

A new species of deep-water catshark, *Apristurus aphyodes* n. sp., from the Eastern North Atlantic (Chondrichthyes: Carcharhiniformes: Scyliorhinidae)*

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Abstract

A new deep-water catshark, *Apristurus aphyodes* n. sp., is described from 1014 to 1800 m depth in the Eastern North Atlantic Ocean. The description is based on a total of 30 type specimens, which include immature and mature males and females, ranging 209.2 to 540.0 mm in total length. This new species is distinguishable from the other 10 Atlantic congeners by the following characters: upper labial furrow shorter than lower one, large eyes with horizontal diameter 1.9 to 2.5 times in interorbital width, subequal size of dorsal fins, anterior position of 1st dorsal fin with origin above front half of pelvic base, widely spaced pectoral and pelvic fins with distance between their origins equalling head length, 9 to 11 spiral valves in the intestine and uniform whitish colouration. *A. aphyodes* is a medium-sized species among the Atlantic species of the genus, attaining its full sexual maturity at a length of 470 mm TL. A key to the 11 Atlantic species of the genus *Apristurus* is provided.

Kurzfassung

Apristurus aphyodes n. sp. wird beschrieben als eine neue Tiefwasser-Katzenhaispezies aus 1014 bis 1800 m Tiefe im Nordostatlantik. Die Beschreibung stützt sich auf eine Typenserie von 30 Exemplare von unreifen bis geschlechtsreifen Tieren beider Geschlechter mit einer Längenspannung von 209,2 bis 540,0 mm TL. Die neue Spezies unterscheidet sich hauptsächlich von ihren 10 atlantischen Schwesterarten in folgenden Merkmalen: Labialfalten des Oberkiefers kürzer als die des Unterkiefers; große Augen mit Horizontallänge 1,9 bis 2,5 mal in der Interorbitalbreite; etwa gleich große Dorsalflossen; Position der I. Dorsalflosse relativ weit kopfwärts mit Ansatz über der Vorderhälfte der Bauchflossenbasis; große Rumpflänge mit weitem Abstand zwischen Brust- und Bauchflossen, deren Ansatzdistanz der Kopflänge entspricht; niedrige Zahl von 9 bis 11 Spiralfalten im Darm und einheitlich weißliche Färbung. Im Vergleich mit den anderen atlantischen Arten der Gattung ist *A. aphyodes* eine mittelgroße Spezies, die mit etwa 470 mm TL geschlechtsreif ist. Ein Bestimmungsschlüssel zu den 11 atlantischen Arten von *Apristurus* ist angefügt.

* Contribution No. 7 by M. Stehmann and other authors to taxonomic, faunistic and ecological results of German/British deep-water surveys in the Rockall Trough and surrounding waters 1974-1986

Introduction

The genus *Apristurus* Garman, 1913 is a large group of deep-water catsharks, inhabiting continental slopes and submarine elevations mainly below 500 m. Thirty two species are currently recognized as valid from the world oceans, but taxonomic reviews of the genus are very limited (e.g., Springer 1966, 1979; Nakaya 1975; Cadenat and Blache 1981; Compagno 1984), and identification to species is often impossible. In addition, the presence of many undescribed species is suggested from the Southern Hemisphere (Paulin *et al.* 1989; Last and Stevens 1994).

Ten nominal species are known from the Atlantic Ocean; *A. profundorum* (Goode and Bean, 1885) and *A. manis* Springer, 1979 from the Western North Atlantic; *A. riveri* Bigelow and Schroeder, 1944, *A. canutus* Springer and Heemstra, 1979 and *A. parvipinnis* Springer and Heemstra, 1979, from the Caribbean Sea or Gulf of Mexico; *A. laurussoni* (Saemundson, 1922), *A. atlanticus* (Koefoed, 1927), *A. maderensis* Cadenat and Maul, 1966 from the Eastern North Atlantic; *A. microps* (Gilchrist, 1922) and *A. saldanha* Barnard, 1925 from South African waters. Holotypes of two species are missing, though additional material of one of these, *A. microps*, was available, but four other species are represented only by their holotypes. In addition, most of them have hardly ever been redescribed according to modern scope of external and internal characters and based on new material. For example, Cadenat and Blache (1981) reviewed Atlantic species, but mostly they conformed with Springer's (1966) views and mistakes.

During taxonomic work at the fish collection of the Institut für Seefischerei Hamburg (ISH), we re-investigated many whitish specimens of *Apristurus* sp., which were collected mainly by the junior author from the Eastern North Atlantic and turned out to be distinct from any other species of the genus. Below we describe these representatives as a new species.

Material and methods

Beyond the type specimens of our new species listed below, the following comparative material of other species was investigated:

A. atlanticus: Holotype – ZMUB 3203, male, 247.0 mm TL, eastern Atlantic near Canary Islands.

A. canutus: Holotype – USNM 206176, female, 451.0 mm TL, Lesser Antilles; Paratypes – USNM 206180, 3 males and 1 female, 318.0–433.0 mm TL, Lesser Antilles; 9 other specimens, USNM 221293, 221294 (2 spec.), 221295, 221297, 221299, 221454; ZMB 31556, 4 males and 5 females, 208.0–436.0 mm TL, Caribbean Sea.

