ON THE GREENLAND SPECIES OF THE GENERA ARTEDIELLUS, COTTUNCULUS, AND GYMNOCANTHUS (TELEOSTEI, SCLEROPAREI,–COTTIDAE)

BY

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WITH 1 PLATE

Artediellus.

As far as I can judge the genus Artediellus[1]) is represented in Greenland waters by two species: *A. uncinatus* (Reinhardt) and *A. atlanticus* Jordan and Evermann which can be distinguished from each other by the following characters:

A. uncinatus

Both dorsal fins of the male with round white spots, each surrounded by a dark ring.

Number of pores in the lateral line 27—30. Size up to 100 mm.

Number of rays in the second dorsal fin 12—13.

A. atlanticus

Second dorsal fin of the male with dark and light cross bands or dark with light cross bands; first dorsal fin with dark and light spots.

Number of pores in the lateral line 20—25. Size up to 168 mm. Number of rays in second dorsal fin 13—15.

In both species the dorsal fin of the female is lower than that of the male and with obliquely running dark and light cross bands. The other characters are as in the males.

In Greenland waters *A. uncinatus* is a southern species, distributed from about 60°—68° N., *A. atlanticus* is a northern species, distributed from about $66^3/_4°$—$77^1/_2°$ N. Their bathymetric distribution is about 10—100 fms. and about 50—435 fms. respectively.

Artediellus uncinatus (Reinhardt).

(Plate I, fig. 1 a—b).

Cottus uncinatus Reinhardt, Overs. K. D. Vidensk. Selsk. Forhandl. 1833—34, pp. 2—3 (1835), K. D. Vidensk. Selsk. Skr., Naturvidensk. og mathem. Afh., VII, 1838, p. 114 and p. 118 (No. 4). — *Centridermichthys uncinatus* Lütken, Vidensk. Meddel. Naturhist. Foren. 1876, p. 379; Pietschmann, Meddel. om Grønland, 92, 3, 1932, p. 40, Fig. 16. — *Arte-*

[1]) Instead of the ambiguous genus *Centridermichthys* Jordan (Catal. of the Fishes of North America, 1885, p. 110) has established a new genus *Artediellus* and to this referred *Cottus uncinatus* Reinhardt as type.

diellus uncinatus Jensen, Meddel. om Grønland, XXIX, 1909, p. 241, Pl. XII, Fig. 2 a & b.

Regarding the characteristic features of this species see introduction to the genus *Artediellus*.

West Greenland.

Nanortalik. 1833. Arøe. 84 (♀) and 98 (♂). These are REINHARDT's original specimens of *Cottus uncinatus*.

Bredefjord, 29—47 fms., 47—53 fms., 66—74 fms., K. Stephensen, August 1912. 4 specimens, 50—62 mm.

Kvanefjord, 10—28 fms. K. Stephensen, June 1912. 1 specimen, 56 mm.

Godthaabfjord, udfor Karusukløbet i Kugssuk, 50—100 m. Paul Hansen, 13.6.1936, 5 specimens, 30, 35, 39, 45 and 50 mm.

65°35′ N. 54°50′ W., 75 fms., "Fylla" 7.7.1884, 3 specimens, 45, 47 and 55 mm.

65°34′ N. 54°31′ W., 68 fms., "Ingolf" St. 29, 5.7.1895 } 4 specimens,
66°35′ N. 55°54′ W., 88 fms., "Ingolf" St. 31. 11.7.1895 } 39, 43, 62 (♀) and 67 (♂) mm

67°57′ N. 55°30′ W., 35 fms., "Ingolf" St. 33, 12.7.1895, 94 specimens. The largest male 100 mm, the largest female 78 mm, the smallest specimen is 24 mm.

East Greenland.

Angmagssalik, 10—0 fms., Søren Jensen, 14-16.9.1900, 1 specimen, 57.5 mm.

Sexual dimorphism in *Artediellus uncinatus*.

It is well known that in cottoids the sexual dimorphism will often show itself in the exterior of the fish, now in one way, now in another, or at the same time in several ways[1]).

In *Artediellus uncinatus* the sexual dimorphism is most conspicuous. When I examined the numerous specimens which were brought home by the Ingolf Expedition from a trawling in Davisstræde (St. 33) I noticed that while nothing unusual was to be observed in the foremost dorsal fin of some specimens, this fin was in other specimens very high. By the dissection of several specimens I was convinced that the specimens with the high dorsal fin are males, those with the lower one females. The smaller the specimens are the less is the difference, but yet it is still perceptible in specimens of 57 mm. Also the 2nd dorsal fin is higher in the males than in the females, but the difference is not so conspicuous in large specimens as it is with regard to the foremost dorsal. The anal fin is about equally high in both sexes. The two figures in Pl. I illustrate the sexual dimorphism between the largest male (fig. 1 a) and

[1]) CHR. LÜTKEN: Kønsforskellen hos de nordiske Ulkefiske. Vidensk. Meddel. Naturhist. Foren., Kbhvn. 1876, p. 387.

female (fig. 1 b) from the Ingolf Expedition Station 33. For special comparison I give the following measurements:

	♂	♂	♀	♂	♀	♂	♀
Total length in mm	100	77	78	69	69	57	57
The longest ray of 1st dorsal fin in mm	24	14	6	10	5.5	6.5	5
The longest ray of 2nd dorsal fin in mm	20	14.5	9.5	12	9	9.5	7

It will be seen from this that the first dorsal fin is always somewhat lower in the females than the 2nd dorsal fin; its height is equal to the length of the snout (reckoned to the anterior margin of the eye). In the males, on the other hand, the difference between the height of the two fins diminishes as they grow older (in the three smallest ones from 3—2—0.5 mm), and in the largest male D^1 is even 4 mm higher than D^2, though D^2 at the same time has increased proportionately more in height than in the females. The length of the longest ray in D^1 in the male of 100 mm is equal to the distance between the end of the snout and the upper incision of the gill opening; in the male of 77 mm equal to the distance between the same point and the posterior border of the orbit; in the male of 69 mm and of 57 mm equal to the distance between the end of the snout and the posterior margin of the pupil and the anterior margin of the eye respectively.

