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The genus Harriotta GOODE & BEAN 1895 (Chondrichthyes, Chimaeriformes, Rhinochimaeridae)

by Christine Karrer

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Christine K a r r e r

THE GENUS Harriotta GOODE & BEAN 1895 *)

(Chondrichthyes, Chimaeriformes, Rhinochimaeridae)

With the description of a new species from the North Atlantic

I N T R O D U C T I O N

In 1970, on the twenty-fourth trawling trip of the research vessel "E. HAECKEL" (Institute for High Sea Fisheries and Fish Processing, Rostock - Marienehe), 23 Rhinochimaeroids were captured at one station in the NW Atlantic. Two deep-frozen specimens were obligingly given to our Museum by the leader of the campaign, Mr. W. MAHNKE, to whom heartfelt thanks are herewith addressed. The animals were identified as belonging to the genus Harriotta, although they considerably differed from H. raleighana GOODE & BEAN 1895; therefore, they will be described in the following as a new species.

In 1953, H. raleighana was circumstantially described by BIGELOW &

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*) With 5 Figures and 2 Tables. Manuscript received 13 October, 1971

SCHROEDER in "Fishes of the western North Atlantic" and, in 1954, subsequent to the capture of numerous additional specimens, the named authors devoted to them another supplementary report. A survey of the literature has revealed that two juvenile specimens described as H. raleighana markedly diverge from the typical characters of this species. They are: the smallest of the four syntypes from the NW Atlantic and the male captured near the Canary Islands; the latter had been figured as early as in 1912 by MURRAY & HJORT, but it was described only in 1927 by KOEFOED. Although most of the authors had recognized the considerable proportional differences in comparison with the otherwise known much larger Harriotta specimens, they had explained them as juvenile characters; it is only now that GARRICK (in the press) expresses doubts in regard to their specific position. The present author was able to compare her specimens with that of the "M. SARS," and Dr. W.R. TAYLOR provided the accurate measurements for the (204)
syntype of H. raleighana; both of these specimens belong to the new species. Since, consequently, the original description of H. raleighana has to be based on two species, a redefinition of the specific description is necessary; furthermore, because of the fact that a second species is known, an extension of the generic diagnosis is requisite. A few brief remarks concerning juvenile Rhinochimaeridae will precede.

The following species served for a comparison:

Rhinochimaera pacifica (MITSUKURI): ZMB 16 344 — Urugama, Sagami-See, Japan; ♀, 1160 mm TL, 740 mm SL.

Rh. atlantica HOLT and BYRNE: ZMB 22626 — „E. HAECKEL", 26. 4. 65. 62° 50′ N, 23° 55′ W, 800–870 m; ♂, 710 mm SL, ♀ mit verletzter Schnauze, etwa 900 mm SL. MCZ 37508 — „CAP'N BILL II" St. 97/52, 42° 40′ N, 63° 51′ W, 465–480 fms.; ♀, 439 mm TL, 290 mm SL. ISH 52/65 — „A. DOHRN" St. 413, 62° 43′ N, 24° 30′ W, 730–780 m; ♂, 153 mm TL, 95 mm SL. MCZ 38256 — „CAP'N BILL II", 15. 7. 53, 42° 22′ N, 64° 55′ W, 290–340 fms.; ♂, 85 mm SL. Institut Scientifique et Technique des Peches Maritimes, Sète – nahe Kap Verde, 450–650 m; ♀, konserviert 1020 mm TL, 690 mm SL.

)[1] with an injured snout, about 900 mm SL

)[2] near Cap Verde ..... preserved 1020 mm TL, 690 mm SL

Neobarriotta pinnata (SCHNAKENBECK): ZMB 22008 — „E. HAECKEL" St. 234, 28. 5. 68, 18° 51′ S, 11° 36′ E, 320–330 m; ♂, 1020 mm TL, 713 mm SL. ZMB ohne Fundort;)[1] ♂, 1012 mm TL, 695 mm SL.