A. laurussoni: Holotype – NHMR (uncatalogued), female, 663.0 mm TL, Icelandic waters.

A. maderensis: Holotype – MMF 18750, female, 665.0 mm TL, Madeira.

A. manis: Holotype – MCZ 38299, female, 390.0 mm TL, waters off Massachusetts; Paratypes – MCZ 37416 (2 spec.), 37512, 37535, 227.0–255.0 mm TL, 3 males and

1 female, waters off Massachusetts; 11 other specimens, ARC 8601097, 8602997, ISH 154-1974a, 154-1974b, 3412-1979, 3449-1979, 3712-1979, 3713-1979 (2 spec.), MCZ 37407, Institute of Oceanology Moscow (uncatalogued), 4 males and 7 females, 183.2-852.1 mm TL, North Atlantic.

A. microps: MCZ 58434, female, 259.3 mm TL, 39°48' N, 69°45' W; ISH 195-1967, female 385.0 mm TL and male 372.0 mm TL, 25.VI.1967, South Africa, 33°49' S, 17°13' E, 1000 m; ISH 943-1973, 2 females, 412.0 and 423.0 mm TL, 14.V.1973, Newfoundland, 45°16' N, 48°08' W, 2000-2200 m; ISH 944-1973, female, 730.0 mm TL, 12.V.1973, Newfoundland, 45°30' N, 48°19' W, 1200 m; ISH 945-1973, male, 679.0 mm TL, 13.V.1973, Newfoundland, 45°17' N, 48°14' W, 1500-1640 m; ISH 697-1974, female, 52 cm TL, 16.XI.1974, Anton Dohrn Seamount, 57°23' N, 11°29' W, 1850-1900 m; ISH 698-1974, male 544.0 mm TL and female 423.0 mm TL, 16.XI.1974, Anton Dohrn Seamount, 57°23' N, 11°29' W, 1850-1900 m; ISH 493-1981, 3 males, 464.0-530.0 mm TL, 30.IX.1981, Lousy Bank, 60°20.5' N, 14°44' W, 1800 m.

A. parvipinnis: Holotype - USNM 206178, male, 472.0 mm TL, Gulf of Mexico; Paratypes - USNM 200969, 206179, 2 females, 403.0-466.0 mm TL, Gulf of Mexico; 25 other specimens, MCZ 40249, UF 27946, 39943 (2 spec.), 45231 (2 spec.), USNM 165557, 201906 (2 spec.), 221451, 221487, 221488, 221489, 221490, 221496, 221500, 221502, 221508 (2 spec.), 221537, 221639, 221640 (3 spec.), ZMB 31555, 12 males and 13 females, 258.0-520.0 mm TL, Caribbean and Gulf of Mexico.

A. profundorum: Holotype - USNM 35646, male, 510.0 mm TL, off Delaware Bay.

A. riveri: Holotype - MCZ 36092, female, 413.0 mm TL, north of Cuba; 16 other specimens, USNM 199395, 199396, 201760 (2 spec.), 221526 (2 spec.), 221528, 221530, 221531, 221533 (2 spec.), 221535, 221536 (2 spec.), 221760 (2 spec.), 7 males and 9 females, 298.0-470 mm TL, Caribbean and Gulf of Mexico.

Morphometric measurements follow Nakaya (1991), vertebral terminology and counts Springer and Garrick (1964), and clasper terminology Compagno (1988). Institutional acronyms are those of Leviton *et al.* (1985).

***Apristurus aphyodes* n. sp.** (Figs. 1-4)

Apristurus atlanticus. Compagno, 1984: 261, figs.

Holotype: ISH 71-1981, mature male, 538.0 mm TL, FRV 'Walther Herwig' cruise 47, station 599/81, 7.X.1981; George Bligh Bank, 58°42.8' N, 13°37.6' W, 1200-1240 m depths, 200'-BT; temperature 5.45 °C and salinity 35.03 ppm at bottom.

29 Paratypes (Temperatures and salinities are those at bottom): ISH 17-1974, adult female, 532.0 mm TL, FRV 'W. Herwig' cr. 10, sta. 229/74, 6.V.1974; Lousy Bank, 60°42' N, 12°57' W, 1014-1024 m, 200'-BT; — ISH 138-1974, 4 males and 2 females, 370.0-490.0 mm TL, HUMZ 152329, female, 345.0 mm TL, ZMUB 10171, male 495.0 mm TL (the latter ones: *ex* ISH 138-1974), FRV 'W. Herwig' cr. 10, sta. 314/74, 27.V.1974; NW slope of Porcupine Bank, 53°47' N, 14°19' W, 1520-1740 m, 200'-BT; T_b 9.53 °C, S_b 35.126 ppm; — ISH 739-1974, female, 410.0 mm TL,

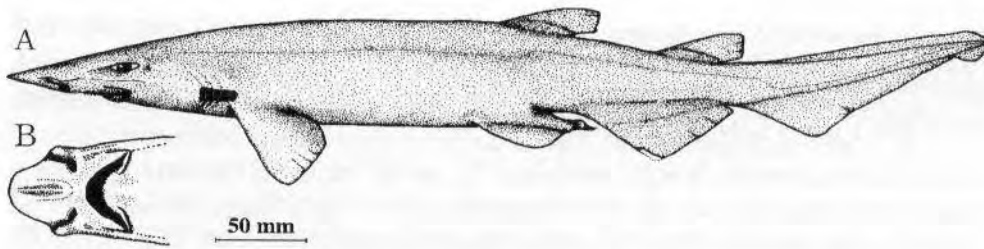


Figure 1: *Apristurus aphyodes* n. sp. Holotype ISH 71-1981, male, 538.0 mm TL. (A) lateral view, (B) ventral side of head.

