Deep-Water Eels from Cook Strait, New Zealand

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Abstract

New records are *Borodinula gilli* (Bean), *Borodinula infans* (Günther), *Serrivomer samoensis* Bauchot, *Simenchelys parasiticus* Gill, *Synaphobranchus affinis* Günther and *Diastobranchus capensis* Barnard, which are described. *Diastobranchus danae* (Bruun) is a synonym of *D. capensis*. *Borodinula gilli* is osteologically more closely similar to *B. bowersii* (Garman), also from the Pacific, than it is to other species of the genus.

Introduction

The recorded apodal fauna of New Zealand waters is not large. Griffin (1937, pp. 12–26) revised the eels of this region recognising 15 species. Whitley (1956, pp. 401–402) has listed 20 species from this area, including two fresh-water species, a bathypelagic species, *Nemichthys scolopaceus* Richardson, 1848, and a deep, benthic species *Diastobranchus danae* (Bruun, 1937) described originally from a pelagic larval specimen. The others were all shallow-water, coastal eels. One other deep-water eel has been recorded from New Zealand, *Serrivomer bertini* Bauchot, 1959, collected by the *Dana* 1928-30 Expeditions.

The extensive feeding grounds on the continental slope around New Zealand and the wide areas of temperate seas with their rich plankton would be expected to support an abundant and diverse benthic and bathypelagic deep-sea eel fauna. The known deep-water eel fauna as indicated above is yet small and is the result of the limited collections to date. This is demonstrated by the results reported here from sporadic collections made in the one area of Cook Strait over a short period of time.

During two of the years, 1956-1957, in which trawling and longlining were undertaken by the Department of Zoology, Victoria University of Wellington, in the Cook Strait area, six species new to the New Zealand region were collected in depths of more than 400 fathoms, thus increasing the known apodal fauna of this region by about 30 per cent. Only one of these species is as yet known from a restricted area, the remainder are in general known from widely spaced locations in the Indo-Pacific and Atlantic oceans. In the following account these six species are described and their systematic relationships discussed.

The Apodes represent perhaps one of the most specialised orders of teleost fishes, a specialisation of external morphology, osteology and life history. Other groups of teleosts have developed the eel-like form of the body, but few have the simplified

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osteology and the unique larval development that are peculiar to the true eels. The specialisation and simplification of the external characters in the Apodes have produced many difficulties for the systematist. The families constituting the Order Apodes are well defined, but generic and specific characterisations are often less clear. Early, and even some recent workers in this group have relied to a large extent on differences in major body proportions in the separation of species, proportions which in many cases are of less positive value than originally supposed. While two of the most widely used characters in the classification of teleosts, scale and fin-ray counts, are generally regarded as of less systematic significance in eels, the value of fin-ray counts has been commonly underestimated in the past, but they should not be ignored in specific descriptions. The rather inaccessible osteology is also a valuable basis for classification, and wherever possible in the following account osteological characters are given.

MATERIAL AND METHODS

The eels which form the basis of this account represent the major part of the apodal material collected from east of Cook Strait by the Department of Zoology, Victoria University of Wellington, and from near Kaikoura by Mr. R. Baxter, a commercial fisherman, during the years 1956-57. The area represented by the collections covers about 165 square miles, extending from well south-east of Cape Palliser, with depths of 1,500 fathoms, south with 800 fathoms and south of Cape Turakirae with 500 fathoms. Actual depths fished varied from 450 to 1,300 fathoms, but the majority of collections were made in about 600 fathoms. A number of specimens were collected off Kaikoura in about the same depth. Collecting methods were (a) trawling with "open" bathypelagic cone-nets, (b) longlines and (c) baited traps attached to longlines. When the two latter methods were used eels often made up the bulk of the catch.

Skeletal material was prepared and studied by dissection, maceration, alizarin-stained whole mounts, or wherever possible, by X-ray photography. Measurements of specimens were made to the nearest millimetre by dividers; drawings were made directly from the specimen in the case of larger structures and by a standard camera lucida in the case of scales and small skeletal structures. Proportional measurements are given as follows: Total length: snout tip to extremity of caudal fin; standard length: snout tip to distal end of upper hypural; head: snout tip to posterior margin of opercular membrane; snout: snout tip to anterior margin of eye; eye: horizontal diameter; interorbital: least fleshy space between the dorsal margins of the eyes; postorbital: posterior margin of eye to anterior extremity of pectoral base; cleft of mouth: snout tip to angle of mouth when open; predorsal: snout tip to origin of dorsal fin; preanal: snout tip to origin of anal; depth: maximum depth of body, unless where stated; branchial interspace: distance between ventral or posterior extremities; pectoral: anterior extremity of base to tip of fin when held against body. Vertebrae were counted to include the terminal element bearing the hypurals.