N. carri BULLIS and CARPENTER: MCZ 47840 — „OREGON" St. 3598, 9° 03′ N, 81° 22′ W, 200–220 fms.; ♂, 219 mm TL, 99 mm SL.

ISH Institut für Seefischerei, Hamburg
MCZ — Museum of Comparative Zoology, Harvard University
ZMB — Zoologisches Museum Berlin
ZMUB — Zoologisk Museum, Universitetet i Bergen

)[1] without a locality; /‾ TL = total length ‾/

In this work, standard length (SL) refers to the distance snout – termination of second dorsal, because the origin of the upper caudal fin can often not be determined with precision; or also because not all Rhinochimaeridae possess an anal fin. The measurements are listed in T a b l e 1 . General size indications contained in the descriptions do not include the proportional dimensions of very small specimens.

Prof. Dr. J.A.F. GARRICK (Wellington) obligingly allowed the present author to examine his manuscript, for which sincerest thanks are expressed to him as well as to the following colleagues: Dr. M. BONNET (Sète); Dr. Ø. FRØILAND (Bergen); Dr. G. KREFFT and Miss Chr. LUBBEN (Hamburg); Dr. Cl. MAURIN (Nantes); Mr. G. MAYER (Cambridge, Mass.); Dr. G.J. NELSON (New York); Dr. J. RODRÍGUEZ-RODA (Cadiz); Dr. W.R. TAYLOR (Washington); Dr. Y. TOMINAGA (Tokyo); Mr. P.J. WHITEHEAD (London), all of whom extended their assistance; this refers particularly to Mrs. Dr. M.M. DICK (Cambridge, Mass.).

JUVENILE CHARACTERS IN RHINOCHIMAERIDAE

Juvenile Chimaeriformes (DEAN 1906; POLL 1951) are conspicuous by their large pectoral fins and minute dermal denticles on either side along the midline of the cranial crown, anterior to the 2nd dorsal, also between the latter and the upper caudal fin. The number of these denticles (in the sequence as indicated above) varies in the Rhinochimaeridae: H. raleighana 3, 3-4, 4-6; H. haeckeli 3, 6, 6 (acc. to figure in GOODE & BEAN 1895); Rhinochimaera atlantica

3, 7-8, 6-8; N. carri 3, 3-4, 6-7 (according to the specimen investigated and also acc. to BULLIS & CARPENTER 1966); N. pinnata 4-6, 5-6, 7-8 (acc. to BULLIS & CARPENTER 1966, partly occurring in double series).

In newly hatched Rhinochimaeridae the following characters count: (205)
(1) Caudal filament already developed, if at all present in adults. (2) Snout short and, therefore, head relatively small (about 30%, adult 40-50% of SL). In the respective smallest investigated specimens of both H. raleighana and Rh. atlantica the part of the snout extending forward from the mouth forms, as it were, a small leaflike process at the upper margin of the head; in the slightly larger specimens of both species it can be recognized that the lengthening of the snout begins very soon. (3) The mucous canals of the head and the lateral line already display the species-specific course, but the suborbital canal (F i g . 2) in front of the eye is curved much stronger than in older animals (it is only in H. haeckeli that this character is preserved in the adult specimen). (4) A great supply of yolk might cause a ± strong displacement of the paired fins either forward or backward.

Harriotta GOODE and BEAN, 1895

Harriotta GOODE and BEAN, 1895 (a): 471 (Typusart: *H. raleighana* GOODE and BEAN).
GOODE, 1886: 104 (nur Name genannt). (only the name indicated).
Hinteliochimaera TANAKA, 1909: 7 (Typusart: *H. chaetirhamphus* TANAKA).
Typusart: *H. raleighana*

Rhinochimaeridae with a long and very sharp-tipped snout, dorso-ventrally compressed at least at its termination. The dorsal profile of the head slopes obliquely from the neurocranium to the tip of the snout. Mouth below area of eyes, not considerably anterior thereto; the compact dental plates (in the upper jaw one pair of vomer and palatinal plates each, in the lower jaw one pair

of mandibular plates) are notched in their outer margins and have series of small knoblike projections (tritors) on the surfaces of the large plates; with growing age, the projections mostly increase in numbers and size. Gill openings short, ventro-lateral, not extending higher dorsally than to the basal centre of the pectoral fins.