FRV 'W. Herwig' cr. 14, sta. 889/74, 26.XI.1974, Lousy Bank, 60°48' N, 12°41' W, 1500-1550 m, 140'-BT; T_b 3.91 °C; — ISH 807-1974, male, 314.5 mm TL, FRV 'W. Herwig' cr. 14, sta. 951/74, 7.XII.1974; Porcupine Seabight, 51°30' N, 12°48' W, 1500-1525 m, 140'-BT; T_b 4.66 °C; — ISH 24-1981, juvenile female, 209.2 mm TL, FRV 'W. Herwig' cr. 47, sta. 569/81, 26.IX.1981; Bill Bailey Bank, 59°56.8' N, 10°03.8' W, 1138-1140 m, 200'-BT; T_b 5.82 °C, S_b 35.14 ppm; — ISH 36-1981, female, 508.0 mm TL, FRV 'W. Herwig' cr. 47, sta. 578/81, 28.IX.1981; Lousy Bank, 60°49.7' N, 12°49.7' W, 1200-1210 m, 200'-BT; T_b 4.95 °C, S_b 34.33 ppm; — ISH 49-1981, female, 494.0 mm TL, FRV 'W. Herwig' cr. 47, sta. 584/81, 30.IX.1981; Lousy Bank, 60°20.5' N, 14°44' W, 1800 m, 140'-BT; T_b 3.67 °C, S_b 34.87 ppm; — ISH 84-1981, 3 males and 3 females, 362.3-475.0 mm TL, HUMZ 152330, male 510 mm TL, MNHN 1998-0041, female 368.0 mm TL, USNM 347837, female 455.0 mm TL, ZIN N51551, female 380.0 mm TL (the latter ones: *ex* ISH 84-1981), FRV 'W. Herwig' cr. 47, sta. 608/81, 13.X.1981; Hebridean Terrace, 56°35.1' N, 09°38.4' W, 1500 m, 140'-BT; T_b 4.78 °C, S_b 34.96 ppm; — ISH 124-1981, male, 478.0 mm TL, FRV 'W. Herwig' cr. 47, sta. 631/81, 18.X.1981; northern Bay of Biscay, 49°37.7' N, 12°35.1' W, 1740-1750 m, 140'-BT; — ISH 184-1983, 2 males, 448.0-540.0 mm TL, BMNH 1998.1.22.1, male 483.0 mm TL (*ex* ISH 184-1983), FRV 'W. Herwig' cr. 58, sta. 361/83, 25.V.1983; west slope of Porcupine Bank, 52°48.3' N, 15°04.3' W, 1295-1320 m, 200'-BT; T_b 4.2 °C, S_b 34.95 ppm; — ISH 187-1983, female, 407.9 mm TL, FRV 'W. Herwig' cr. 58, sta. 372/83, 28.III.1983; Porcupine Seabight, 49°31.9' N, 12°34.6' W, 1487-1491 m, 200'-BT; T_b 5.1 °C, S_b 35.13 ppm.

All type specimens with ISH numbers are kept in the former ISH collection at the ZMH, so that loan requests should be addressed to the ZMH fish curator.

Diagnosis

A species of *Apristurus* with a slender body, upper labial furrow shorter than the lower one, large horizontal eye diameter which is 1.9 to 2.5 times in interorbital width, dorsal fins subequal in size, anterior position of 1st dorsal fin originating above front half of pelvic base, widely spaced pectoral and pelvic fins with interspace between origins about equal to head length, 9 to 11 spiral valves and uniform whitish colouration of body.

Description of the holotype

Proportional measurements and meristic counts are given in Table 1. Differences for paratypes demonstrating the range of meristic counts and other features are given in parentheses.

Body slender and cylindrical. Snout relatively long and flattened; preorbital snout length a little less than half of head length; prenarial snout a little longer than half of preoral snout length, 1.2 to 1.3 times the internarial width, and nearly three fourths of interorbital width; snout bell-shaped, with snout edges protruding at level of anterior nasal apertures, and its tip rather bluntly rounded (Figure 1B). Nostrils expanding obliquely inward from snout edges; their diameter a little less than internarial width and almost equal to horizontal eye diameter. Posterior corner of nostrils separated from mouth by a distance of half the internarial width. Numerous pores of Lorenzini's ampullae conspicuous on dorsal and ventral surfaces of snout; those on midline of ventral side arranged in an elliptical field (Figure 1B); those on dorsal side arranged in a few rows anteriorly, and in about 10 rows posteriorly forming a slender elliptical patch.