There is also a great difference with regard to colour pattern between males and females, especially in large specimens. The above mentioned, 100 mm long, male may serve as type for the final colour of the male sex. The trunk is very dark, chocolate-coloured, with the exception of the belly which has retained a yellowish colour with a dark tinge here and there. On this dark background small white spots appear especially along and below the lateral line; also on gill cover and cheek a few white spots are seen. The fins have likewise turned dark, almost soot-coloured, with light stripes and spots. Along the rays the dorsal fins are ornamented with eye-like spots formed by a white centre and a dark ring; the anal fin has slanting stripes of a pure white colour; the light transverse stripes of the caudal fin and the pectoral fins are partly broken up into little spots which at the base of the fins are of a pure white colour, but become darker farther out; even on the ventral fins a single or a few white spots are seen[1]). The smaller the males are,

[1]) This description is given from the specimen preserved in alcohol. Fig. 9 in plate IV in the account of The Ichthyological Results of the Danish Ingolf Expedition (Vol. II, 1, 1898) will give an idea of the colours of the live specimen; with regard to an exact representation of the mutual proportions of the parts of the body this figure leaves much to be desired.

the more they resemble the females with regard to colour. The brown colour which by aid of a pocket lens is seen to arise from a compact crowding of chromatophores is paler, so that the three characteristic dark transverse bands can appear, and the white spots are less shiny; still at a total length of 57 mm the white pattern of the fins is yet purer in the males than in the females and is partly broken up into rounded spots.

The urogenital papilla is not on the whole very conspicuous in this cottoid, but yet perceptibly longer in the male than in the female; in two specimens of 77 and 78 mm the length of the papilla is respectively 1.5 (♂) and 0.75 (♀) mm.

As a rule the males are larger than the females. Among the 94 specimens from the Ingolf St. 33 the largest males are 100, 94, 90 and 89 mm, while the largest female is only 78 mm.

Among the adult individuals from the said Ingolf trawling St. 33 were 19 males and 20 females; if anything can be concluded from this the numerical distribution of the sexes is almost equal.

Specimens caught on July 12, in Davisstræde at 35 fms. (Ingolf St. 33) had their bellies dilated from roe, and a specimen measuring 78 mm had 78 large eggs in the ovaries which measured almost 3 mm in diameter, besides very small eggs determined for the next spawning period.

Distribution. In West Greenland *A. uncinatus* was taken from about 60° to 68° lat. N., partly in fjords in Julianehaab, Frederikshaab and Godthaab disticts, partly in Davisstræde on Lille and Store Hellefiskebanke, at depths ranging from about 10 to 100 fms. at bottom temperatures of about 1.6°—0.2° C. In East Greenland it was taken near Angmagssalik (about $65^1/_2$° N.), at a depth of 10—0 fms.

It is not known outside Greenland.

Artediellus atlanticus Jordan and Evermann.

[Plate I, fig. 2 a—b).

Centridermichthys uncinatus Collett, The Norwegian North-Atlantic Expedition, Fishes, 1880, p. 29, Pl. I, Fig. 7. — *Artediellus uncinatus* Goode and Bean, Oceanic Ichthyology, 1895, p. 267, Fig. 255; Jordan and Evermann, Fishes of North and Middle America, II, 1898, p. 1905; Hofsten, Kungl. Sv. Vetensk. Ak. Handl., 54, N:10, 1919, p. 12. — *Artediellus europaeus* Knipowitsch, Mém. de l'Acad. Imp. d. sci. de St. Pétersbourg, VIII Sér., Cl. Phys.-Math., vol. XVIII, No. 5, 1907, p. 17. — *Artediellus uncinatus europaeus* Rendahl, Ark. f. Zool., Bd. 22 A, No. 10, 1931, p. 23; Nybelin, Zool. Anz., Bd. 133, 1941, p. 223. — *Artediellus atlanticus* Jordan and Evermann, Fishes of North and Middle America, II, 1898, p. 1906.

Regarding the characteristic features of this species see introduction to the genus *Artediellus*.

West Greenland.

Amerdloq and Ikertôq near Holsteinsborg, 150—250 fms., 1936—39, 12 specimens, 42—118 mm.

66°42′ N. 56°12′ W., 130 fms., 31.5.1909, "Tjalfe" St. 397; 106 (♀) and 108 (♂) mm.

66°44′ N. 56°08′ W., about 175 fms., 5.7.1908, "Tjalfe" St. 100; 118 (♂) mm.

66°45′ N. 56°23′ W., about 175 fms., 20.5.1909, "Tjalfe" St. 370; 80—132 mm.

The largest male is 132 mm, the largest female 106 mm.

68°08′ N. 57°30′ W., 398 m, 26.6.1925, "Dana" St. 2361.

According to the journal altogether 144 specimens were taken; of these 50 ♂♂, 95—130 mm, 61 ♀♀ 80—115 mm and 3 juv. 30—75 mm.

68°17′ N. 58°14′ W., 410 m, 12.9.1928, "Godthaab" St. 160, 10 specimens, 75—130 mm.

68°20′ N. 54°03′ W. 220—280 fms., 9.7.1908, "Tjalfe" St. 107 b; 62, 119 and 138 mm.

68°28′ N. 54°47′ W., 245—184 fms., 18.8.1908, "Tjalfe" St. 199; 92—126 mm.

69°08′ N. 53°12′ W., 140 fms., 12.7.1908, "Tjalfe" St. 113; 98 and 116 mm.

69°15′ N. 53°18′ W. 144—161 fms., 10.8.1908, "Tjalfe" St. 182; 131, 132, 142 and 154 mm.

69°17′ N. 52°14′ W., 227—234 fms., 16.7.1908, "Tjalfe" St. 122; 136 mm.

69°17′ N. 52°50′ W., about 225 fms. 15.7.1908, "Tjalfe" St. 117; 118. 129 and 136 mm.

69°40′ N. 51°38′ W., 128 fms., 22.8.1908, "Tjalfe" St. 143; 99, 120, 120, 137, 140, 141, 147, 154 and 168 mm.

70°42′ N. 54°48′ W., 253 fms. 7.8.1908, "Tjalfe" St. 177; 148 (♀) and 165 (♂) mm.

70°52′ N. 53°06′ W., 260 fms., 6.8.1908, "Tjalfe" St. 176; 128 and 134 mm.

70°53′ N. 54°03′ W., 685 m, 3.9.1928, "Godthaab" St. 143. 3 specimens, 120—130 mm.

74°52′5 N. 62°12′ W., 450 m, 30.7.1928, "Godthaab" St. 73. 2 specimens, 130—135 mm.

75°35′ N. 65°41′ W., 490 m, 1.8.1928, "Godthaab" St. 81. According to the journal altogether 41 specimens 70—150 mm were taken.

77°28′5 N. 68°46′ W., 875 m, 6.8.1928, "Godthaab" St. 94. 2 specimens, 120 and 130 mm.

East Greenland.

74°17′ N. 15°20′ W., 127 fms., 18.7.1891, Ryder, 1 specimen, 68 mm.

Remarks to the synonymy.