Two dorsal fins, the first one with a sturdy spine of a varying length; cross-section of spine triangular, anterior margin somewhat set off. No anal fin; a thickening in the membrane of the ventral median line. Both caudal fins either of an equal configuration and, in that case, not higher than the 2nd dorsal; or lower caudal fin longer and of a considerably greater vertical height than the upper caudal fin. Pectoral fins wide. Caudal filament of a varying length.

Frontal tenaculum of the males present; clasper plain.

Dispersion: North Atlantic, Pacific.

Two species.

Harriotta is distinctly separable from the two other genera of the family. Neoharriotta (BIGELOW & SCHROEDER 1950) is unambiguously characterized by its short anal fin. Rhinochimaera (GARMAN 1901) is differentiated by numerous characters: (1) Its dorsal head profile is horizontal, at times with a very slight upward curve at the beginning of the snout; (2) its mouth is far forward of the eyes; (3) dental plates thin, horny and narrow, without ridges, but instead with smooth and sharp cutting edges; (4) gill openings long, extending to the upper origin of the pectoral fins; (5) spine thin; (6) pectoral fins much narrower in outline and fin base (Fig. 1); (7) in adult animals (males at all times, females not always) the dorsal margin of the upper dorsal fin is transformed into small horny denticles. (206)

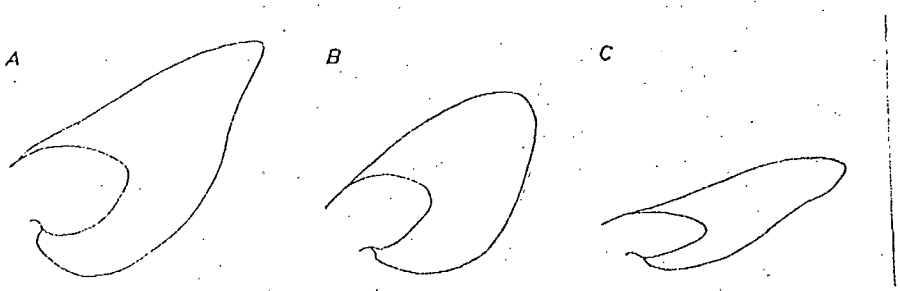


Fig. 1. Pectoral fins of - A: Harriotta raleighana (ZMB 22623); B: Harriotta haeckeli (paratype ZMB 22592); C: Rhinochimaera atlantica (MCZ 37508); fins reduced at an equal scale.

Harriotta raleighana GOODE and BEAN, 1895 (Abb. 1 A, 2)

(Only works reporting new localities are cited, as well as those having appeared since 1953; the older literature is contained in BIGELOW & SCHROEDER 1953).