Mouth strongly arched and moderate in size, with well developed labial furrows; upper furrow slightly shorter than lower one (apparently shorter than lower furrow in most paratypes, and very rarely subequal); upper furrow not reaching to mid-point between mouth corner and posterior margin of nostril. Eye large and oval, with a weak subocular fold; horizontal diameter a little less than internarial width, or a little less than one third of snout length. Spiracle small, placed slightly below level of horizontal axis of eye. Five small gill openings; the smallest, 5th, gill opening above pectoral fin base.

Pectoral fins relatively small, narrow and subquadrangular; when laid back, their tips not reaching anterior one third of interspace between bases of paired fins. Pelvic fins moderate in size; their overall length a little longer than half of interspace between bases of paired fins. Pectoral and pelvic fins widely separated; distance between origins of pectoral and pelvic fins almost equal to head length; interspace between bases of paired fins longer than length from snout tip to spiracle, but shorter than length to 1st gill opening. First dorsal fin slightly smaller than 2nd dorsal fin; its origin over anterior half of pelvic base; its posterior end of base above interspace between pelvic and anal fins; its tip above anal origin. Second dorsal fin origin above middle of anal base; its posterior end of base slightly before, or above that of anal fin base. Anal fin high, with short base; its origin below free rear tip of 1st dorsal fin; its posterior end of base a little behind or below that of 2nd dorsal fin; its anterior corner subangular (rather rounded in female paratypes). Anal fin and caudal fin separated only by a notch. Caudal fin slender and short; its lower anterior corner slightly expanded; a distinct subterminal notch present. Caudal peduncle high; its height a little more than internarial width (equal in smaller paratypes), or about three fifths of interorbital width; caudal axis nearly straight. (Figure 1 A)

Clasper (Figure 2) short and robust; ventral and outer lateral sides covered with dermal denticles; clasper hooks or claws absent; pseudosiphon a rounded hole in shape; cover rhipidion vestigial; pseudopera large and deep; exorhipidion flat and simple in shape, lacking free posterior end.

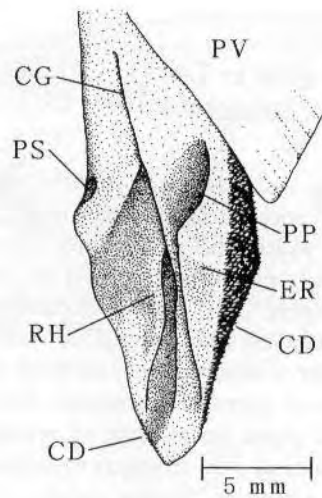


Figure 2: Dorsal view of right clasper of *Apristurus aphyodes* n.sp., holotype ISH 71-1981, 538.0 mm TL. Abbr.: CD = clasper denticles; CG = clasper groove; ER = exorhipidion; PP = pseudopera; PS = pseudosiphon; PV = pelvic fin; RH = rhipidion.

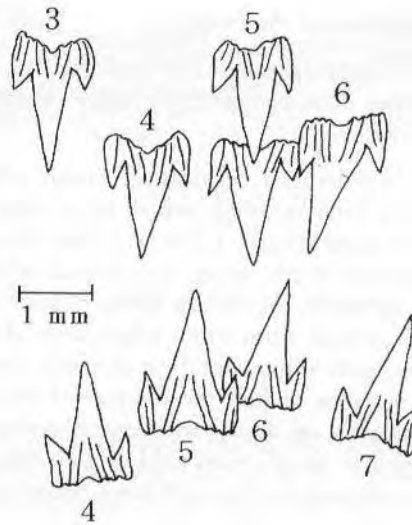


Figure 4: Outer view and distribution of teeth on left side of upper (above) and lower (below) jaws in the holotype of *Apristurus aphyodes* n. sp., ISH 71-1981, male 538.0 mm TL. The numbers indicate the tooth position from the symphysis.

Dermal denticles from dorsolateral side of body (Figure 3) small and erect; strongly tricuspid, with a long medial cusp; outer surfaces of denticles rather concave as a whole, with elevated outer margin of lateral cusps and weak medial ridge. Denticles on dorsal margin of caudal fin closely packed, but not enlarged in size, and not forming a crest.

Teeth (Figure 4) small in upper and lower jaws, each with a long central cusp and a short lateral cusp on each side of central cusp (two lateral cusps in smaller male paratypes, two or three lateral cusps in female paratypes). Tooth rows 29+29/28+25 in upper/lower jaw (32-34+29-34/27-31+26-33 in paratypes).

Number of monospondylous vertebrae 36 (34-37 in paratypes). Number of precaudal diplospondylous vertebrae 27 (24-28). Number of spiral valves 10 (9-11).

Colour in alcohol: Upper and lower surfaces of body and fins uniformly whitish, or lead grayish. Fins darker distally.

Sexual maturity: This species attains sexual maturity between 400 and 470 mm TL, and is fully mature at 470 mm TL or larger sizes. Specimens larger than 500 mm TL are all mature.

