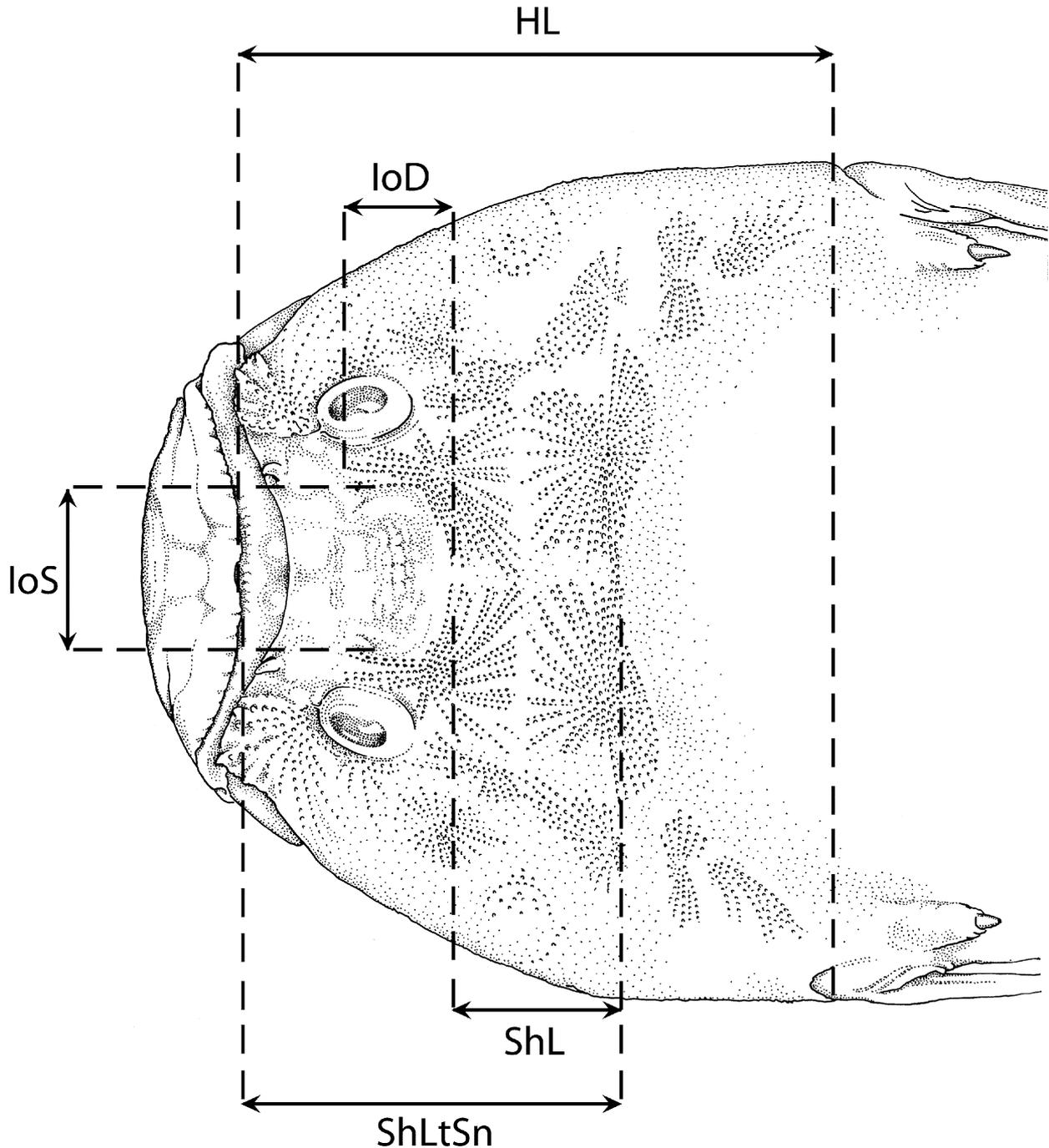
### Introduction

The trachinoid family Uranoscopidae is thought to comprise eight genera and nearly 50 species (Nelson, 2006), of which seven genera and about half of the species occur in the Australasian region, making it the most diverse geographical region for the family worldwide. The numerically dominant genus, *Uranoscopus* is mostly confined to the tropics with seven species recorded from Australasia (Bray & Hoese, in Hoese *et al.*, 2006), while the most diverse genus having a predominantly temperate distribution in the Australasian region is *Kathetostoma* (Günther, 1860) comprising a total of at least eight species, three of which are endemic to the distant coastal waters of the Americas: *K. albigutta* Bean, 1892 and *K. cubana* Barbour, 1941 in the central Western Atlantic, *K. averruncus* Jordan & Bollman, 1890 in the central Eastern Pacific, *K. canaster* Gomon & Last, 1987, *K. laeve* (Bloch & Schneider, 1801) and *K. nigrofasciatum* Waite & McCulloch, 1915 in southern Australian waters, and *K. giganteum* Haast, 1873 and an undescribed species in New Zealand and the eastern Tasman Sea. Smith *et al.* (2006) verified the specific stature of the second New Zealand species using both genetic and meristic information and gave evidence for a closer relationship of *K. giganteum* to the Australian *K. canaster* than to its undescribed New Zealand congener. A name and formal description of the new species, together with a brief redescription of *K. giganteum*, is presented below.

### Methods and material

The description of the new species is based on the holotype with variations observed in paratypes for features following as parenthetical expressions. Counts, measurements and terminology follow Hubbs & Lagler (1947) and Gomon & Johnston (1999), with measurements associated with the head not identified in these two publications illustrated in Fig. 1. Morphometric information was recorded and is presented here to three significant digits. The

centre of the upper jaw is the anterior extreme for measurements taken from the 'anterior end' of the specimen, including standard length, head length, snout length, etc.; Head Length ('HL', Fig. 1) and Caudal Peduncle Length are measured parallel with the axis of the body; other dimensions are direct measurements. Morphometric ranges are reported as percent standard length (%SL), percent head length (%HL) or as otherwise stipulated. Meristic values for most internal features reported, apart from gill rakers, were taken from radiographs. Vertebrae were counted from radiographs (excluding hypural plate). Parenthetical expressions in lists of material examined provide the number and length in mm SL for each registered lot; where a lot comprises a single specimen only the length is provided. Institutional acronyms are those of Leviton *et al.* (1985).



**FIGURE 1.** Selected head measurements: Head Length (HL), Interorbital Depth (IoD), Interorbital Space (IoS), Shield Length (ShL) and Shield Length to Snout (ShLtSn). Illustrated by R. Plant.