While previously *Artediellus uncinatus* (Reinhardt) was supposed to occur both in the western and eastern parts of the northern Atlantic and adjacent Ice Sea, the Russian scientist, N. KNIPOWITSCH in 1907 established a new species, *A. europaeus*, for the population in Norway, Spitsbergen and the European Ice Sea, whereas he presumed *A. uncinatus* to occur in Greenland and on the northeast coast of America.

According to KNIPOWITSCH (l. c. pp. 17—18) the two species can be distinguished from each other by the following characters:

Artediellus uncinatus	*Artediellus europaeus*
Männchen mit Reihen von runden weissen Flecken auf den Rückenflossen sowie auf den Seiten.	Nur dunkle und helle Streiffen auf den Rückenflossen sowohl bei Männchen, wie bei Weibchen.
Anzahl Poren in der Lateral-linie je 27—30.	Anzahl der Poren in der Laterallinie in der Regel 20—23 (ausnahmsweise bis 26).
Grösse bis 100 mm.	Grösse bis $133^1/_2$ mm.

In his paper "Die Fische des Eisfjords" v. HOFSTEN concludes (l. c.) that *A. uncinatus* living on the coast of northeast Greenland does not deviate from the form near Spitsbergen; the specimens caught by the Swedish Expedition in 1900 in Northeast Greenland in size (several of them being more than 100 mm long) as well as in the structure of the lateral line completely agree with specimens from Spitsbergen. v. HOFSTEN therefore contests that *A. europaeus* Knip. is established as a distinct species. RENDAHL (l. c.) also comes to the result that there is not sufficient basis for segregating the two forms as species; by examining some specimens from West Greenland he finds that the number of pores may overlap; this character, therefore, cannot alone distinguish the different species; he regards the "European" form as a geographical subspecies calling it "*A. uncinatus europaeus*" Knipowitsch. RENDAHL at the same time examined 7 specimens from Spitsbergen; in six of them he found 19—22 pores in the lateral line, in the 7th 24 and 25 pores; thus they belong to *A. uncinatus europaeus* Knip. with few pores. Recently NYBELIN (l. c.) has given some particulars of the Swedish material from Northeast Greenland; he examined 30 specimens taken by the Nathorst Expedition in 1900 in 72°25′ N. 17°56′ W. at a depth of 158 fms.; at the same time he examined specimens from Spitsbergen (20) and Scandinavia (12); in all cases the number of pores in the lateral line fluctuated from 18 to 22, only one specimen from Norway had 21/24.

It will be seen from the introduction to the genus *Artediellus* (p. 3) that in working up the collection from Greenland I uphold

two species, and as regards the characters used I principally follow Knipowitsch, although I replace *A. europaeus* by the older name *A. atlanticus*. The characterization has been somewhat changed, as I had for treatment about 200 Greenland specimens, while KNIPOWITSCH for his investigation had only 9 specimens of *A. uncinatus* belonging to the Zoological Museum of Copenhagen, and 20 specimens of *A. europaeus*, belonging to Riksmuseet, Stockholm.

JORDAN and EVERMANN (l. c. p. 1906) maintain that *Artediellus atlanticus* Jordan & Evermann occurring in northeastern America is different from the European form described and figured by COLLETT (l. c.) as *A. uncinatus*. To this I wish, however, to give the following remarks: After an examination of one single American specimen these authors find that it has "A blunt occipital ridge or spine" while COLLETT's figure shows: "Occiput with a bony protuberance on each side provided with radiating ridges", and consequently the American form which had hitherto been identified with *A. uncinatus* should be "apparently distinct". I have not myself seen any specimen with radiating ridges on the occipital protuberance nor does COLLETT mention such a sculpture, but mentions them in just the same expressions as JORDAN and EVERMANN, viz.: "two blunt obtuse protuberances on the occiput". I suppose the artist who drew the figure in COLLETT (Pl. I, fig. 7) has represented in a somewhat exaggerated way the indistinct folds which are sometimes seen in the skin covering the spine, so that it looks as if the spine itself was provided with keels.

The description of *A. atlanticus* in the said two authors further shows that it agrees in all essentials with *A. europaeus* Knipowitsch, e. g. in the following two important characters: In *A. atlanticus* there are 20 pores in the lateral line; also the colour pattern is the same, there are e. g. dark and light transverse bands on the dorsal fins.

I thus come to the result that *A. atlanticus* is identical with *A. europaeus* Knipowitsch. As *A. atlanticus* was established as early as in 1898, this name has the priority; consequently the designations *A. uncinatus* (Reinh.) and *A. atlanticus* Jordan & Evermann should be used for the two species in future. The designation *A. atlanticus* is also preferable because it substitutes the misleading name *europaeus*.

Sexual dimorphism in *Artediellus atlanticus*.

In this species too, although less distinctly than in *A. uncinatus*, the dorsal fins in the adult specimens are higher in the males than in the females. This will be illustrated by the measurements of some individuals given below:

	♀	♂	♂	♂	♀	♀	♂	♀
Total length in mm	168	165	154	154	148	147	141	140
The longest ray of 1st dorsal fin in mm	16	30	19	26	17	14	17	10.5
The longest ray of 2nd dorsal fin in mm.....	22	32	24	27	21	19	20	17

Laid down D^1 in the adult male reaches some distance beyond the beginning of D^2,[1]) in the female only to the beginning of D^2.

The dorsal fins are much darker in the male than in the female.

In the male the second dorsal fin has obliquely running dark and light transverse bands of nearly equal breadth, while its pattern may vary a good deal; the light bands may be narrow and sometimes, on the posterior part of the fin above, disintegrated into small spots on the rays with intermediate portions of the dark colour; this fin thereby may bear some resemblance to that of the preceding species, but it is not, as in *A. uncinatus*, along the rays ornamented with eye-like spots each formed by a white nucleus and a dark ring. And the light and the dark on 1st dorsal fin occur approximately as bands, while in *A. uncinatus* they quite resemble those on the second dorsal fin. In the female the dark and light bands of the second dorsal fin are generally equally broad; but there may be some variation so that the dark bands become broader than the light stripes.

The specimens vary greatly with respect to the appearance of the occipital protuberances; they are small, sometimes vestigial in southern specimens, but become distinct or even strongly developed in northern individuals.

The males are as a rule larger than the females. Thus from "Dana" St. 2361 the largest male out of 114 specimens measures 130 mm, the largest female 115 mm; a single example showing that the female may surpass the male in size we have from "Tjalfe"'s St. 143, where a female measures 168 mm, while the largest of all the males is 165 mm long "Tjalfe" St. 17 y).

There does not seem to be any great difference between the numerical distribution of the sexes. From "Dana"'s trawling station 50 were males and 61 females.