Harriotta raleighana (part.) GOODE and BEAN, 1895 (a): 472, pl. 19, fig. 1, 2 (Originalbeschreibung; 37°—40° N, 71°—74° W, 707—1081 fms.; kein Holotypus festgelegt; nur die Exemplare USNM 35631, 38200, 39415). MURRAY and HJORT (part.), 1912: 127, 389, 394 fig. 260 (nach GOODE and BEAN), 416, 417, 432, 433, (nur Fundort: „M. SARS" St. 101, 7. 8. 1910, 57° 41′ N, 11° 48′ W, 1853 m). KOEFOED (part.), 1927: 29, fig. 4, 6, 7? (Verlauf der Schleimkanäle am Kopf, Kauplatten, Eikapsel), pl. 3, fig. 1 (Beschreibung der Exemplare, die MURRAY and HJORT, 1912, erwähnen). ROULE et ANGEL, 1933: 75, pl. 4, fig 34 (Beschreibung; 42° 36′ N, 63° 36′ W, 1332 m). ROULE, 1934: 163, 161 fig., pl. 9 (nochmalige Erwähnung und Abb. des 1933 beschriebenen Exemplars). SMITH, 1953: 78, fig. 96 (nach GOODE and BEAN) (keine eigenen Angaben). BIGELOW and SCHROEDER, 1953: 551, fig. 124—126 (Beschreibung; 41°—43° N, 64° — 66° W, 400—460 fms.); 1954: 81, fig. 6 D—F, 7 (Schleimkanäle am Kopf, Pectoralis) (Abgrenzung gegen *Rhinochimaera*; 39°—43° N, 64°—73° W, 290—730 fms.). SCHROEDER, 1955: 362 (Mitteilung über den Fang der von BIGELOW and SCHROEDER genannten Exemplare). MATSUBARA, 1955: 145[1]), pl. 10, Fig. 33 (nur Fundort: Japan, Sagami-Golf). GREY (part.), 1956: 101 (Zusammenstellung der Literatur). IDYLL (part.), 1964: 178 (Erwähnung der Art als Tiefseeform). LEIM and SCOTT, 1966: 70, fig. (Vorkommen im NW-Atlantik, keine eigenen Fundangaben). KREFFT, 1966: 176 (nur Fundort: 63° 06′ N, 21° 33′ W, 750—800 m); 1967 (part.): 184 (nur Fundort: 62—63° N, 22°—24° W, 700—800 m; das kleine Exemplar der St. 413 ist *Rh. atlantica*). IWAI et al., 1970: 4 (nur Fundort: SW-Pazifik, Chatham Inseln, 380—750 m). HAEDRICH and HORN, 1970: 392 (nur Fundort: 39° 09′ N, 72° 11′ W, 700 fms.). GARRICK (im Druck): (Beschreibung, Neuseeland).

)[1] (original description;))[2] no holotype established; only the specimens USNM ....)3 (only locality:...)[4] (Course of mucous canals at head, dental plates, egg case))[5] (description of specimen mentioned by MURRAY & HJORT))[6] (another mention & illustr. of 1933 specimen))[7] (no own data))[8] (mucous canals at head, pectoral) (delimitation against Rhinochim.;))[9] (report on capture of specimens named by BIG. & SCHROED.))[10] (Survey of literature)

*) Warmest thanks are expressed to Dr. Y. TOMINAGA for the translation of the passage; according thereto, this is the second specimen of the species from the Japanese area.

)[11] (mention of the species as deep sea form))[12] (occurrence in NW Atlantic, no own data on locality))[13] (only locality))[14] (the small specimen of station 413 is Rh. atlantica))[15] (only locality))[16] only locality))[17] (in the press): (description, New Zealand).

H. curtissjamesi TOWNSEND and NICHOLS, 1925: 6, fig. 2 (Originalbeschreibung; 25° 43′ N, description
113° 39′ W, 645 fms.; Holotypus).

Intelliochimaera chatirhamphus TANAKA, 1909: 7, pl. 1 (Originalbeschreibung; Japan, Sagami-Golf, etwa 400 fms.; Holotypus).

Material (207)

ISH 88/65 — „A. DOHRN" St. 426, 29. 4. 65, 63° 00′ N, 22° 06′ W, 800 m; 2 ♂♂ adult, 514, 502 mm SL. ZMB 22623 — „E. HAECKEL" St. 687, 7. 12. 70, 26° 27′ N, 15° 07′ W, 1424—1300 m; ♂ adult, 475 mm SL. MCZ 37614 — 42° 40′ N, 63° 51′ W; ♀ juv., 104 mm SL. MCZ 37026 — „CARYN" St. C 9—14, 41° 25′ N, 65° 54′ W, 400—450 fms.; ♀ juv., 81 mm SL.

Body (snout to cloaca) shorter than the tail that ends in a very long filament; thick; greatest height at origin of 2nd dorsal, 5 times within SL.