The faunal areas of the ocean are given as in Grey (1956, pp. 78-79). The deep-sea fauna is that below 100 fathoms; the terms abyssal and deep-abyssal have been added to define the faunas below 500 fathoms and 1,000 fathoms respectively. The continental shelf extends from the coast to 100 fathoms; the continental slope extends from 100-2,000 fathoms; the abyssal plain is located below 2,000 fathoms.

MATERIAL EXAMINED

Victoria University of Wellington, Department of Zoology Collections

Coll. VUZ 23 (Station FOR): Palliser Bay, 41° 36′ 30″ S., 174° 57′ 30″ E., 14/1/56, 1745-2130 hrs, 540 fathoms, longline and baited trap.
3 *Simenchelys parasiticus*.

Coll. VUZ 74 (Station KOQ) : Off Palliser Bay, 41° 45′ S., 174° 54′ E., 24/11/56, 1250-1700 hrs, 780 fathoms, longline and baited trap. 4 *Diastobranchus capensis.*

Coll. VUZ 75 (Station KOP) : Off Palliser Bay, 41° 45′ S., 174° 53′ E., 24/11/56, 1330-1530 hrs, c. 600 fathoms, r.gn.m., longline and baited trap. 25 *Simenchelys parasiticus,* 2 *Synaphobranchus affinis.*

Coll. VUZ 85 (Station KUC) : South of Cape Palliser, across 41° 74′ S., 175° 02′ E., 19/4/57, 1915-2400 hrs, c. 800 fathoms, N4M towed at about 600 fathoms. 2 *Borodinula gilli.*

Coll. VUZ 86 (Station KUC) : South of Cape Palliser, across 41° 47′ S., 175° 02′ E., 20/4/57, 0045-0530 hrs, c. 800 fathoms, N4M towed at about 600 fathoms. 1 *Borodinula gilli.*

Coll. VUZ 90 (Station HOR) : Off Palliser Bay, 41° 40′ 30″ S., 174° 57′ E., 12/7/57, 1215-1400 hrs, c. 600 fathoms, longline and baited trap. 2 *Synaphobranchus affinis,* 5 *Diastobranchus capensis,* 17 *Simenchelys parasiticus.*

Coll. VUZ 95 (No Station Lettering) : South of Cape Palliser, approx. 42° 10′ S., 175° 35′ E., 25/8/57, 0230-0845 hrs, c. 1400 fathoms, N4M towed at 500-600 fathoms. 1 *Borodinula infans.*

Coll. VUZ 104 (Station DOR) : Off Palliser Bay, 41° 35′ S., 174° 56′ E., 10/12/57, 1130-1400 hrs, c. 500 fathoms, longline and two baited traps only. 2 *Simenchelys parasiticus.*

Coll. VUZ 105 (Station LUB) : Off Palliser Bay, 41° 47′ S., 175° 01′ 30″ E., 28/12/57, 1130-1440 hrs, c. 925 fathoms, N4M towed in 450-500 fathoms. 1 *Serrivomer samoensis.*

Kaikoura Collection (Mr. R. Baxter) : About three to four miles from Kaikoura, 17/9/56, 540 fathoms, longline and baited trap. 3 *Diastobranchus capensis,* 22 *Simenchelys parasiticus.*

ABBREVIATIONS

Coll., Collection; hrs, hours (in the International 24-hour system) ; c., approximately; r.gn.m., rock and green mud; N4M, 4 metre cone-net.

SYSTEMATIC ACCOUNT

Family NEMICHTHYIDAE

Naked deep-sea eels with the body extremely slender and jaws excessively attenuated; snout much more than half length of head; teeth small with backwardly-directed, curving lips, numerous, set in curving bands and quincunxial rows; two pairs of large nostrils, the anterior with a short tube, close in front of eye; nuchal constriction present; gill-openings well developed, convergent forward, anus far in advance of middle of length; pectorals and vertical fins well developed; fin membranes thin, not enveloping rays; lateral line pores present or absent; caudal filament present or absent.—Beebe and Crane, 1937b, p. 350.