**Comparative material:** *Kathetostoma canaster* AMS E3354 (158), AMS E4944 (92.6), AMS E4945 (89.5), AMS E4946 (89.5), AMS I. 21304-001 (2: 111-195), CSIRO H654-01 (165), NMV A 217 (185), NMV A 1400 (186), NMV A 1401 (215), NMV A 1222 (165), NMV A 1550 (154), NMV A 1563 (2:150–156), NMV A 1594 (holotype, 166), NMV A 2153 (2: 201-255), NMV A 2166 (2: 121-128); *K. leave* AMS I.15003 (2: 129-140), AMS I.19392-004 (173), CSIRO H2344-02 (206); CSIRO T2010-01 (81.0), NMV A 646 (167), NMV A 1360 (176), NMV A 26348-001 (58.9), NMV A 26349-001 (138), SAMA 462 (210), SAMA 557 (272), SAM 802 (249), SAM 892 (224), SAM 895 (167), SAM 951 (2: 89.2-105), SAM 986 (210), SAM 1110 (162), SAM 1243 (3: 65.0-187), SAM 1687 (81.8), SAM 1170 (2: 161-202), WAM P3269 (272); *K. nigrofasciatum* AMS E3511 (155), AMS E3512 (93.4), CSIRO T1843-02 (165); SAMA F8072 (192), SAMA F8073 (189), SAMA F8074 (183), SAMA F8071 (164), SAMA F8070 (6: 109-158).

## Genus *Kathetostoma*

*Kathetostoma* Günther, 1860: 231 (type species *Uranoscopus laevis* Bloch & Schneider, 1801, by monotypy)

*Cathetostoma* Gill, 1861: 114; Boulenger 1901: 266 (an incorrect subsequent spelling of *Kathetostoma* Günther)

**Diagnosis.** Body naked; head square to rectangular in cross section; eyes directed upward, small; bony orbital rim separated medially by naked rectangular space; mouth with several prominent canines between smaller canines; chin smoothly curved, without tabular (plectroid) processes or fleshy barbel; lips with short ridge-like crenulations; ventral margin of preopercle with four spine-like processes; anterior end of isthmus with a pair of prominent forward directed spines; prominent cleithral spine sheathed with skin above pectoral fin base without fringe ventrally; scales absent; lateral line pores in skin high on side close to base of dorsal fin. Dorsal fin continuous, with 13–18 segmented rays, lacking separate spinous section anteriorly or short nub-like spines unconnected by membranes anteriorly on back; anal fin with 12–18 segmented rays; pectoral fins huge, fan-like; pelvic fins moderately large.

**Distribution.** Temperate and cool tropical parts of Australia and New Zealand in the Indo-West Pacific, the central part of the west coast of the Americas in the Eastern Pacific and the central Western Atlantic.

**Comments.** The two widely separated species complexes with contrasting tropical and temperate distributions that constitute this genus, with relationships supported by genetic evidence (Smith et al, 2006), is unusual for the family, but at least two other uranoscopid genera, *Ichthyoscopus* Swainson, 1839 and *Xenocephalus* Kaup, 1858 have both low and high latitude species.

## *Kathetostoma giganteum* Haast, 1873

Giant Stargazer

Figs 2, 5, 6: Tbls 1–2.

*Kathetostoma leave* (non Bloch & Schneider, 1801): Hutton, 1872: 23, Wellington Harbor.

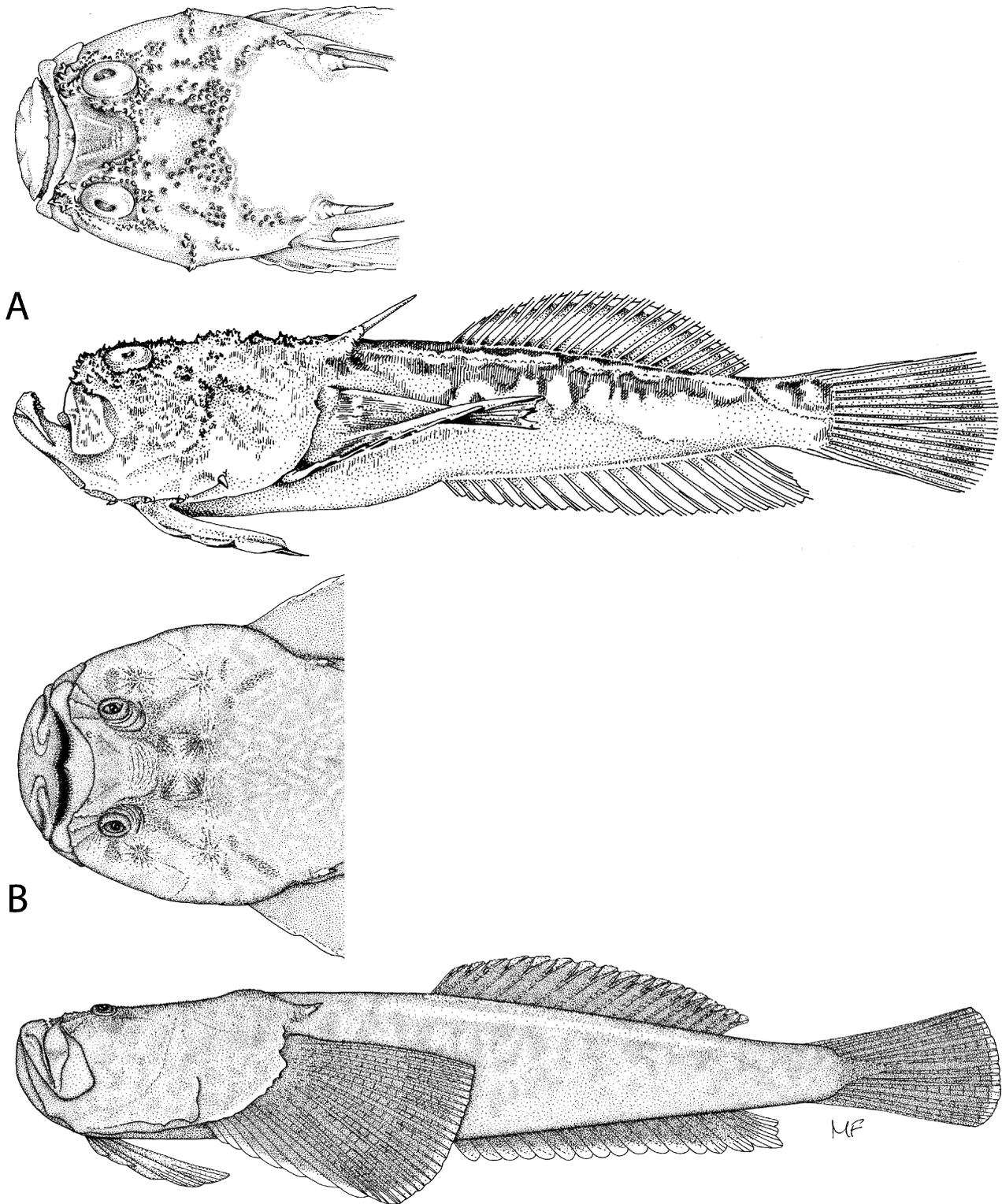
*Kathetostoma giganteum* Haast, 1873: *Trans. Proc. New Zeal. Inst.* 5: 274, pl. 16 (second from top), Heathcote estuary, NZ; holotype: CMC.