Of egg numbers and egg size we have the following particulars: COLLETT (l. c. p. 32) found 64 eggs of nearly 2 mm in diameter in a female, 69 mm long, caught on July 2nd. LÖNNBERG[1]) found 15 eggs

[1]) Later addition: Under the name *Centridermichthys uncinatus* F. A. SMITT in his work: Skandinaviens Fiskar, I, 1892, p. 163 has figured a fish from Taimyr Sound on the north coast of Siberia; it is evidently a young *Artediellus atlanticus* ♂.

[2]) LÖNNBERG: Fishes from Spitsbergen and King Charles Land. Bihang K. Sv. Vet.-Akad. Handl., Bd. 24, Afd. IV, No. 9, p. 8, 1899.

of 4 mm in a female also 69 mm long, but caught on September 4th; he sets forth the view that the eggs ripen in successive batches, 8—10 at a time, since he cannot believe that a female of 69 mm can hold 64 eggs each of 4 mm in diameter; I do not think he is right, evidently his specimens have been at the end of the egg laying period. It can be added that COLLETT[1]) later in two females, 95 and 105 mm long, found 57 and 71 eggs resp. with a diameter of about 4 mm; they were caught near Spitsbergen on July 25th. — It appears from this that *A. atlanticus* spawns in summer.

Distribution.

In West Greenland *Artediellus atlanticus* is distributed from about $66^3/_4$—$72^1/_2°$ lat. N., about 50—435 fms., bottom temperature — 0.42° to 2.56° C. In East Greenland it is only known from the northernmost parts (72°25′ and 74°17′ N.) about 127—158 fms.

In Europe *A. atlanticus* (= *A. europaeus*) has been taken near Iceland by the "Thor" off the east coast at 145 fms., and by C. F. WANDEL both on the north coast (Skagestrandsbugt, 114 fms.) and on the east coast (135 fms.) and also between Iceland and the Faroes (64°16′ N. 11°15′ W.) at 198 fms. Along the coast of Norway it is known from Varangerfjord right down to the Swedish boundary[2]), although it is most abundant north of the Polar circle; the depth is usually 50—100 fms. (COLLETT). Besides it has been met with near the Murman coast (KNIPOWITSCH), in the sea between the North Cape and Spitsbergen, 147—223 fms. (COLLETT) and between Norway and Beeren Eiland, 210 fms. (LÖNNBERG), almost midway between Beeren Eiland and Spitsbergen (75°31′ lat. N.), 123 fms. (COLLETT), near Spitsbergen and King Charles Land (to 80°57′ lat. N.), 74—184 fms. (KNIPOWITSCH and LÖNNBERG)[3]). On the east coast of North America it is known from Labrador to Cape Cod, in fairly deep water[4]).

Where the bottom temperature has been noted, it rules between — 1.7° and 3.5° C.

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[1]) Chria. Vidensk. Selsk. Forhandl. 1902, No. 1, p. 23.

[2]) NYBELIN (l. c. p. 223) has stated later that 7 specimens are available from a single place in Sweden, viz. from the vicinity near Koster in northern Bohuslän.

[3]) The *Artediellus* which lives in the shallow, eastern and southeastern part of the European Ice Sea, in the Kara Sea and the North-Siberian Ice Sea to the entrance of Bering Strait (about 44°—173°24′ long. E.) KNIPOWITSCH (l. c. p. 18, Pl. I, figs. 7—12) has established *A. scaber* as a distinct species. In his revision of the genus *Artediellus* Rendahl (l. c. p. 23) comes to the result that *A. scaber* should be upheld as a distinct species.

[4]) GOODE and BEAN who list it as *A. uncinatus*, give numerous localities with statement of depths, where it has been taken by the "Speedwell", the "Fish Hawk" and the "Albatross" (Oceanic Ichthyology, 1895, p. 267 and fig. 255).

Cottunculus Collett.

Two species of this cottoid genus have been taken in Greenland; they are easily distinguished by the following characters:

C. thomsonii	*C. microps*
Uniformly grey-brown, without markings.	Head spotted, often with a dark band across the snout; body and fins with three brown-black cross bands across the beginning and posterior part of the dorsal and the tail root.
The skin almost naked and smooth, only with scattered, extremely delicate spines.	The skin almost everywhere rough on account of small spines which are often gathered in small groups.
The eyes comparatively big, larger than the interorbital space.	The eyes comparatively small, smaller than the interorbital space.

Cottunculus thomsonii (Günther).

Cottus thomsonii Günther, Proc. Roy. Soc. Edinb., XI, 1882, p. 679. — *Cottunculus thomsonii* Günther, Voyage H. M. S. Challenger, Zool., XXII, 1887, p. 61, Pl. 9, Fig. B; Lütken, Vidensk. Medd. Naturhist. Foren. Kbhvn., 1891, p. 28; Goode & Bean, Oceanic Ichthyology, 1895, p. 270, Pl. 72, Fig. 258 & Pl. 73, Fig. 262; Jordan & Evermann, Fishes of North and Middle America, II, 1898, p. 1993. — *Cottunculus torvus* Goode, Proc. U. S. Nat. Mus., III, 1880, p. 479 (nomen nudum); Bull. Mus. Comp. Zool., X, 1883, pp. 212—13; Vaillant, Expéd. Scient. du Travailleur et du Talisman, 1888, p. 360, Pl. 28, fig. 3; Lütken. The Danish Ingolf Expedition, II, 1, p. 34, 1898.

West Greenland. A small specimen (152 mm long) was taken in 1889 by the cruiser "Fylla" in Davisstræde (66°49′ N. 56°28′ W.), at a depth of 235 fms.; the bottom consisted of sand and ooze, its temperature was + 4°4 C.

Another, slightly larger, specimen (170 mm) and a small one (70 mm) were taken with otter trawl on June 22, 1925 by the research vessel "Dana", also in Davisstræde at station no. 2346, and very near the first specimen, viz. in 66°37′ N. 56°37′ W. at a depth of 460 m; the bottom consisted of fine sand and its temperature was 3°12 C.

Distribution. Off the east coast of North America (33°42′15″—41°47′ N.) it was taken by the "Blake", the "Albatross" and the "Fish Hawk", numerous specimens at depths ranging from 105, 225 and 300 to 843 fms.

In the eastern Atlantic it has been caught in the following places: SW. of Iceland, 912 fms., bottom temperature + 3°5 ("Ingolf" St. 83); the Faroe Channel (59°33′ N. 7°14′ W.), 555 fms., bottom temperature 44°4 Fahr. ("Knight Errant", 1880, St. 4); Faroe Channel (59°23′ N. 7°40′ W.), 580—687 fms., bottom temperature 7°88 C. ("Michael Sars", 1902, St. 76); off the coast of Sudan and Banc d'Arguin, 1139—1495 m ("Travailleur" et "Talisman").