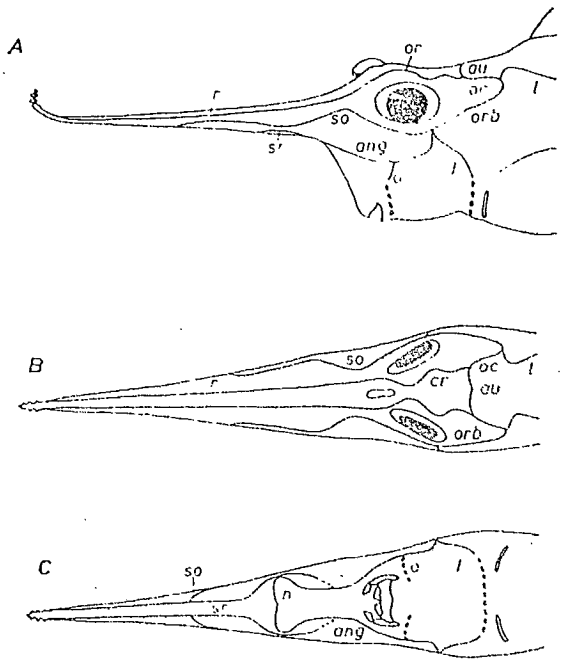
Head large, 2.1 to 2.3 times within SL; eyes very large (7-8 times within length of head); their position in the head oblique and close to the dorsal profile. Interorbital space flat and as wide as length of eye. Snout extremely sharp-tipped because the ventral line forward of the mouth ascends abruptly; therefore, the snout dorso-ventrally flattened on the anterior 2/3 part of its length. Mouth below anterior margin of eyes or very little forward thereto; dental plates - see generic diagnosis. Gill openings always shorter than interspace between them.

First dorsal close posterior to the head, long and much higher than 2nd dorsal. Spine sturdy and very long, so that, laid down, it reaches the beginning of 2nd dorsal; it is nearly straight; its rear margins finely serrate; at an advanced age these serrations might be lost (BIGELOW & SCHROEDER 1954). The soft part of the first dorsal begins with a thick fleshy portion, from which the horny radials proceed divergently; first dorsal, in all of its length, basally attached by a ligament along the dorsal line, and a projecting

membraneous fold extends from its termination to the 2nd dorsal. Interspace between 1st and 2nd dorsals considerably shorter than the base of first dorsal. Second dorsal long (varying between lengths of snout and head), its last radials terminating blindly, without a connection to the median line. Both caudal fins diverging in origin and height: upper caudal at a certain distance rearward of the 2nd dorsal, of an equal height as the latter; lower caudal starts below the termination of the 2nd dorsal; therefore, it is longer and, moreover, considerably higher (3-4 times) than upper caudal; its outline triangular, narrowing from the distal tip more strongly in the rostrate than in the caudate direction. Pectoral fins (Fig. 1A) pointed and as long as the snout; they arise forward of the first dorsal, extend far below the 2nd dorsal and almost to the origin of the ventral fins; the latter about below the middle of the 2nd dorsal.

Skin bare, smooth. The dermal denticles on either side of the dorsal line (3 on the head, 3-4 anterior to the 2nd dorsal, 4-6 between the 2nd dorsal and the upper caudal) can, according to BIGELOW AND SCHROEDER (1954), no longer be perceived in animals measuring 485 mm to the termination of the upper caudal (which corresponds to about 370 mm SL).

Pattern of the mucous canals on the head (Fig. 2 , nomenclature according to GARMAN 1888): aural canal at the centre between posterior edge of eyes and first dorsal, medially with a tip or a depression directed backward. Cranial canals on the crown of the cranium undulate (in very large specimens to a lesser extent), contracting the surface above the eyes from 1/3 to 1/4 of the length of the aural canal; although they again diverge very slightly, they run in their continuation - now called rostral canals - straight to the



F i g . 2 . Harriotta raleighana. A: head laterally; B: dorsally; C: ventrally. Course of the mucous canals; ang - angular; au - aural; cr - cranial; j - jugular; l - linea lateralis; n - nasal; o - oral; oc - occipital; orb - orbital; r - rostral; so - suborbital; sr - subrostral

tip of the snout. The occipital canal is relatively long and runs in a caudate direction; at the origin of the lateral line it forms an acuminate angle with the orbital canal and, in the process, it circumscribes a tongue-shaped surface back of the eye. The sometimes faintly undulate orbital canal runs more strongly in a rostrate than in a ventrate direction. The origins of the jugular and angular (+ oral) canals arise partly in common, partly separately below the posterior part of the eye; the separation of the oral and angular ca- (208)
nals takes place below the centre of the eye or forward thereof. The suborbital canal rises some little distance forward of the eye to an insignificant elevation and, approximately after the first third part of the distance nasal loop - tip of snout, it joins the subrostral canal. The underside of the

snout displays numerous mucous pores.