*Kathetostoma giganteum*: Waite, 1911: 241; Waite & McCulloch, 1915: 471; Phillipps, 1921: 123, listed; Phillipps, 1927: 43; Mees, 1960: 47, 56; Whitley, 1968: 69, listed; Ayling & Cox, 1982: 271, pl. 35; Paul, 1986: 118; Francis, 1988: 48, pl. 116; Paul, 2000: 118; Kashimoto in Amaoka *et al.* 1990: 297, pl. 229, description; Anderson *et al.* 1998: unnumbered, distribution map; Smith *et al.* 2006: 379, figs 1, 3, 4, molecular analysis and meristics; Roberts *et al.*, 2009: 535, listed.

**Material examined** (17: 52.0-529). NMNZ P.1286 (105), NMNZ P.10376 (529), NMNZ P.30702 (78.3), NMNZ P.30818 (4: 72.2–195), NMNZ P.38774 (104), NMNZ P.40882 (277), NMNZ P.40883 (227), NMNZ P.40884 (422), NMNZ P.41212 (52.0), NMNZ P.41739 (3: 110–123), NMNZ P.42067 (503), NMNZ P.42081 (314).

**Diagnosis.** Dorsal fin rays 17–19; anal fin rays 17–18; vertebrae 33–34. Body rather elongate, tapering from a moderately broad, flat, bony head (head width 1.1–1.4 times its length) covered with tiny blunt spines in juveniles (Fig. 2A) to low radiating ridges in adults; eyes directed upwards, small; bony orbital rim separated medially by naked rectangular space; mouth large, vertical, with several prominent canines between smaller canines; chin smooth; lips with short ridge-like crenulations; ventral margin of preopercle with four spine-like processes; anterior end of isthmus with a pair of prominent forward directed spines; prominent cleithral spine sheathed with skin

above pectoral fin base; 14–17 gill rakers on first arch in the form of patches of fine teeth, patches narrow, teeth in three or four rows, innermost row rather long; scales absent; lateral line pores in skin high on side close to base of dorsal fin; dorsal fin low, elongate, its base 67–82% of predorsal length; pectoral fins huge, fan-like; pelvic fins moderately large, their length 20–25% SL. (See Table 1 for a summary of proportional measurements and meristic values.)



**FIGURE 2.** *Kathetostoma giganteum*: A, NMNZ P.1286, 105 mm SL, juvenile, dorsal view of head and lateral view of body (illustrated by R. Plant); and B, NMNZ P.42067, 503 mm SL, adult, dorsal view of head and lateral view of body (illustrated by M. Freeborn).

Maximum size of specimens examined 650 mm SL, but reported in the literature as reaching 850 mm (Francis 2001).

Pigmentation in alcohol. Juveniles dark overall with lengthwise, often irregular pale stripes, one at base of dorsal fin extending onto nape. Slightly larger individuals rather uniformly dark dorsum extending to posterior end of dorsal fin with narrow lengthwise white stripe following lateral line onto caudal fin and shorter stripes above and below anterior to dorsal fin; white markings smaller and more irregular in larger juveniles; dark area reaching ventrally to lateral midline only below posterior end of dorsal fin and above pectoral fin; underside pale; top of head mottled pale and dark; caudal peduncle very pale; dorsal, caudal and pectoral fins dark with pale distal margins; anal and pelvic fins pale. Large adults rather uniformly dark with some darker speckles and mottling; pale lateral line becoming less apparent.

Fresh colours. Mottled dark greenish brown and tan above with scattered dark brown to black speckles and blotches, pale areas, especially around lateral line, almost white, underside greyish white with pink tinges, dorsal caudal and pectoral fins dark greenish brown, dorsal and pectoral speckled with brown; pelvic and anal fins dusky white with white margins.

**Distribution.** Endemic to New Zealand, distributed widely in coastal, shelf and offshore waters, including Chatham Rise, Lord Howe Rise and Campbell Plateau; the record from Tasmanian waters (Scott, 1974; 1980) is incorrect and a misidentification of specimens of *K. canaster*. Occurs at a wide range of depths from shallow estuaries to more than 1000 m on the upper slope with the species' greatest abundance at 200–400 m.

**Comments.** *Kathetostoma fluviatilis* Hutton, 1972, based on a 1.7 inch juvenile collected in fresh water of the Manawatu River, may be an earlier name for this species. The type is apparently no longer extant. Although Hutton's brief description more closely matches the species described below, descriptions of uranoscopids by early authors have proven to be unreliable, especially with fin ray counts. As neither of New Zealand's species of *Kathetostoma* has been adequately documented in fully freshwater conditions, questions remain about the true identity of the species. It is therefore regarded as a *nomen dubium*.

### ***Kathetostoma binigrasella* sp. nov.**

Banded Stargazer

Figs 3–6; Tbls 1–2.

*Kathetostoma* sp.: Paul, 1986: 118; 2000: 118; Anderson *et al.* 1998: unnumbered, distribution map; Roberts & McPhee, 1998: 66; Smith *et al.* 2006: 379, figs 1, 3, 4, molecular analysis and meristics. Roberts *et al.*, 2009: 535, listed;

*Kathetostoma giganteum* (non Haast, 1873): Doak, 1978: 132, colour plate 59 top.

*Kathetostoma laeve* (non Bloch & Schneider, 1801): Kashimoto in Amaoka *et al.* 1990: 298, plate 230, description.

**Holotype.** NMNZ P. 42147 (334) New Zealand, North Island, 11 Miles off Ninety Mile Beach, Northland, 35° 42' S, 173° 37' E, 100m, FV *Brac*, 4 July 2002, bottom trawl.

**Paratypes.** (31: 67.7–560): AMS I.42757-004 (316) New Zealand, West Norfolk Ridge, Wanganella Bank, 32° 36.067' S – 32° 36.067' S, 167° 34.600' E – 167° 34.517' E, 116–119m, TAN0308-112, RV *Tangaroa*, NORFANZ team, 30 May 2003, ratcatcher trawl; BMNH 2010.10.22.1 (244), formerly part of NMNZ P.39337; CAS 230375 (267), formerly part of NMNZ P.39337; NMNZ P.10111 (67.7) New Zealand, North Island, North Auckland, NW off Cape Reinga, 34° 3.5500' S, 172° 12.4500' E, 481–503m, JCO 8106/055, RV *James Cook*, 23 April 1981, trawl; NMNZ P.18175 (483) New Zealand, North Island, Bay of Plenty, Off the East side of Mayor Island, Bay of Plenty, 37° 18' S, 176° 18' E, 37–91m, MoNZ T86, FV *Asterix*, G. Nicholson & K. Smith, 17 February 1986, set net; NMNZ P.29710 (2: 305–366) New Zealand, Snares Islands, E Snares Shelf NW Campbell Plateau, 48° 18.28' S, 167° 57.25' E, 132–134m, TAN 9301/066, RV *Tangaroa*, 23 February 1993, bottom trawl; NMNZ P.31966 (188) New Zealand, South Island, Otago, approx. 20 nautical miles S of Dunedin, 46° 35.345' S, 167° 14.390' E, 63–66, TAN 9502/144, RV *Tangaroa*, P. McMillan, 10 March 1995, bottom trawl; NMNZ P.33673 (560) New Zealand, North Island, Taranaki, off the Puniho coast, SW of New Plymouth, 39° 10' S, 173° 35' E, 80m, J. & R. Ansley, September 1996; NMNZ P.34887 (2: 316–398) New Zealand, Chatham Islands, NE Chatham Rise, 43° 15.1450' S, 177° 4.4083' W, 310–327m, TAN 9801/030, RV *Tangaroa*, P. McMillan, 08 January 1998, bottom trawl; NMNZ P.39337 (3: 308–453) Australia, Norfolk Island, Wanganella Bank, 32° 37.200' S, 167° 35.635' E, 120–127m, NORFANZ TAN 0308/117, RV *Tangaroa*, 30 May 2003, ratcatcher trawl; NMNZ P.40689 (255) New Zealand,