Egg capsule: Unknown.

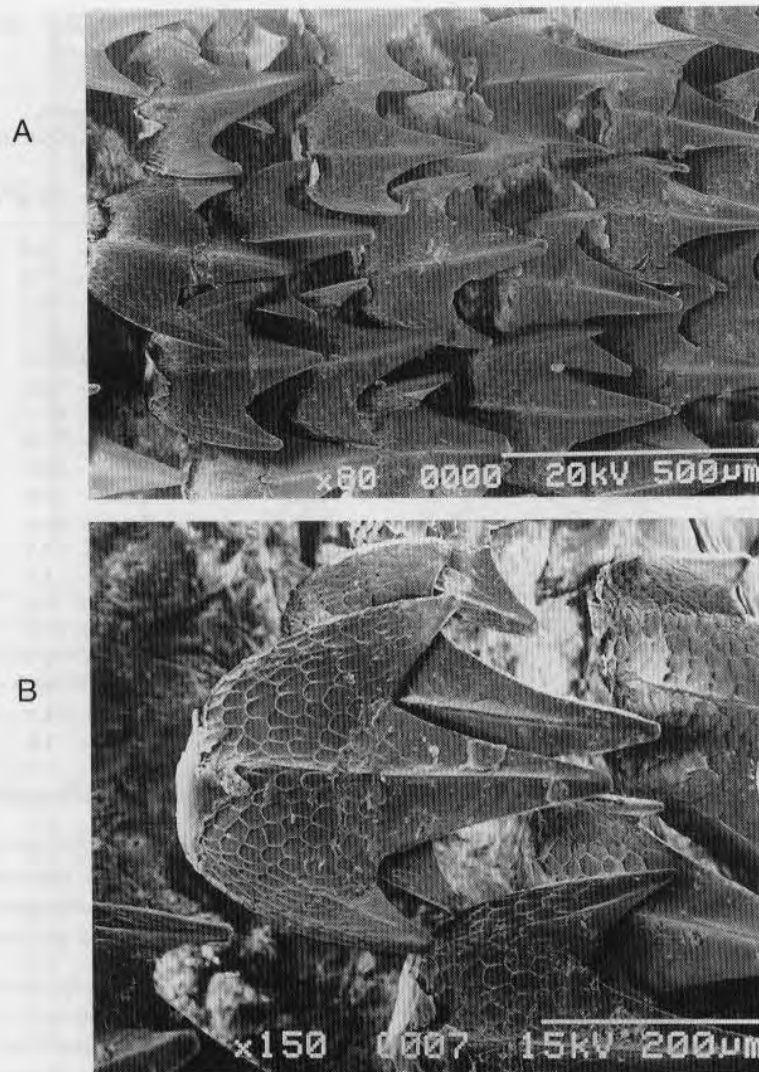


Figure 3: Dermal denticles from dorsolateral part of body, (A) holotype [male] of *Apristurus aphyodes* n.sp., ISH 71–1981, and (B) enlarged denticle of female paratype ISH 36–1981.

Distribution: Northern Eastern North Atlantic (Figure 5) at 1014 to 1800 m depth.

Etymology: The new species was first distinguished on board from other species by the junior author by the German word “hell” (meaning “light colour”), and the specific name *aphyodes* refers to its whitish body colouration.

Table 1: Proportional morphometrics, as per cent of total length, and meristic counts of *Apristurus aphyodes* n. sp., holotype and 20 selected paratypes.

TL, mm	Holotype	Paratypes
n	1	20
Sex	♂	10 ♂♂ + 10 ♀♀
Snout tip to anterior nostril	4.2	4.0 - 6.4
mouth	7.7	7.7 - 9.8
eye	10.3	9.9 - 12.7
1 st gill opening	19.8	19.1 - 22.5
5 th gill opening	23.1	23.5 - 25.8
1 st dorsal fin origin	50.9	44.4 - 52.6
2 nd dorsal fin origin	65.8	59.4 - 67.2
lower caudal fin origin	72.5	66.8 - 72.9
pelvic fin origin	47.4	42.1 - 48.4
pectoral fin origin	22.3	22.2 - 25.0
anal fin origin	58.6	50.6 - 60.8
Head width	10.3	10.4 - 13.5
Eye, horizontal diameter	3.1	3.0 - 3.5
Nostril diameter	3.0	2.7 - 3.6
Mouth width	8.0	8.4 - 11.0
Internarial width	3.6	4.0 - 4.7
Interorbital width	6.7	6.6 - 8.2
Length upper labial furrow	2.5	1.8 - 3.1
lower labial furrow	2.6	2.6 - 3.8
Length 1 st gill opening	1.7	1.6 - 2.7
3 rd gill opening	2.0	1.8 - 3.2
5 th gill opening	1.4	1.3 - 2.3
Distance between dorsal fin bases	8.2	5.8 - 8.8
pectoral and pelvic fins	17.6	11.2 - 18.3
origins of pectoral and pelvic fins	24.7	18.3 - 25.3
origins of 1 st and 2 nd dorsal fins	15.4	12.6 - 15.7
First dorsal fin, height	3.1	2.2 - 3.3
base length	7.0	6.0 - 7.6
Second dorsal fin, height	3.3	2.8 - 3.5
base length	7.0	6.1 - 7.5
Anal fin, height	5.7	3.7 - 6.1
base length	13.5	12.5 - 14.5
Pectoral fin outer (= anterior) margin	11.3	8.5 - 12.2
Pelvic fin, overall length	9.9	8.0 - 11.0
Caudal fin, lower origin to tip	27.6	26.7 - 33.6
Caudal peduncle height	4.3	4.0 - 4.8
Tooth rows upper jaw	58	56 - 68
lower jaw	53	49 - 64
Monospondylous vertebrae	36	34 - 37
Diplospondylous pre-C vertebrae	27	24 - 28
Spiral valves	10	9 - 11