Cottunculus microps Collett.

Cottunculus microps Collett, Tillægsh. til Forh. Vidensk. Selsk. Chria. 1874, p. 20, pl. 1, figs. 1—3; idem, Den Norske Nordhavs Exped., Fiske, 1880, p. 18, pl. 1, figs. 5—6; Günther, Voyage H. M. S. Challenger, Zool., XXII, 1887, p. 60, pl. 9, fig. A; Smitt, Skandinaviens Fiskar, I, 1892, p. 158, fig. 45; Goode & Bean, Oceanic Ichthyology, 1895, p. 269, pl. 72, fig. 257 & pl. 73, fig. 261; Jordan & Evermann, Fishes of North and Middle America, II, 1898, p. 1992; Lütken, The Exped., II, 1, 1898, p. 33.

In West Greenland *Cottunculus microps* has been caught in the following localities:

Godthaabsfjord, Kugssuk, 150 fms. 15.6.1908, "Tjalfe" St. 55, 1 spec. (260 mm).

Sukkertoppen, 6 spec., sent home in 1885, 1889, 1906 and 1919, 200—300 mm long.

64°05′ N. 55°20′ W., 580 fms., 8.5.1909, "Tjalfe" St. 337. 1 spec. (92 mm).

65°14′ N. 55°42′ W., 420 fms., Bottom temp. 3°5 C., 1.7.1905, "Ingolf" St. 28. 1 spec. (46.5 mm).

65°16′ N. 55°05′ W., 362 fms., Bottom temp. 3°6 C., 18.7.1905, "Ingolf" St. 35. 1 spec. (53 mm).

66°35′ N. 56°38′ W., 318 fms., Bottom temp. 3°9 C., 11.7.1905, "Ingolf" St. 32. 2 spec. (77.5—166.5 mm).

66°37′ N. 56°37′ W., 460 m, Bottom temp. 3°12 C., 22.6.1925, "Dana" St. 2346. 4 spec. (100—180 mm).

66°45′ N. 56°23′ W., about 175 fms., 20.5.1909, "Tjalfe" St. 370. 2 spec. (76—130 mm).
68°08′ N. 57°30′ W., 398 m, 2°47 C., 26.6.1925, "Dana" St. 2361. 6 spec. (120—200 mm).
68°20′ N. 54°03′ W., 220—280 fms., 9.7.1908, "Tjalfe" St. 107. 2 spec. (150—178 mm).
68°28′ N. 54°47′ W., 245—184 fms., 18.8.1908, "Tjalfe" St. 199. 1 spec.
69°17′ N. 52°14′ W., 227—234 fms., 16.7.1908, "Tjalfe" St. 122. 8. spec. (170—240 mm).
69°46′ N. 51°22′ W., about 250 fms., 27.7.1908, "Tjalfe" St. 155. 1 spec. (223 mm).
70°49′ N. 53°16′ W., 260 fms., 30.7.1908, "Tjalfe" St. 159. 4 spec. (200—210 mm).
70°52′ N. 53°6′ W., 260 fms., 6.8.1908, "Tjalfe" St. 176. 21 spec. (158—233 mm).
70°53′ N. 54°03′ W., 685 m, 1′06 C., 3.9.1928, "Godthaab" St. 143. 2 spec. (100—110 mm).
73°12′ N. 58°08′ W. 850 m, 0°47 C., 28.7.1928, "Godthaab" St. 64. 2 spec. (55—120 mm).
74°52′5 N. 62°12′ W., 450 m, 0°72 C., 30.7.1928, "Godthaab" St. 73. 3 spec. (65—125 mm).
75°26′ N. 62°26′ W., 820 m, 0°69 C., 31.7.1928, "Godthaab" St. 77. 22 spec. (80—200 mm).
75°35′ N. 65°41′ W., 490 m, 0°73 C., 1.8.1928, "Godthaab" St. 81. 33 spec. 90—200 mm).
75°54′ N. 81°01′ W., 610 m — 0°59 C., 17.8.1928, "Godthaab" St. 119. 1 spec. (210 mm).
77°05′5 N. 71°13′ W., 790 m, — 0°43 C., 4.8.1928, "Godthaab" St. 87. 14 spec. (80—210 mm).
77°28′5 N. 68°46′ W. 875 m, — 0°42 C., 6.8.1928, "Godthaab" St. 94. 7 spec. (100—250 mm).
78°14′ N. 74°10′ W., 672 m, — 1°29 C., 8.8.1928, "Godthaab" St. 99. 17 spec. (100—250 mm).

It will be seen that there is a great difference between the two species of *Cottunculus* as regards the distribution in West Greenland.

Only two specimens have been caught of *Cottunculus thomsonii*, both in Davisstræde south of the submarine Greenland-Cumberland ridge, where the deep sea fauna has an Atlantic character (the "warm" area).

Of *Cottunculus microps*, on the other hand, about 160 specimens have been taken, not only in Godthaabsfjord and in Davisstræde off this fjord and farther north, but also in the deep sea north of the said

ridge, up through Baffins Bugt right up in Smith Sund; thus it occurs both in the "warm" and the "cold" areas, at temperatures which may change from about 4° to — 1.3° C.

The small elevations in the skin of *C. microps*, where part of the spines are gathered, may in northern specimens be coarser, wart-like. — In northern specimens the dark cross bands are sometimes more or less blurred.

In East Greenland it has been taken in the following places.

Off south-eastern Greenland (65°30′ N.), 130 fms., Nordenskiöld's Expedition 1883. 1 specimen (157 mm).

The mouth of Kejser Franz Josephs Fjord, about 105—160 fms. The Kolthoff Expedition 1900. 1 specimen.

Distribution. — Off the east coast of North America it has been taken in many localities by the "Blake" and the "Albatross" (38°28′—42°15′25″ N. 65°48′—73°22′ W.), 238—487 fms.

The Ingolf Expedition took it west of Iceland, depth 295 fms., bottom temperature 5°8 C. (St.9) and north of Iceland, 293 fms., bottom temperature — 0°5 C. (St. 126). East of Iceland the "Michael Sars" took it in 1902 (St. 96), at a depth of 300 fms., bottom temperature — 0°38 C.

North of the Faroes the "Ingolf" took it at a depth of 679 fms. and at a bottom temperature of — 0°6 C. (St. 141).

In the Faroe Channel the "Knight Errant" in 1880 (St. 8) and the "Triton" in 1882 (St. 4 and 9) took it at depths from 327 to 430 fms., 540 and 608 fms., at bottom temperatures of 31.5°—32° Fahr., 29°2 Fahr. and 30° Fahr.

NNW. of Shetland the "Michael Sars" took it in 1902 (St. 55) at a depth of 360 fms. and at a bottom temperature of — 0°3 C.