South Island, Southland, Snares Islands Shelf, 48° 49.55' S, 166° 59.30' E, 176–195m, OBS 1738/065, FV *Chiyo Maru* 3, Marli Dee, 20 February 2003, bottom trawl; NMNZ P.40700 (2: 157–195) New Zealand, Snares Islands, South-east Snares Shelf, 48° 49.90' S, 166° 57.75' E, 176–182m, OBS 1856/018, FV *Sur Este 707*, Chris Petyt, 27 January 2004, bottom trawl; NMNZ P.40701 (207) New Zealand, Snares Islands, Southern Snares Shelf, 48° 47.65' S, 166° 29.75' E, 174–190m, OBS 1856/026, FV *Sur Este 707*, Chris Petyt, 30 January 2004, bottom trawl; NMNZ P.41511 (324) New Zealand, Snares Islands, south eastern Snares Shelf., 48° 33.8850' S, 168° 5.6250' E, 250–500m, TAN 0118, RV *Tangaroa*, November 2001, bottom trawl; NMNZ P.41697 (146) New Zealand, South Island, Southland, North-east Puysegur Trench, 44° 57.10' S, 166° 4.35' E, 174–222m, OBS 1604/079, FV *Oyang* 97, 12 March 2002, bottom trawl; NMNZ P.41747 (2: 128–175) New Zealand, South Island, Southland, Puysegur Bank, 46° 31.50' S, 166° 4.25' E, 185–270m, OBS 1609/052, FV *Tomi Maru* 86, Julian Hall, 02 March 2002, bottom trawl; NMNZ P.42076 (209) New Zealand, Snares Islands, South of The Snares, 48° 48.75' S, 166° 40.55' E, 180–244m, OBS 1609/016, FV *Tomi Maru* 86, Julian Hall, 09 February 2002, bottom trawl; NMNZ P.42132 (307) New Zealand, South Island, off Stewart Island; NMNZ P.42145 (262) New Zealand, North Island, 11 Miles off Ninety Mile Beach, Northland, 35° 42' S, 173° 37' E, 100m, FV *Brac*, 04 July 2002, bottom trawl; NMNZ P.42146 (292) New Zealand, North Island, 11 Miles off Ninety Mile Beach, Northland, 35° 42.000' S, 173° 37.000' E, 100m, FV *Brac*, 04 July 2002, bottom trawl; NMNZ P.42153 (308) New Zealand, North Island, 11 Miles off Ninety Mile Beach, Northland, 35° 42' S, 173° 37' E, 100m, FV *Brac*, 04 July 2002, bottom trawl; NMV A 25153-001 (223) New Zealand, West Norfolk Ridge, Wanganella Bank, 32° 36.067' S – 32° 36.067' S, 167° 35.217' E – 167° 35.217' E, 116–122m, TAN0308-105, RV *Tangaroa*, M. Gomon, 29 May 2003; NMV A 25157-003 (282) same data as AMS I 42757-004; NMV A 25161-003 (311), New Zealand, West Norfolk Ridge, Wanganella Bank, 32° 35.783' S – 32° 35.783' S, 167° 38.550' E – 167° 41.250' E, 325–497m, TAN0308-118, RV *Tangaroa*, M. Gomon, 30 May 2003, ratcatcher trawl; USNM 398707 (172), formerly part of NMNZ P.40700.

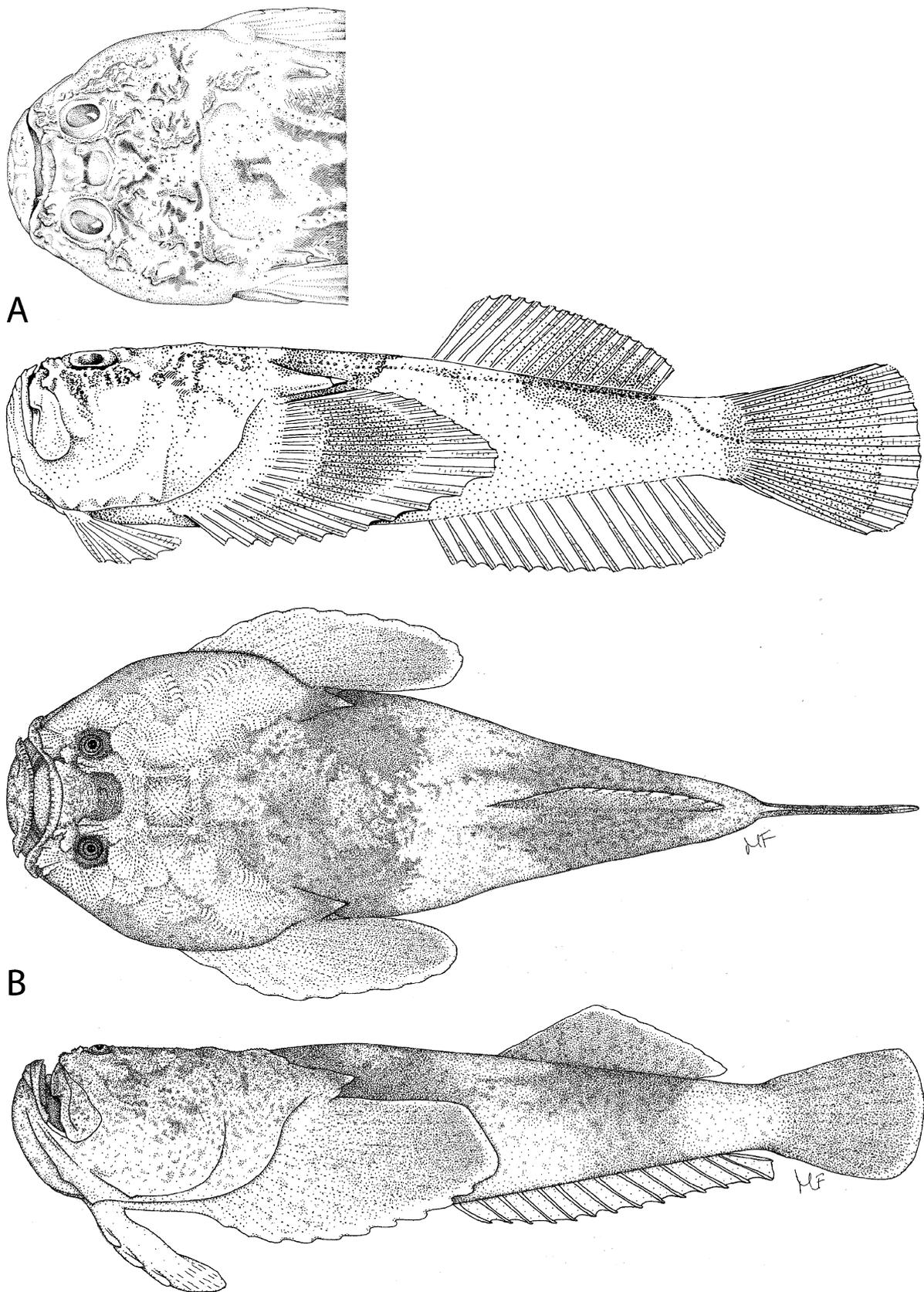
**Other material.** NMNZ P.10111 (66.3); NMNZ P.13112 (2: 360–400); NMV A 25157-006 (197); NMV A 25161 (308).