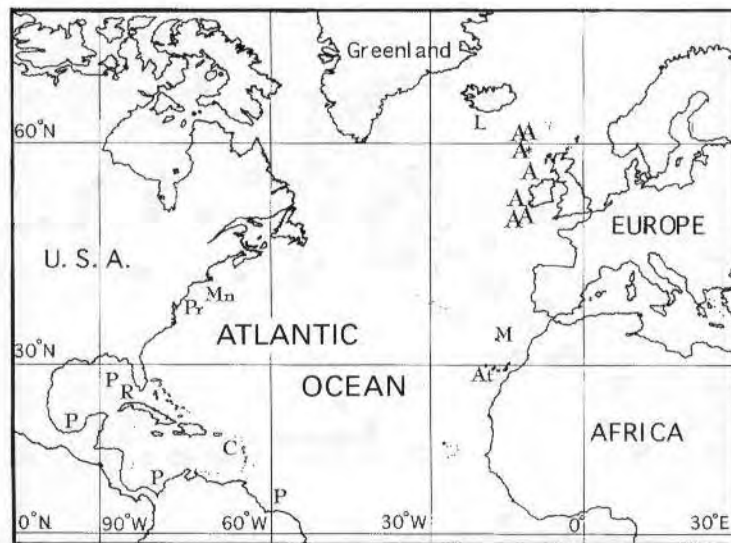


Figure 5: Geographical distribution of *Apristurus aphyodes* n. sp. and type localities of other North Atlantic species of *Apristurus*. A* = Holotype of *A. aphyodes*; A = paratypes of *A. aphyodes*; At = *A. atlanticus*; C = *A. canutus*; L = *A. laurussoni*; M = *A. maderensis*; Mn = *A. manis*; P = *A. parvipinnis*; Pr = *A. profundorum*; R = *A. riveri*.

Interspecific comparison and discussion

We examined all the existing type specimens, but those of the South African species *A. microps* and *A. saldanha* are lost (Compagno, 1984) and could not be re-investigated. The original description of *A. microps* is poor, and we followed Compagno (1984) concerning distinguishing characters of this species.

Our new species has low spiral valve counts (9–11), and is thus clearly distinguishable from *A. canutus* (14–17), *A. parvipinnis* (15–17), *A. atlanticus* (18), and *A. maderensis* (19) by these counts. The spiral valve count of *A. laurussoni* is not available, because the intestine of the holotype is missing.

The length relation of upper and lower labial furrows at the mouth corners is also a reliable taxonomic character, and the species of the genus *Apristurus* are divided into two groups by this relation (Nakaya and Sato, in press). Some species have definitely longer upper labial furrows than the lower ones, but the upper labial furrows are equal to or shorter than the lower ones in others. Our new species has upper labial furrows shorter than the lower ones, and is hereby distinct from *A. canutus*, *A. parvipinnis*, *A. laurussoni*, *A. atlanticus* and *A. maderensis*, because they all have upper labial furrows apparently longer than the lower ones (Figure 6). Although we could not examine the type specimen of *A. saldanha*, this species has upper labial furrows apparently longer than the lower ones also (Barnard, 1925).