The members of this widely distributed family are delicate, attenuated eels living the major part of their lives in mid-water depths. Roule and Bertin (1929, pp. 1–113) and Beebe and Crane (1937b, pp. 349–383) have added greatly to the knowledge of this family and in particular *Nemichthys scolopaceus* Richardson, 1848 and *Borodinula infans* (Günther, 1878). Less frequently recorded species of these genera, especially those from the Pacific region, are not well known.

Previous to this account the Nemichthyidae has been recorded only once from New Zealand waters; this was the occurrence of a damaged specimen of *Nemichthys* on a baleen plate of a humpback whale killed near Tory Channel, Cook Strait, in July, 1952. The specimen retained sufficient character in spite of its damaged condition to be referrable to *N. scolopaceus.* In their description of the specimen, Richardson and Garrick (1953, p. 467) are of the opinion that the eel had been

taken by the whale at a depth between 50 and 100 fathoms. The genera of the family are well characterized. Günther (1878, p. 251) originally included all known snipe-eels in the genus *Nemichthys* but Gill and Ryder (1883, p. 26) later divided this genus into two sections, *Nemichthys* and *Labichthys,* mainly on the nature of the lateral line—a triple row of pores in the former and a single row in the latter. It was further recognised by Jordan and Davis (1891, p. 655) that *Labichthys* could be divided into those forms in which the "ano-pectoral length" is very short, equal to only about 0.7 of the postorbital length, and those in which this was much greater, equal to five times the postorbital length. The forms so recognised were named *Labichthys* and *Avocettina* respectively. Whitley (1931, p. 334) has rejected the generic name *Avocettina,* this being preoccupied by *Avocettina* (pro- *nus* Bonaparte, 1850), Mulsant and Verreaux, 1866, Aves, in favour of *Borodinula,* and this is accepted in the following account.

Borodinula Whitley, 1931

Nemichthys Günther, 1878 (partim). *Ann. Mag. Nat. Hist.,* 5 (2): 251.
Labichthys Gill and Ryder, 1883 (partim). *Proc. U.S. Nat. Mus.,* 6: 26.
Avocettina Jordan and Davis, 1891. *Rep. U.S. Comm. Fish.* (1888), 16: 655.
Borodinula Whitley, 1931. *Aust. Zool.,* 6 (4): 334.

Nemichthyids with a single row of pores in the lateral line and the anus located far behind the level of the pectoral base; caudal filament absent, teeth quincunxially arranged in straight rows; dorsal origin immediately behind level of pectoral base; dorsal rays in middle third of body neither short nor spinous.—Beebe and Crane, 1937b, p. 366.

Four species of *Borodinula* are recognised. *B. infans* (Günther, 1878), is cosmopolitan in distribution; *B. exophthalma* (Parr, 1932) is known from the Atlantic; the remaining two, *B. gilli* (Bean, 1890) and *B. bowersii* (Garman, 1899) are restricted to the Pacific. Of these species, *B. infans* was shown by Roule and Bertin (1929, pp. 26–28) to be a widely variable form possibly divisible into more than one species. These authors also synonymised *B. gilli* and possibly *B. bowersii* with *B. infans,* although Beebe and Crane (1937b, p. 367) consider that these three species are valid. *B. exophthalma,* having a wide interorbital space, larger eye and swollen head profile is clearly separable from the other three species which have a narrow interorbital region and in general, a smaller eye. Characteristic of both *B. infans* and *B. exophthalma* is the high number of dorsal fin-rays (300–350) and anal rays (about 30 less than the dorsal). *B. bowersii,* on the other hand, has only about 260 dorsal rays and 230 anal rays as well as a long postorbital region, clearly longer than in *B. infans* or *B. exophthalma.* The fin-rays have not as yet been counted in the type of *B. gilli,* and thus the case for the establishment of *B. gilli* as a species distinct from *B. infans,* is not so well defined, at least on this character. Bean's description of the type of *B. gilli* omitted all fin-ray counts and the number of lateral line pores; in addition, the tips of the jaws were broken off, although Bean was apparently unaware of this, with resultant errors in proportional measurements referred to the head. From more detailed examinations of the type by Bean (Parr, 1932, p. 13) and by Beebe and Crane the following information was added: the interorbital width is only one-half the diameter of the eye; there is no bulge in the profiles near the eyes; the eye is contained in the postorbital length about 2.2 times; there are 177 or 178 pores in the lateral line behind the pectoral origin and three in front of it; the anal originates at the vertical between the 18th and 19th pores behind the pectoral base.