**Diagnosis.** Dorsal fin rays 15–17; anal fin rays 14–16; vertebrae 30–31; head and body broad, head width 1.2–1.7 times its length, covered with tiny blunt knobs in juveniles to almost smooth in adults; mouth with several prominent canines between smaller canines; chin smooth; ventral margin of preopercle with four spine-like processes; anterior end of isthmus with a pair of prominent forward directed spines; prominent cleithral spine sheathed with skin above pectoral fin base; 17–19 gill rakers on first arch in the form of patches of fine teeth, patches broad, about six to ten teeth across patches, not in distinct rows, innermost teeth rather short; dorsal fin of moderate length, its base 43–66% of predorsal length; pelvic fins large, their length 23–28% SL; body whitish below usually with two broad, vertical, dark-brown, variously distinct bands or saddles across back, most distinct in juveniles and small adults.

**Description.** (See Table 2 for frequencies of values for selected meristic characters.) Dorsal fin rays 15–17; anal fin rays 14–16; pectoral fin rays 21; pelvic fin rays I, 5; vertebrae 30–31.

(See Table 1 for comparative ranges of selected proportional measurements.) Body tapering from a broad, flat, bony head (head width 1.2–1.7 times its length) covered with tiny blunt knobs in juveniles to almost smooth with fine radiating pattern in adults. Eyes directed upwards, small; bony orbital rim separated medially by naked rectangular space. Mouth large, vertical, with several prominent canines between smaller canines; chin smooth; lips with short ridge-like crenulations. Ventral margin of preopercle with four spine-like processes; anterior end of isthmus with a pair of prominent forward directed spines; prominent cleithral spine sheathed with skin above pectoral fin base. Scales absent; lateral line pores in skin high on side close to base of dorsal fin. Dorsal fin low, of moderate length, its base 43–66% of predorsal length. Pectoral fins huge, fan-like. Pelvic fins large, their length 23–28% SL. Largest specimen examined 560 mm SL.

Pigmentation in alcohol. Pale dusky with two broad dark blotchy bands across dorsum to midside (most distinct in juveniles and small adults; large adults more uniformly dark above), one across predorsal with paler area on dorsal midline, second across dorsal base, paler areas including side of head and chin speckled with smaller darkish blotches; top of head rather pale with darkish blotches on skin covered areas (as lines radiating from eyes in some); underside slightly dusky; dorsal, caudal and pectoral fins dark, dorsal and caudal fins with continuous pale margin; pectoral fin dark to margin centrally with pale distal margin dorsally and ventrally, anal and pelvic fins dusky, pelvics with pale margin.



**FIGURE 3.** *Kathetostoma binigrasella* sp. nov.: A, NMNZ P.10111, 67.7 mm SL, juvenile, dorsal view of head and lateral view of body (illustrated by R. Plant); and B, holotype, NMNZ P.42147, 334 mm SL, adult, dorsal and lateral views (illustrated by M. Freeborn).

**TABLE 1.** Selected proportional measurements and counts for *Kathetostoma giganteum* and types of *K. binigrasella* sp. nov.

|                           | <i>Kathetostoma binigrasella</i> sp. nov. |                  |           | <i>Kathetostoma giganteum</i> |           |
|---------------------------|---|------------------|-----------|-------------------------------|-----------|
|                           | Holotype                                  | Paratypes (n=32) | Mean ± SD | (n=15)                        | Mean ± SD |
|                           |   | Range            |           | Range                         |           |
| Standard length (mm)      | 334                                       | 67.7–560         |           | 52.0–529                      |           |
| % SL                      |   |                  |           |                               |           |
| Body depth                | 21.7                                      | 17.7–28.8        | 21.6±2.3  | 18.1–27.9                     | 20.7±2.9  |
| Body width                | 25.3                                      | 18.0–31.5        | 23.4±2.8  | 19.0–24.0                     | 21.9±2.3  |
| Head length               | 30.5                                      | 27.2–32.7        | 29.5±1.6  | 27.0–32.4                     | 28.6±2.0  |
| Caudal peduncle depth     | 9.9                                       | 8.8–10.6         | 9.7±0.4   | 7.9–10.8                      | 8.8±0.7   |
| Caudal peduncle length    | 7.2                                       | 5.2–9.0          | 7.0±0.9   | 6.60–10.6                     | 8.6±1.4   |
| Predorsal length          | 60.5                                      | 52.8–64.1        | 58.0±2.5  | 49.7–54.5                     | 52.1±1.6  |
| Preanal length            | 55.1                                      | 50.4–62.7        | 55.4±2.9  | 40.6–51.3                     | 48.1±4.8  |
| Prepectoral length        | 37.7                                      | 34.29–40.0       | 37.0±1.5  | 31.3–37.5                     | 33.3±1.6  |
| Pelvic fin origin to anus | 47.0                                      | 42.4–56.6        | 44.9±8.7  | 34.3–54.8                     | 42.3±5.1  |
| Anus to anal fin origin   | 4.2                                       | 3.5–7.3          | 4.5±1.4   | 2.7–5.9                       | 3.9±0.9   |
| Dorsal fin base           | 30.2                                      | 27.7–36.2        | 32.2±2.2  | 35.9–40.9                     | 38.1±1.3  |
| Anal fin base             | 38.6                                      | 33.1–44.5        | 38.9±2.6  | 37.7–48.2                     | 41.2±3.6  |
| Pectoral fin length       | 30.8                                      | 27.7–35.1        | 31.9±1.8  | 28.0–33.7                     | 30.3±1.5  |
| Pelvic fin length         | 24.9                                      | 23.1–27.9        | 25.5±1.2  | 19.5–24.6                     | 21.8±1.7  |
| Caudal fin length         | 22.5                                      | 20.4–27.2        | 24.4±1.8  | 21.7–27.9                     | 24.4±2.0  |
| Mouth width               | 18.4                                      | 15.2–23.7        | 18.2±1.7  | 14.9–20.6                     | 16.5±1.8  |
| % HL                      |   |                  |           |                               |           |
| Head depth                | 74.0                                      | 74.8–90.5        | 82.3±5.7  | 66.3–93.7                     | 80.8±8.3  |
| Head width                | 141                                       | 118–169          | 137±11.9  | 110–143                       | 124±8.2   |
| Orbit diameter (length)   | 15.6                                      | 12.9–22.1        | 17.5±1.9  | 17.0–24.6                     | 21.1±2.7  |
| Orbit diameter (width)    | 13.6                                      | 12.3–20.4        | 15.2±1.9  | 14.9–23.3                     | 19.2±2.9  |
| Shield length             | 57.1                                      | 35.8–69.3        | 58.1±9.6  | 34.9–64.1                     | 52.0±9.7  |
| Shield length (to snout)  | 71.8                                      | 67.6–85.0        | 74.1±4.6  | 67.3–77.3                     | 72.7±2.5  |
| Humeral spine length      | 28.9                                      | 21.3–38.1        | 30.7±4.5  | 22.5–50.3                     | 36.8±7.8  |
| Interorbital width        | 35.3                                      | 27.0–42.2        | 37.0±2.7  | 29.0–38.2                     | 33.2±2.4  |
| Interorbital space        | 19.5                                      | 11.9–25.9        | 21.0±2.9  | 11.4–26.3                     | 17.9±4.5  |
| Interorbital length       | 36.1                                      | 22.1–39.1        | 33.7±4.3  | 31.0–38.2                     | 34.7±2.4  |
| Maxillary length          | 27.0                                      | 24.0–38.3        | 29.1±3.2  | 26.8–40.3                     | 30.3±4.8  |
| Maxillary width           | 19.9                                      | 18.5–24.7        | 21.2±1.5  | 17.4–22.7                     | 20.2±1.6  |
| Snout length              | 12.2                                      | 7.7–15.4         | 11.2±1.7  | 9.4–16.9                      | 12.9±2.2  |
| % predorsal length        |   |                  |           |                               |           |
| Dorsal fin base           | 50.0                                      | 43.2–66.0        | 55.6±5.6  | 66.7–82.2                     | 73.2±3.6  |
| Meristic values           |   |                  |           |                               |           |
| Dorsal-fin rays           | 15  | 15–17            |           | 17–19                         |           |
| Anal-fin rays             | 15  | 14–16            |           | 17–18                         |           |
| Vertebrae                 | 30  | 30–31            |           | 33–34                         |           |