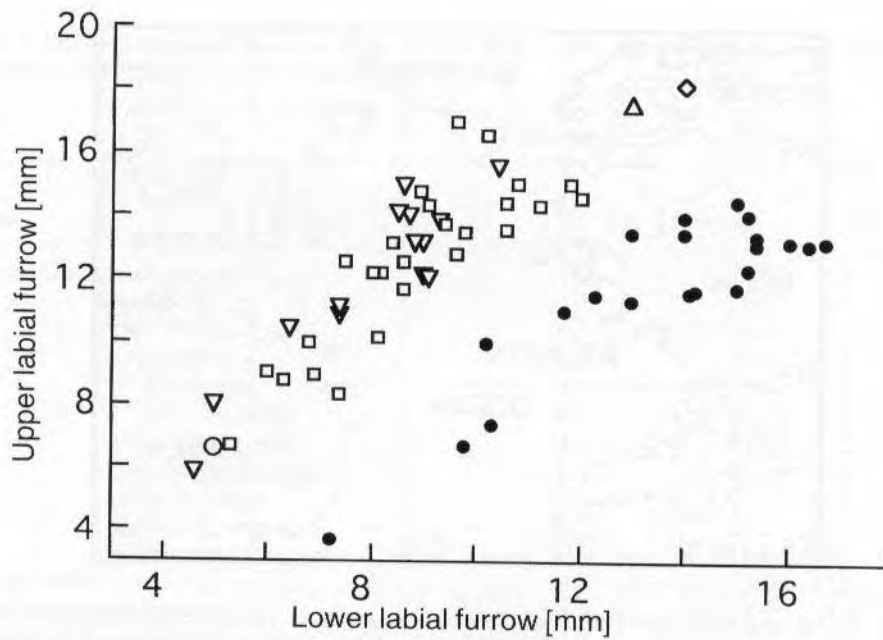


Figure 6: Relation of upper and lower labial furrow lengths in *Apristurus aphyodes* n. sp. and North Atlantic congeners with high spiral valve counts. ● = *A. aphyodes*; ○ = *A. atlanticus*; ▽ = *A. canutus*; △ = *A. laurussoni*; ◇ = *A. maderensis*; □ = *A. parvipinnis*.

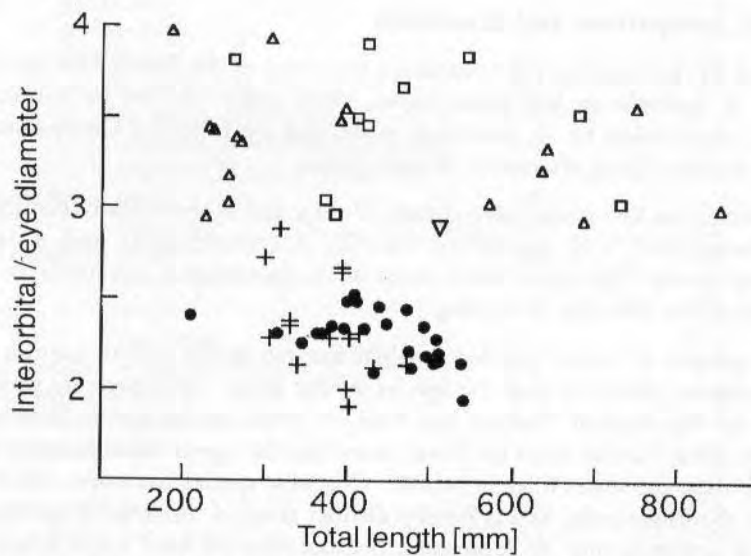


Figure 7: Relation of interorbital width and eye diameter in *Apristurus aphyodes* n. sp. and North Atlantic congeners with low spiral valve counts. ● = *A. aphyodes*; △ = *A. manis*; ▽ = *A. profundorum*; □ = *A. microps*; + = *A. riveri*.

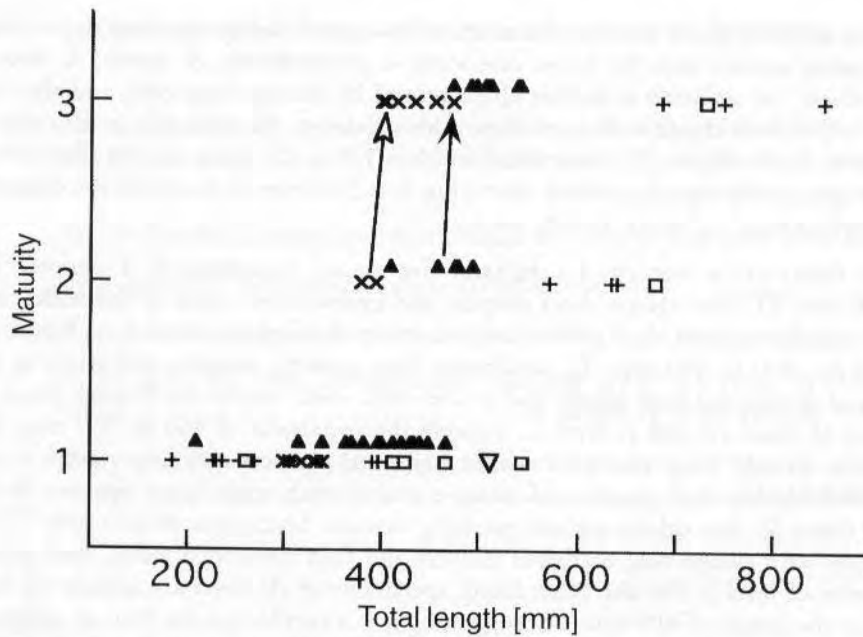


Figure 8: Sexual maturity stages and size in mm TL in *Apristurus aphyodes* n. sp. and North Atlantic congeners with low spiral valve counts. Maturity stage 1 = immature (clasper short, or gonads undeveloped); Maturity stage 2 = adolescent (clasper elongate but soft, or gonads developing); Maturity stage 3 = adult (clasper long and stiff, or gonads completely developed). Solid arrow = maturity of *A. aphyodes*; open arrow = maturity of *A. riveri*. ▲ = *A. aphyodes*; + = *A. manis*; □ = *A. microps*; ▽ = *A. profundorum*; x = *A. riveri*.