In northwestern Norway it has been taken, according to Collett (1902), in Trondhjemsfjord and Finmarken, at 105—225 fms. NW. of Hammerfest it was caught by the Norwegian North-Atlantic Expedition (St. 290) at a depth of 191 fms., and at a bottom temperature of 3°5 C.

In addition, it has been taken between Norway and Beeren Eiland, at a depth of 217 fms. and at a bottom temperature of 2° C. (Lönnberg) and at Beeren Eiland, depth 130 fms. (Collett, 1902).

Finally, west of North Spitsbergen, 260 fms., bottom temperature 1°1 C. and at 459 fms., bottom temperature — 1° C. (The Norwegian North-Atlantic Exped. St. 363 and St. 362).

The hitherto known maximum sizes are as follows: Spitsbergen 175 mm, northwestern Norway 155 mm, Beeren Eiland 195 mm, Faroe Channel $9^2/_3$ inches (= 246 mm), east of Iceland 230 mm and West Greenland 300 mm.

APPENDIX

Up to 1898 only two of the species of *Cottunculus* mentioned above were known from the northernmost Atlantic and adjacent Arctic Ocean, but in that year LÜTKEN added a third species, which he referred to *Cottunculus inermis* Vaillant[1]), known from the coast of Sudan and Banc d'Arguin. LÜTKEN's specimens were caught by the Ingolf Expedition in the icy cold northern deep-sea and northeast of Iceland. During a revision of the fish fauna in the "cold area" of the Norwegian Sea I came to the result that this *Cottunculus* must be a distinct species which I called *C. subspinosus*. As its description has only been published in Danish I take this opportunity to have it reproduced in English.

Cottunculus subspinosus As. S. Jensen.

Cottunculus inermis Lütken (nec Vaillant), The Danish Ingolf Expedition II, 1, 1898, p. 35. — *Cottunculus subspinosus* Ad. S. Jensen, Vidensk. Meddel. naturhist. Foren. i Kbhvn. 1901, p. 214.

Head, body and fins with extremely fine and short spines, placed fairly densely in small specimens, but in adult individuals with great interspaces so that the skin has an almost naked appearance. The length of the head is contained 2.6—2.8 times in the total length. Eyes very small, their horizontal diameter is contained 9 to 10 times in the length of the head, the distance between the two eyes is 3.1—3.4 times as great as the horizontal diameter of the eye. The two pairs of tubercles of the forehead are very small, nearly hidden by the skin; no distinct tubercles on the preoperculum. The gill opening is very wide. Fine teeth on the premaxillary and the lower jaw, none on the vomer. The anterior dorsal rays are particularly low. The pectoral fins reach nearly to the beginning of the anal fin. The ventral fins are short and slender, with great interspace. The anus is situated more closely to the last caudal vertebra than to the tip of the snout. The colour (in alcohol) uniformly brown-grey, without cross bands. Size up to 148 mm.

R. br. 6, D. 19, A. 10, P. 19—20, V. 3.

Distribution.

St. 102. 66°23′ N. 10°26′ W. 750 fms. Brown mud. Bottom temperature — 0°9 C. 1 spec. 58 mm.

St. 104. 66°23′ N. 7°25′ W. 957 fms. Light greybrown mud. Bottom temp. — 1°1 C. 1 spec. 94 mm.

St. 125. 68°08′ N. 16°02′ W. 729 fms. Brown mud. Bottom temperature — 0°8 C. 2 spec. (50 and 148 mm).

VAILLANT says about *C. inermis* that the skin is "absolutement nue", which does not agree with the form from the Norwegian Sea, not even at its fully grown stage; moreover the number of fin rays is very different, etc. There can be no doubt, therefore, that the form from the deep Norwegian Sea and that from the Atlantic deep-sea represent two distinct species, though they stand close to each other by the absence of teeth on the vomer.

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[1]) L. VAILLANT: Poissons, p. 365, pl. XXVIII, fig. 2. Expéd. du Travailleur et du Talisman, 1888.

Gymnocanthus[1]) *tricuspis* (Reinhardt).

Cottus gobio Fabricius (non Linné), Fauna groenl., 1780, p. 159. — Cottus tricuspis Reinhardt, K. D. Vidensk. Selsk. Skr. naturvidensk. og mathem. Afh., VII, 1838, p. 114 and p. 117 (No. 3); (*Phobetor*) Krøyer, Naturhist. Tidsskr. 2. Rk., I, 1844, p. 263; (*Cottus*) Günther, Catal. of Fishes, II, 1860, p. 168; (*Gymnocanthus*) Jordan & Evermann, Fishes of North and Middle America II, 1898, p. 2008; Jensen, Meddel. om Grønland, XXIX, 1904, p. 227; Knipowitsch, Mém. de l'Acad. Imp. des Sci. de St.-Pétersbourg, VIII Sér. Cl. phys.-math., XXIII, No. 5, 1907, pp. 11—15; Schmidt, Ann. Mus. zool. l'Acad. Sci. de l'URSS, XVIII, 1, 1927, p. 28. — *Cottus fabricii* Girard, Monograph of Cottoids (Smithsonian contributions to knowledge), 1851, p. 59. — *Acanthocottus patris* Storer, Bost Journ. Nat. Hist., VI, 1857, p. 250, Tab. VII, Fig. 2. — *Phobetor ventralis* Lütken (non Cuvier & Valenciennes)[2]), Vidensk. Meddel. Naturhist. Foren. 1876—77, p. 363; (*Gymnacanthus*) Collett, Norske Nordh.-Exped., Fiske, 1880, p. 26; Smitt, Skandinaviens Fiskar, I, 1892, p. 160, Fig. 46; (*Phobetor*) Johansen, Medd. om Grønland, XLV, 1912, p. 649. — *Gymnacanthus pistilliger* Vanhöffen (non Pallas), Grönland-Exped. d. Gesellsch. f. Erdkunde zu Berlin, II, 1897, p. 89. — *Sclerocottus schraderi* Fischer, Jber. Hamburg. Wiss. Inst., 2, 1885, p. 58[3]).

West Greenland. Here the antlered Sea Scorpion has been taken in many localities, from Nanortalik up to Upernavik. Further north it occurs at Kap York, since in the stomach content of a *Phoca groenlandica* shot in 1911 and sent home by P. Freuchen I found bones of this species; and in 1919 two specimens from Wolstenholme Fjord were received from P. Freuchen. Near Thule the "Godthaab" in 1928

[1]) The generic name is sometimes written *Gymnacanthus*, sometimes *Gymnocanthus*; when Swainson who in 1839 is the author of the genus calls it *Gymnocanthus* I use this form in the present paper.