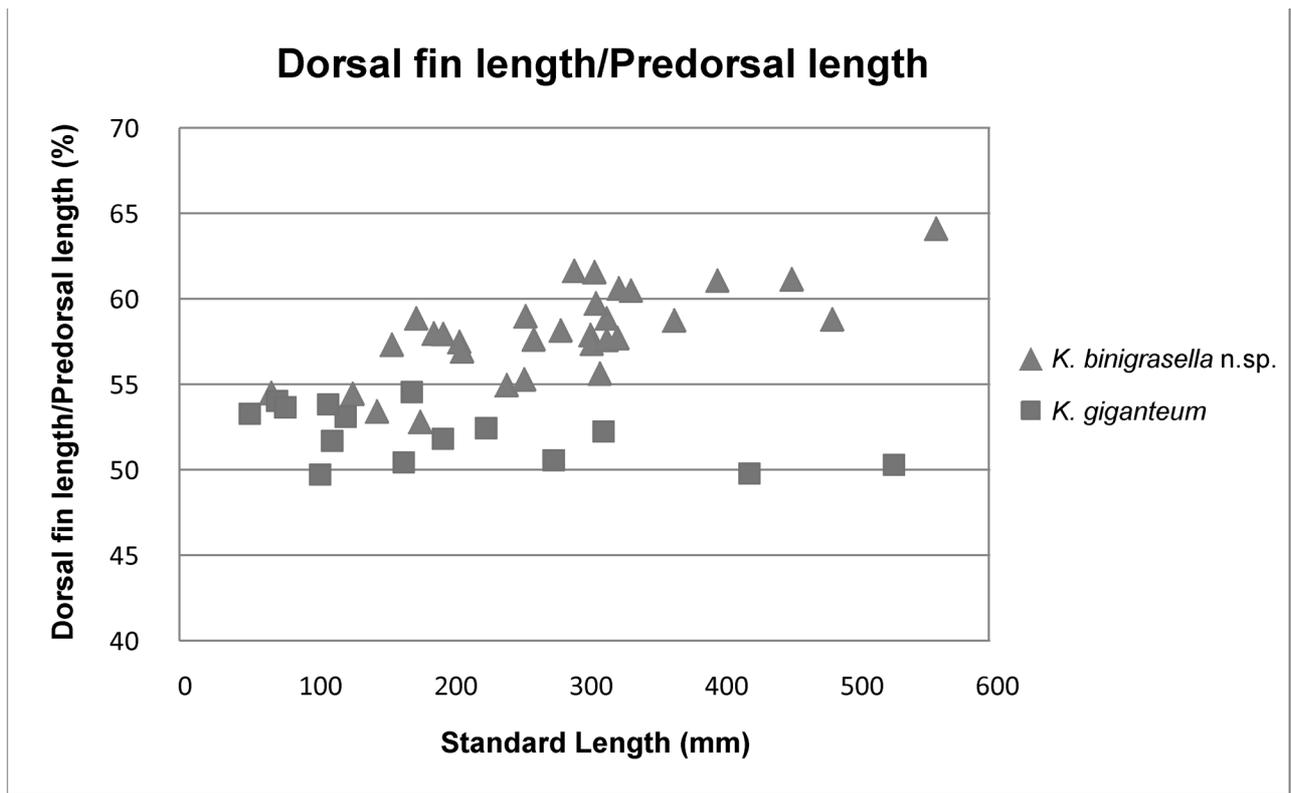
**TABLE 2.** Observed frequency of values for selected meristic features in Australasian species of *Kathetostoma*.

|                                    | 13              | 14 | 15 | 16 | 17 | 18 | 19 | 28        | 29 | 30 | 31 | 32 | 33 | 34 |
|------------------------------------|-----------------|----|----|----|----|----|----|-----------|----|----|----|----|----|----|
| <i>Kathetostoma</i> spp            | Dorsal Fin Rays |    |    |    |    |    |    | Vertebrae |    |    |    |    |    |    |
| <i>binigrasella</i> <b>sp.nov.</b> |                 |    | 16 | 9  | 1  |    |    |           |    | 23 | 1  |    |    |    |
| <i>giganteum</i>                   |                 |    |    |    | 1  | 4  | 6  |           |    |    |    |    | 1  | 11 |
| <i>canaster</i>                    |                 |    |    | 9  | 7  | 5  |    |           | 1  |    | 3  | 12 | 2  |    |
| <i>laeve</i>                       |                 |    | 3  | 17 | 6  |    |    | 3         | 13 | 7  |    |    |    |    |
| <i>nigrofasciata</i>               |                 | 2  | 9  |    |    |    |    | 3         | 6  |    |    |    |    |    |
|                                    | Anal Fin Rays   |    |    |    |    |    |    |           |    |    |    |    |    |    |
| <i>binigrasella</i> <b>sp.nov.</b> |                 | 3  | 23 | 2  |    |    |    |           |    |    |    |    |    |    |
| <i>giganteum</i>                   |                 |    |    |    | 6  | 6  |    |           |    |    |    |    |    |    |
| <i>canaster</i>                    |                 |    | 3  | 17 |    |    |    |           |    |    |    |    |    |    |
| <i>laeve</i>                       | 3               | 15 | 7  |    |    |    |    |           |    |    |    |    |    |    |
| <i>nigrofasciata</i>               | 8               | 3  |    |    |    |    |    |           |    |    |    |    |    |    |