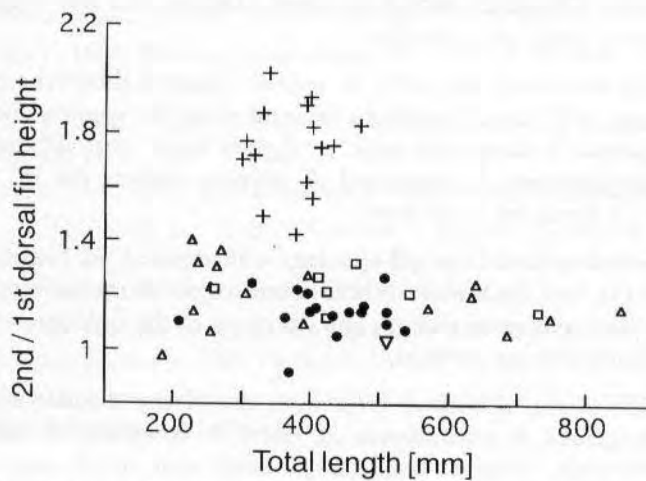


Figure 9: Height relation of 1st and 2nd dorsal fins in *Apristurus aphyodes* n. sp. and North Atlantic congeners with low spiral valve counts. ● = *A. aphyodes*; △ = *A. manis*; □ = *A. microps*; ▽ = *A. profundorum*; + = *A. riveri*

Apristurus aphyodes shares the two characters of low spiral valve counts and upper labial furrow being shorter than the lower one with *A. profundorum*, *A. manis*, *A. microps* and *A. riveri*. *A. aphyodes* is further characterized by having large eyes, and the new species differs from the first three of these four species in the ratio of eye diameter to interorbital width (Figure 7). Interorbital width is 1.9 to 2.5 times the eye diameter in the new species, overlapping with *A. riveri*, but it is 2.9 times or more the eye diameter in *A. profundorum*, *A. manis* and *A. microps*.

Figure 8 shows size at maturity for the same five species. Specimens of *A. aphyodes* less than 400 mm TL have always short claspers and undeveloped testes in the males, and slender undifferentiated shell glands and ovaries in the females (level 1 in Figure 8). Some of the 400 to 460 mm TL specimens have growing claspers and testes in the males, and developing shell glands and ovaries with small ova in the females (level 2), but most of them are still at level 1. Among the specimens of 460 to 500 mm TL, some have already long, nearly or totally hardened claspers and large testes in the males, and swollen shell glands and massive ovaries with some large ripe ova in the females (level 3), but others are not yet fully mature. Specimens of 500 mm TL or larger sizes have always long hardened claspers and fully developed testes, shell glands and ovaries of level 3. On the other hand, specimens of *A. riveri* are already all fully mature at the length of 400 mm TL, suggesting it is a smaller species than *A. aphyodes*. In the description of *A. riveri*, Bigelow and Schroeder (1944) noted that the holotype (413 mm TL) does not contain eggs, but an egg capsule of 64×13 mm was found in each oviduct of the holotype by the senior author. Therefore, the holotype is a mature female, and this fact suggests that *A. riveri* is a species with single oviparous mode of reproduction *sensu* Nakaya (1975). Although the number of specimens examined is rather small, Figure 8 also shows that *A. manis* and *A. microps* are species of larger adult size, becoming mature at about 700 mm TL. *A. profundorum* is known only by the holotype of 510 mm TL, which still shows small claspers, and this suggests that *A. profundorum* attains a large adult size also.

Relative sizes of the two dorsal fins differ by species. Figure 9 shows the height of 2nd dorsal fin in relation to 1st dorsal fin height in again these five species. Size of the 2nd dorsal fin of *A. aphyodes* is almost the same, or slightly larger than 1st dorsal fin, as is also seen in *A. profundorum*, *A. manis* and *A. microps*, whereas the 2nd dorsal fin is much larger than 1st dorsal fin in *A. riveri*.

A. riveri was described to have large gill openings with exposed gill filaments (Bigelow and Schroeder 1944), but the senior author's examination of the holotype and other specimens of *A. riveri* confirmed that the gill openings of the holotype are deformed, and thus their peculiarities are artifacts.

From the discussion above, *Apristurus aphyodes* is also clearly distinct from the most similar Atlantic congeners *A. profundorum*, *A. riveri*, *A. manis* and *A. microps*.

Key to *A. aphyodes* and other Atlantic species of *Apristurus*

- 1a Spiral valves 12–19; upper labial furrow longer than lower labial furrow
..... *A. laurussoni*, *A. atlanticus*, *A. maderensis*,
A. canutus, *A. parvipinnis*, *A. saldanha*
- 1b Spiral valves 8–11; upper labial furrow equal to or shorter than lower labial furrow .. 2
- 2a First dorsal fin much smaller than second dorsal fin *A. riveri*
- 2b First and second dorsal fins almost equal in size 3
- 3a Body dark: eye small, its horizontal diameter 2.9 to 4.0 times in interorbital
width *A. manis*, *A. profundorum*, *A. microps*
- 3b Body whitish: eye large, its horizontal diameter 1.9 to 2.5 times in interorbital
width ***A. aphyodes*** n. sp.

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