[2]) That *Phobetor ventralis* in Cuvier and Valenciennes (Hist. Nat. Poissons, IV, 1829, p. 194; Pl. 79, fig. 1) is identical with *Gymnocanthus pistilliger* Pallas is indicated both by the text and the figure as well as by the habitat (Kamtschatka).

[3]) According to J. R. Norman, Copeia, October 15, 1935, No. 3, p. 141.

took 20 specimens in one haul (St. 85, 76°35′ N. lat., 180—80 m) and 1 specimen in Whale Sound (77°17′ N. lat.).

O. FABRICIUS writes that it lives everywhere on sandy or clayey bottoms, is more seldom than *Cottus scorpius*, but more frequent than *Cottus scorpioides*; in some places it may, however, be equally abundant as the common Sea Scorpion, since in Ulkebugt near Holsteinsborg on July 2, 1908 at a depth of 4 fathoms, I caught 60 specimens of the antlered Sea Scorpion (67—260 mm long) with hand seine as against 52 specimens of the common Sea Scorpion. Young specimens have been taken at depths of 10, 15, 30 and 50 fathoms, and off Marrait on the SE side of the island Disko on August 10, 1908 I secured 9 adult specimens (170—215 mm) by the trawl from a depth of 23—29 fms. and soft bottom grown with laminarians; the species is, however, mainly a littoral fish. — The largest female measures 265 mm, the largest male 210 mm.

According to FABRICIUS it feeds on *Ammodytes* and small fishes, but it also takes lower marine animals, e. g. *Vermes*, and LÜTKEN found annelids in its stomach.

East Greenland. — Here it is also a common fish, as it has been taken in great numbers in Nanusik near Angmagssalik, in Uttentals Sund, in Kangerdlugssuaq, in the Scoresby Sund area (Hekla Havn, Kap Stewart, Hurry Fjord and off Kap Hope), at the entrance of Forsblads Fjord, the inner Kejser Franz Josephs Fjord, in Eleonores Bugt, south of Bontekoe Ø, near Kap Broer Ruys, at Sabine Ø and in Danmarks Havn. The depths vary from 0—6 (?14) fms[1]). — The largest female measures 217 mm, the largest male 185 mm.

As already pointed out by FABRICIUS and later on amplified by LÜTKEN there is a pronounced sexual dimorphism: The male has white spots on the sides of the body within the pectoral fins, on the belly behind the vent and on the ventral fins. The female lacks these characteristic spots. The dorsal fin of the male is higher and its ventral fins much longer; the pectoral and ventral fins are provided with spines on the posterior side of the rays. The males are, as said above, smaller than the females. The urogenital papilla of the male is of a considerable length; according to FABRICIUS the male guards the eggs[2]) of the female which are laid among sea weeds.

The shape of the characteristic large uppermost preopercular spine and the number (2—5) of its points vary, according to LÜTKEN in a no

[1]) 5 miles south of Bontekoe Ø however 255 m.

[2]) FABRICIUS adds: "quod etiam praecedentibus cottis conuenit" (which also agrees with the preceding cotti), i. e. *Cottus scorpius* and *Cottus scorpioides*.

small degree both individually and with age, and may often be different on the two sides of the same fish.

On the use and capture of this fish FABRICIUS writes that conditions are the same as for *Cottus scorpius*, but it is not appreciated by everybody as it suffers in a high degree from tapeworm.

Distribution. *Gymnocanthus tricuspis* is a circumpolar species. It occurs in arctic Northeast America (Havnefjord on Ellesmere Island, Exeter Sound on Cumberland, Hudson Bay, Labrador, West and East Greenland[1]), Spitsbergen, northernmost Norway, Murman coast, the White Sea, in the Barents Sea, near Nowaja Zemlya, Kara Sea and in the Siberian Ice Sea (Nordenskjöld Havet og de Nysibiriske Øer), Bering Strait and Bering Sea)[2]). Its vertical distribution is 0—60 (75 fms.). Notably in Greenland and Spitsbergen is it a very common fish.

Remarks. The *Gymnocanthus* form which may be met with in the northern part of the Pacific (from Bering Strait to Korea) represents a distinct species: *G. pistilliger* Pallas (= *G. ventralis* C. & V.) and is not based on a misunderstanding, as LÜTKEN believed (l. c. p. 364). For the male is actually, on that part of the ventral side which is covered by the pectoral fins, provided with the spade-like, soft lobes with a black stalk and white top disc described by PALLAS (Zoogr. Ross. Asiat. vol. III, p. 143), cf. F. A. SMITT[3]) and JORDAN & GILBERT[4]). Such peculiar skin formations are not indicated at all in any of the numerous males of *Gymnocanthus tricuspis* which I have had before me.

Unfortunately, the Zoological Museum of Copenhagen possesses no material of *G. pistilliger* so that I am unable to contribute to the knowledge of this species. F. A. SMITT believed (l. c.) by a direct comparison to have found some other differences between the two forms, viz.

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[1]) Whether *Gymnocanthus* tricuspis is found in Iceland waters seems doubtful to me, confirmation is at any rate needed, as in this Museum only two specimens are kept, both from an older date, and only labelled "Iceland". Though in recent time large collections have been procured from this island, no *G. tricuspis* has appeared.

[2]) NORMAN (l. c.) has stated that the *Sclerocottus schraderi* described by FISCHER, which was reported from South Georgia, is identic with the *G. tricuspis* which is well known from arctic and subarctic seas, and that the specimen by "some confusion of labels" erroneously was stated to be from the South Atlantic (Jahrb. Hamburg. Wiss. Anst., 2, 1885, p. 58).

[3]) SMITT, op. cit., p. 161, Fig. 47.

[4]) JORDAN & GILBERT, The Fishes of Bering Sea. The Fur Seals and Fur-Seal Islands of the North Pacific Ocean, Part III, 1899, pl. 58.

	G. tricuspis	*G. pistilliger* 1 ♂, 163 mm, 1 ♀, 190 mm
a. Length of head in % of total length..	26.3[1])	28.2— 30
b. Distance from beginning of 1st dorsal fin to beginning of 2nd dorsal fin in % of total length	21.8	18.9—19.3
c. Length of ventral fins in ripe males in % of total length	about 20 up to 38	
d. Length of upper jaw in % of total length	at least 33	30.4— 30.9
e. Length of basis of 2nd dorsal fin in % of length of head	89—105[2])	82.6— 84.8

For comparison I have taken the measurements of 7 Greenland *G. tricuspis* and found the following figures:

	G. tricuspis	
	4 ♂♂, long. 167—210 mm	3 ♀♀, long. 217—265 mm
a. Length of head in % of total length..	26.7— 24.8	26.7— 24.2
b. Distance from beginning of 1st dorsal fin to beginning of 2nd dorsal fin in % of total length	15.9— 20.7	18.4— 22.2
c. Length of ventral fins in % of total length	23.3— 29.7	19.8—16.8
d. Length of upper jaw in % of total length	36.4— 37.7	35.4— 36.7
e. Length of basis of 2nd dorsal fin in % of total length	98.1—106.4	95.4—101

If these two calculations are compared it appears that the ratio b can have no significance as a character separating the species, as the variation in *G. tricuspis* is far greater than supposed by Prof. SMITT.