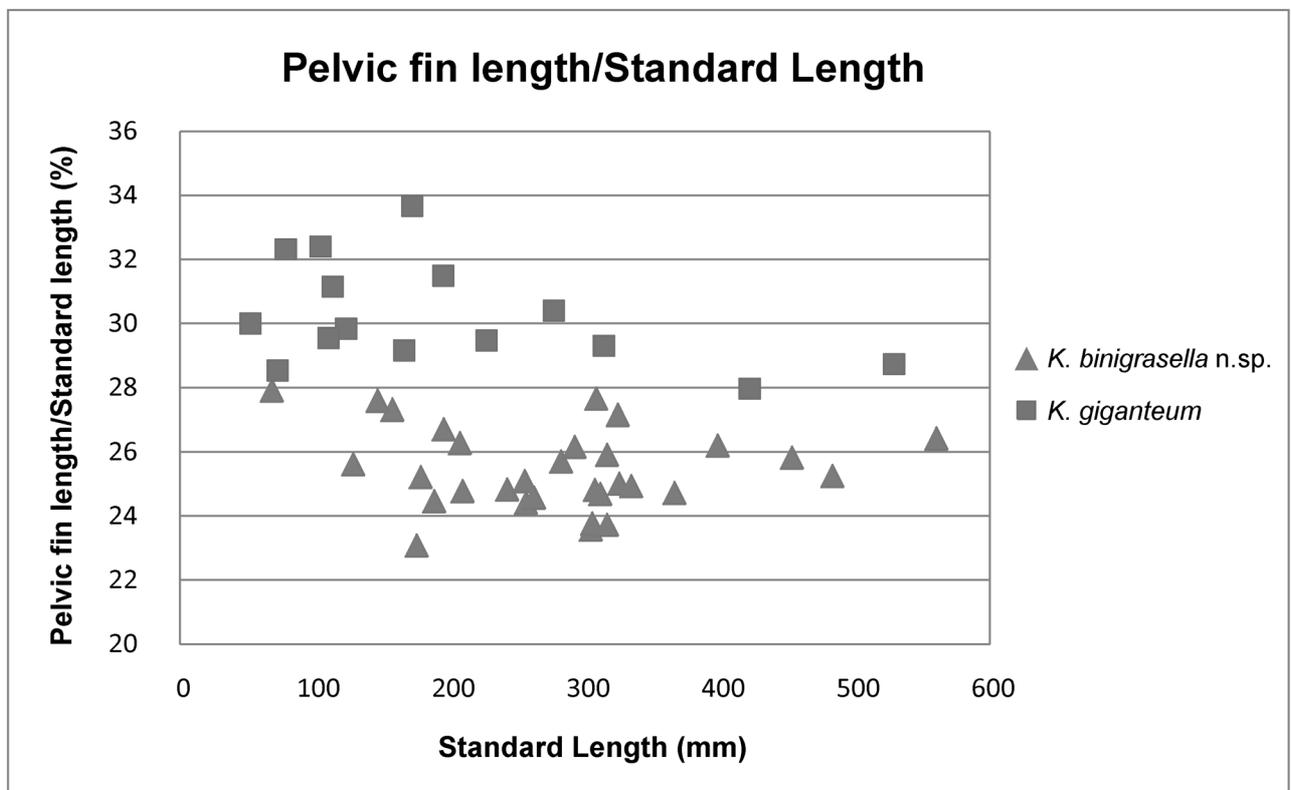
Fresh colours: Greenish tan above, bands brownish with scattered dark brown speckles and blotches, underside greyish white with pink tinges, dorsal, caudal and pectoral fins dark greenish brown, dorsal and pectoral speckled with brown; pelvic and anal fins dusk white with white margins.



**FIGURE 4.** *Kathetostoma binigrasella* **sp. nov.**, paratype, NMV A 25153-001, 223 mm SL, New Zealand, West Norfolk Ridge, Wanganella Bank, 32° 36.067' S – 32° 36.067' S, 167° 35.217' E – 167° 35.217' E, 116–122m, TAN0308-105, RV *Tangaroa*, M. Gomon, 29 May 2003, dorsal and lateral views.



**FIGURE 5.** Comparison of length of dorsal fin base and predorsal length relative to size in specimens of *Kathetostoma binigrasella* sp. nov. and *K. giganteum* examined.



**FIGURE 6.** Comparison of pelvic fin length and standard length relative to size in specimens of *Kathetostoma binigrasella* sp. nov. and *K. giganteum* examined.

**Etymology.** The specific name *binigrasella*, from the Latin *bi* for ‘two’, *nigra* for ‘dark’ and *sella* for ‘saddle’ refers to the broad dark brown saddle-like bands dorsally on the body that are obvious features distinguishing this species from its New Zealand congener.

**Distribution.** Widespread and relatively common in coastal and offshore waters, from the Wanganella Bank (southern Norfolk Ridge) to the Snares shelf, including the Chatham Rise. Endemic to New Zealand. Occurs at 10–500 m depth, but more frequently taken in 100–300 m; lives on sand or mud bottoms.

**Comments.** Despite its recognition for more than 25 years, this species has been confused with its New Zealand congener *Kathetostoma giganteum* in literature and fisheries catch data. Records of New Zealand giant stargazers probably include both species, especially where capture depths are less than 400 m. Based on confirmed records, population sizes of this species are smaller than those of its congener.

A genetic study by Smith *et al.* (2006) implies closer relationships between the new species and the rather broadly distributed Australian *Kathetostoma leave* (Bloch & Schneider, 1801), and between *Kathetostoma giganteum* and the southeastern Australian *Kathetostoma canaster* Gomon & Last, 1987, than the two New Zealand congeners are to one another. This is consistent with differences in morphology (Table 2) and depth distributions of the four, with *K. binigrasella* and *K. leave* having relatively few vertebrae (30–31 and 28–31 respectively) and anal fin rays (14–16 and 13–15), shorter and chunkier bodies, smaller eyes, prominent broad banded colour patterns and shallower depth ranges, and *K. canaster* and *K. giganteum* having more vertebrae (31–33 and 33–35 respectively) and anal fin rays (15–16 and 17–19), more elongate and slender bodies, larger eyes, more obscure banding, if banding is at all apparent, and distributions to greater depths (to 700 and over 1000m respectively). Genetics of the fifth Australasian species *K. nigrofasciatum* confined to the outer portion of the continental shelf and top of the slope in southwestern Australia supports a common ancestry with the ancestor of all four. That species has even lower meristic values, which overlap partially with those of *B. binigrasella* and *B. leave*, as well as a distinctly banded pattern that may be more indicative of the ancestral condition than a relationship between the species, as at least the banded colouration is found in other uranoscopid genera as well.