In Roule and Bertin's study of 30 examples of *Borodinula* which they referred to *B. infans,* they found that the eye was contained in the postorbital 2.5–6.0 times and there were 166–194 pores in the lateral line. The relationship between the diameter of the eye and the interorbital width was not recorded in this account so on this character the type of *B. gilli* is not readily comparable; but it would

appear that if the illustrations of *B. infans* by Roule and Bertin (1929, p. 25, figs. 10 and 11) are representative, then the interorbital would be about equal to the diameter of the eye in this species. In the type of *B. gilli* the interorbital is contained twice in the diameter of the eye.

Chapman's specimen (1940, p. 13), taken from close to the type locality of *B. gilli* and referred to this species, was more completely described than the type. It is clearly distinct from *B. infans*. The dorsal rays number 260, the anal 205; there are 156 pores in the lateral line (a value unusually low even for the genus as a whole: in 24 specimens of *Borodinula infans* in which the lateral line pores were counted by Roule and Bertin, the lowest count was 166 with the number not lower in shorter specimens); the interorbital width is contained twice in the eye, the eye in the postorbital about 3.3 times; there is no tendency for the eye to bulge into the profile of the head. Other proportions are scarcely definitive enough to be used as specific characters.

The above comparisons are presented to show that while the type of *B. gilli* can only be held distinct from *B. infans* on the insecure characters of narrow interorbital space, slightly larger eye and geographic discontinuity, Chapman's specimen, referred to *B. gilli*, is more clearly distinguishable from *B. infans*, whatever the type of *B. gilli* may eventually prove to be. Disregarding fin-ray counts in any case, Chapman's specimen is closer to the latter on other characters than to *B. infans*, and the fact that this specimen was taken close to the type locality of *B. gilli* cannot be ignored.

In the following account two species of *Borodinula* are described from four specimens taken in 500–600 fathoms from Cook Strait; three are identified with *B. gilli*, the fourth, damaged, with *B. infans*.

Borodinula gilli (Bean, 1890)

Labichthys gilli Bean, 1890. *Proc. U.S. Nat. Mus.*, 13: 455.
Avocettina infans Brauer, 1906 (*partim*). *Wiss. Ergebn. "Valdivia"* 15 (1): 129.
Avocettina infans Roule and Bertin, 1929 (*partim*). *Oceanogr. Rep. "Dana" Exped.* 1920–22, 4: 22–23.
Avocettina gilli Beebe and Crane, 1937b. *Zoologica, N.Y.*, 22 (4) 27: 367–368.
Avocettina gilli Chapman, 1940. *Occ. Pap. B.C. Mus.*, 2: 12–14.

Material Examined

Two specimens: Collection VUZ 85; 600 fathoms; April 19, 1957; total lengths 517 mm and 542 mm; adults.

One specimen: Collection VUZ 86; 600 fathoms; April 20, 1957; total length c. 610 mm; adult.