On the other hand, the following characteristics apply in general to adult individuals:

Head comparatively shorter in *G. tricuspis* than in *G. pistilliger.*

Upper jaw comparatively longer in *G. tricuspis* than in *G. pistilliger.*

Length of basis of 2nd dorsal fin greater in *G. tricuspis* than in *G. pistilliger.*

Ventral fins in ripe males longer in *G. pistilliger* than in *G. tricuspis.*

[1]) In 4 large specimens (♀♀) from Spitsbergen LÖNNBERG calculated 24.8—26.9 % (Bih. K. S. Vet.-Akad. Handl., Bd. 24, Afd. IV, No. 9, p. 7. Stockholm 1899).

[2]) In 4 large specimens (♀♀) from Spitsbergen LÖNNBERG calculated 85.1—97.3 %. Ibid.

Besides, a comparison of the two species has later been made by N. KNIPOWITSCH, who had a large material of both species at his disposal, and to whose work cited above reference is therefore made.

F. A. SMITT states still another character for separation, viz.

G. tricuspis: Crown of the head and neck, sometimes even the gill covers and the supporting bones of the cheek more or less densely covered with rough plates or granulations; actual occipital ridges missing.

G. pistilliger: Distinct, quadrangularly placed, occipital ridges; head almost completely devoid of rough plates.

To this I wish, however, to remark that *G. tricuspis* is exceedingly varying, as regards the equipment of the head of such plates. If we consider the seven individuals whose measurements have been given above we find the following variation: In 3 individuals (♂ ♀ ♀) the upper side of the head right to the anterior border of the eyes is covered with rough plates; such plates are also present on the uppermost part of the gill cover and on the cheek behind the eye; one individual bears rough plates on the upper side of the head to the posterior border of the eyes; in 2 individuals only the upper side of the occiput is provided with rough plates, in the one individual only few and so small that they are more like granulations. All these individuals lack occipital ridges. A 7th individual, on the other hand, completely lacks plates on the head, but has 4 small but distinct quadrangularly placed occipital ridges.

The case may also occur that the head is devoid both of plates and occipital ridges. In the majority of the Greenland individuals the upper side of the head is, however, in a greater or smaller degree, provided with rough plates or granulations, while occipital ridges are absent.

In specimens from West Greenland LÜTKEN (l. c.) found the following number of rays: D^1. (10) 11—12; D^2. 15—17; A. 16—19; P. 18 (19). In 11 individuals from East Greenland I counted: D^1. (10) 11—12; D^2. 15—17; A. 17—18; P. 18—19. The number of vertebrae LÜTKEN gives as 40 (12 + 28).

Færdig fra trykkeriet den 5. februar 1952.

Plate I.

Fig. 1 a. *Artediellus uncinatus* (Reinhardt), the male, nat. size. West Greenland. M. o. G. XXIX, Pl. XII, 1909.

Fig. 1 b. *Artediellus uncinatus* (Reinhardt), the female, nat. size. West Greenland. M. o. G. XXIX, Pl. XII, 1909.

Fig. 2 a. *Artediellus atlanticus* Jordan and Evermann, the male, abt. $1^2/_5$ nat. size.

Fig. 2 b. *Artediellus atlanticus* Jordan and Evermann, the female, abt. $1^2/_5$ nat. size.

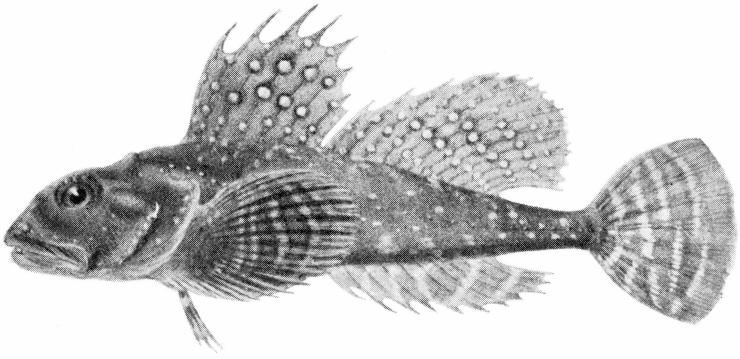

Fig. 1 a.

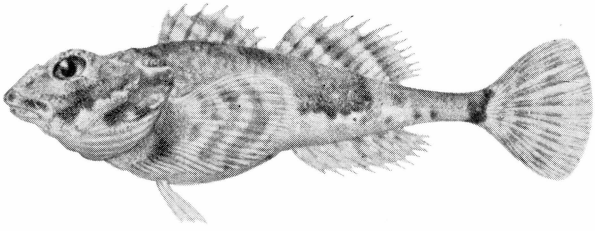

Fig. 1 b.

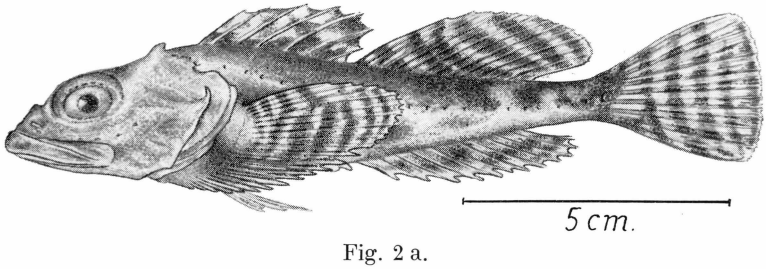

Fig. 2 a.

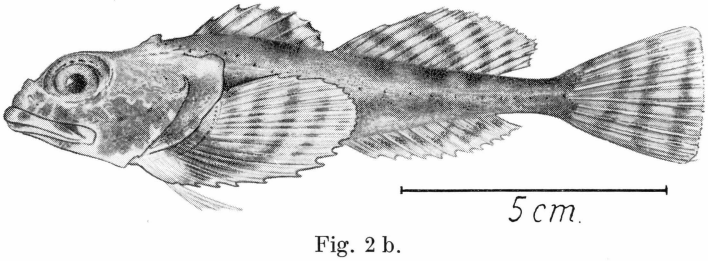

Fig. 2 b.