## Acknowledgments

We thank the following for help with specimens and data: Andrew Stewart, Carl Struthers, Romain Crec’hriou, Lisa Moore (NMNZ), Di Bray (NMV), Mark McGrouther (AMS), and Alaster Graham (CSIRO); specimen collectors Peter McMillan (NIWA), Chris Petyt, Marli Dee, Julian Hall (NZ Scientific Observer Programme), Robin McPhee (NMNZ), John and Roger Ansley (New Plymouth), and G. Nicholson and K. Smith (Tauranga). Illustrations of species were provided by Rhyllis Plant and Michelle Freeborn. This research was funded (in part) by the New Zealand Foundation for Research, Science and Technology (contract CO1X00502) “Biosystematics of NZ EEZ Fishes” project.

## References

- Anderson, O., Bagley, N., Hurst, R., Francis, M., Clark, M. & McMillan, P. (1998) Atlas of New Zealand fish and squid distributions from research bottom trawls. *NIWA Technical Report*, 42.
- Ayling, T. & Cox, G.J. (1982) *Collins Guide to the Sea Fishes of New Zealand*. Collins, Auckland: 343 pp., 48 col. pls, txt figs.
- Bray, D.J. & Hoese, D.F. (2006) Family Uranoscopidae. Pp. 1509–1515. In: Beesley, P.L. & Wells, A. (eds). *Zoological catalogue of Australia*. Vol. 35, part 3. ABRS & CSIRO Publishing: Collingwood: i–xxii, 1473–2178, txt figs.
- Doak, W. (1978) *Fishes of the New Zealand region*. Hodder & Stoughton, Auckland. 135 pp.
- Francis, M. (1988) *Coastal Fishes of New Zealand. A Diver’s Identification Guide*. Reed Publishing, Auckland: 63 pp, 146 col. pls.
- Francis, M. (2001) *Coastal Fishes of New Zealand. An Identification Guide*. Reed Publishing, Auckland: 103 pp., 203 col. pls.
- Freeman, A.N.D. & Tunnicliffe, G.A. (1997) Recent vertebrate types in the Canterbury Museum, Christchurch, New Zealand. *Records of the Canterbury Museum*, 11, 1–16.
- Gomon, M.F. & Johnson, J.W. (1999) A new fringed stargazer (Uranoscopidae: *Ichthyoscopus*) with descriptions of the other Australian species. *Memoirs of the Queensland Museum*, 43 (2), 597–619, figs 1–10, 2 tbls.
- Hardy, G.S. (1990) Fish types in the National Museum of New Zealand. *National Museum of New Zealand, Miscellaneous Series* No. 21, 1–17.
- Hubbs, C.L. & Lagler, K.F. (1947) Fishes of the Great Lakes Region. *Bulletin Cranbrook Institute of Science*, 26, 1–186 (251

figs, 26 col. pls, 38 text-figs).

- Hutton, F.W. (1872) *Fishes of New Zealand. Catalogue with diagnoses of the species*. Colonial Museum and Geological Department, James Hughes, Wellington: i–xvi, 1–133, 12 pls.
- Kashimoto, H. (1990) Uranoscopidae. Pp. 297–300. In Amaoka, K., K. Matsuura, T. Inada, M. Takeda, H. Hatanaka & Okada, K. (eds) *Fishes collected by the R/V Shinkai Maru around New Zealand*. Japan Marine Fishery Resource Research Center: 1–410, color figs (In Japanese and English).
- Leviton, A.E., Gibbs, Jr., R.H., Heal, E. & Dawson, C.E. (1985) Standards in herpetology and ichthyology: part 1. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia*, 1985, 802–832.
- Mees, G.F. (1960) The Uranoscopidae of Western Australia (Pisces, Perciformes). *Journal of the Royal Society of Western Australia*, 43 (2), 46–58, figs 1–9.
- Nelson, J.S. (2006) *Fishes of the World*. 4<sup>th</sup> edition. John Wiley & Sons: i–xvii + 1–600.
- Paul, L.J. (1986) *New Zealand Fishes. An identification guide*. Reed Methuen: 184 pp.
- Paul, L.J. (2000) *New Zealand Fishes. Identification, natural history and fisheries*. Reed Publishing, Auckland: 253 pp.
- Phillips, W.J. (1921) Notes on the edible fishes of New Zealand. With a record of fishes exposed for sale in Wellington during 1918. *New Zealand Journal of Science and Technology*, 4, 114–125.
- Phillips, W.J. (1927) Bibliography of New Zealand fishes. *New Zealand Maritime Department of Fisheries Bulletin*, vol. 1, 1–68.
- Roberts, C.D., Paulin, C.D., Stewart, A.L., McPhee, R.P. & McDowall, R.M. (2009) Appendix. Checklist of living lancelets, jawless fishes, cartilaginous fishes and bony fishes. Pp. 527–536. In: Gordon, D.P. (ed). *The New Zealand Inventory of Biodiversity. Volume 1. Kingdom Animalia*. Christchurch. Canterbury University Press.
- Roberts, C.D. & McPhee, R.P. (1998) Banded boofs. *New Zealand Fishing News*, 21 (7), 66.
- Russell, B.C. (1996) Type specimens of New Zealand fishes described by Captain F. W. Hutton, F. R. S. (1836–1905). *Journal of the Royal Society of New Zealand*, 26 (2), 215–236.
- Scott, E.O.G. (1974) Observations on some Tasmanian fishes: Part XX. *Papers and Proceedings of the Royal Society of Tasmania*, 108, 171–197, 4 figs.
- Scott, E.O.G. (1980) Observations on some Tasmanian fishes: Part XXVI. *Papers and Proceedings of the Royal Society of Tasmania*, 114, 85–144, 2 pls, 7 tbls.
- Smith, P.J., McPhee, R.P. & Roberts, C.D. (2006) DNA and meristic evidence for two species of giant stargazer (Teleostei: Uranoscopidae: Kathetostoma) in New Zealand waters. *New Zealand Journal of Marine and Freshwater Research*, 40, 379–387, 4 figs, 2 tbls.
- Waite, E.R. (1911) Scientific results of the New Zealand Government trawling expedition, 1907. Pisces, Part 2. *Records of the Canterbury Museum*, 1 (3), 157–272, pls 24–57, figs 1–3.
- Waite, E.R. & McCulloch, A.R. (1915) The fishes of the South Australian Government trawling cruise, 1914. *Transactions of the Royal Society of South Australia*, 39, 455–476, fig. 1.
- Whitley, G.P. (1968) A check-list of the fishes recorded from the New Zealand Region. *Australian Zoologist*, 15 (1), 1–102, figs 1–2.