Specimens Previously Recorded

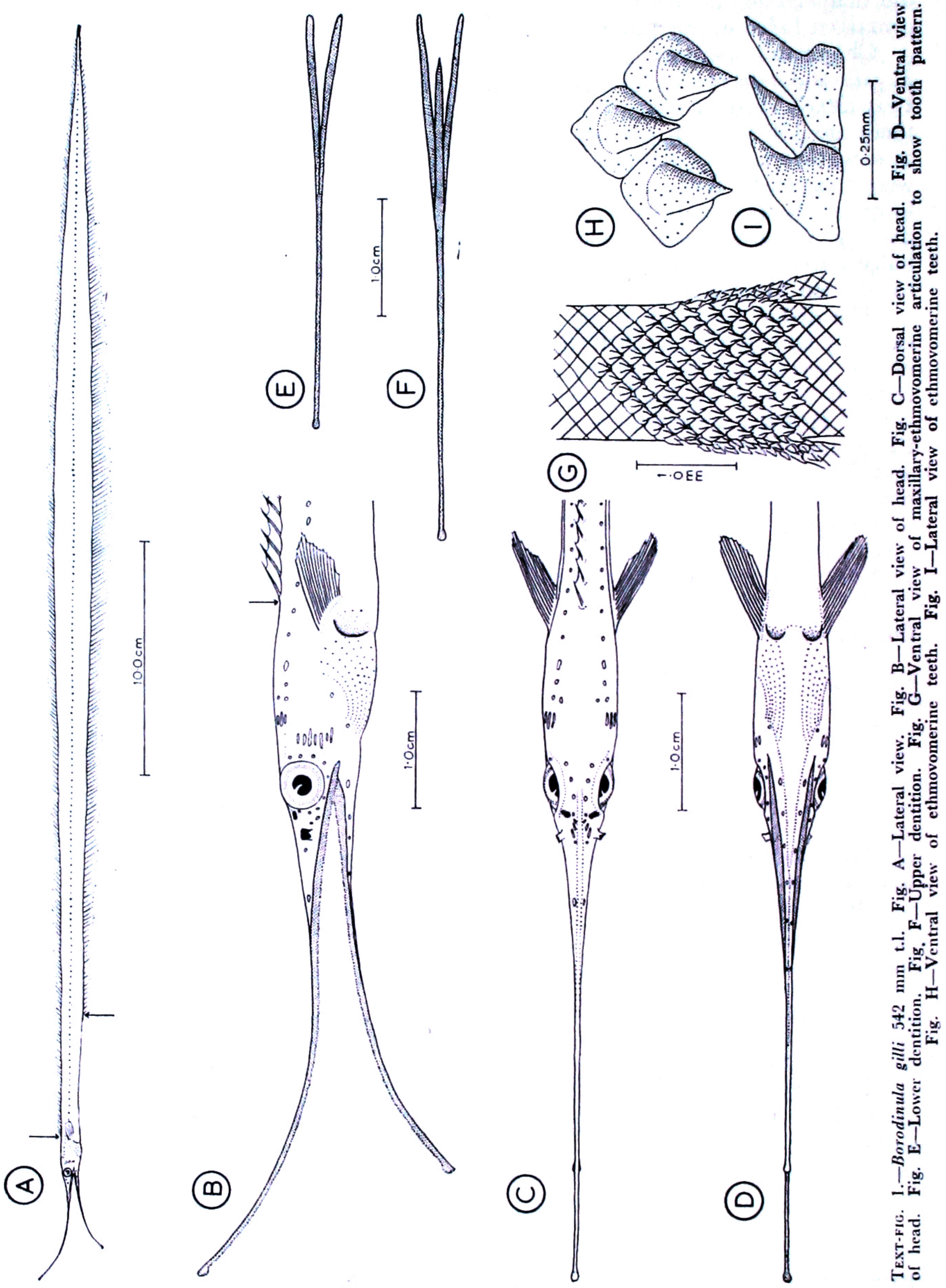
One specimen: Station 2859; 1569 fathoms; August 29, 1888; east of Prince of Wales Island, Alaska; lat. 55° 25′ N., long. 136° 20′ W; total length 463 mm; adult; the type specimen—Bean, 1890, p. 455.

One specimen: Station 1248A; up to 164 fathoms; January 1, 1935; coast of Alaska; lat. 51° N., long. 130° 48′ W; total length 420 mm; adult—Chapman, 1940, p. 12.

Description

(Text-fig. 1, A-I)

Body extremely elongate, moderately compressed anterior to vent, strongly compressed and band-like posteriorly; depth of body greatest at a point half-way along caudal region, where it is contained three times in postorbital length, but body tapering gradually to tip of tail. Head long, with an extended snout and much-produced, toothed jaws; fins delicate, scales absent.



TEXT-FIG. 1.—*Borodinula gilli* 542 mm t.l. Fig. A—Lateral view. Fig. B—Lateral view of head. Fig. C—Dorsal view of head. Fig. D—Ventral view of head. Fig. E—Lower dentition. Fig. F—Upper dentition. Fig. G—Ventral view of maxillary-ethmovomerine articulation to show tooth pattern. Fig. H—Ventral view of ethmovomerine teeth. Fig. I—Lateral view of ethmovomerine teeth.