Because of the long occipital canal with its rearward direction, the lateral line begins posterior to the gill openings, closely anterior to the spine; at its origin the lateral line arches upwards, whereafter it runs a mostly straight caudate course in the upper third part of the body; approximately at the centre of the lower caudal it slopes down to the base of the latter, along which its proceeds to the tip of the tail.

Frontal tenaculum of the males relatively small in comparison with Neoharriotta pinnata and having a curved stem. The distally widened termination can be embedded in a fossa and is armed ventrally with sturdy spines, curved (2 rearward . According to BIGELOW & SCHROEDER (1953), the frontal tenaculum is not recognizable in specimens up to a length of 300 mm (to the termination of the upper caudal).Ventral tenacula in pockets, forward of the ventral fins; they are leaf-shaped and, at the lower margin, they carry about 4 sturdy spines. The claspers attain at most the length of the ventrals; distally they have a globose thickening covered with small prickles. In adult males the tip of the snout is stiffened and curves upwards; furthermore, it is conspicuous in displaying two series of small hard warts (knobs). According to BIGELOW & SCHROEDER (1954), the tip of the snout is less strongly curved and smooth in adult females. KOEFOED (1927) is the only one to mention the warts also for females; according to an information by Dr. Ø. FROILAND, the warts are present in both of the specimens mentioned by KOEFOED; Miss LUBBEN confirms their presence also for the specimen ISH 71/65, but the number of the warts is lower than in males and they are confined to the outermost tip of the snout.

Egg cases allegedly derived from H. raleighana are figured in DEAN (1906),

KOEFOED (1927) and BIGELOW & SCHROEDER (1953); in regard to their questionable specific provenance, however, the reader is referred to the DISCUSSION.

As an addendum to what was said at the beginning, the following details concern juvenile H. raleighana : (1) Snout already strongly flattened. (2) Mouth relatively far forward of the eyes. Dental plates developed and lying uncovered in the buccal cavity, while in the two Rh. atlantica, although present, they are still concealed by a membrane. In the larger specimen (MCZ 37614), the edge of the vomer plates is smooth, in the smaller one (MCZ 37026) it displays notches; in both, the grinding ridges are already indicated on the large plates. (3) Length of the spine and the nonpaired fins like in adult animals. (4) Both caudals still extraordinarily low, although the lower caudal is already much higher than the upper one. Juvenile Rh. atlantica can be distinguished with certainty from H. raleighana by the thinner and shorter spine, the narrower pectorals and, in particular, the narrow, anteriorly nonwidened nasal loop of the head canals.

Colour chocolate brown, fins with a darker edge; spine, stems of the claspers and ventral tenacula whitish.

Maximum length 1025 mm TL (BIGELOW & SCHROEDER 1954).

According to BIGELOW & SCHROEDER (1954), the species is rather frequently encountered in depths around 800 m; greatest depth thus far 1978 m (syntype USNM 39415),

Without being informed about the genus Harriotta, TANAKA has established the genus Anteliochimaera in 1909 (with its species chaetirhamphus). BEAN & WEED (1910) and GARMAN (1911) assigned this species to Harriotta. The holotype is an adult male (which, according to an information by Dr. Y TOMINAGA, Tokyo,

no longer exists), displaying, when compared with the original description, a perfect conformity with H. raleighana in specimens of an equal size; therefore, no doubt can exist in regard to the conspecificity of the two species, as assumed by GARMAN (1911) and actually established by FOWLER (1941).

TOWNSEND & NICHOLS (1925) described H. curtissjamesi from one single specimen, about 150 mm long and captured at the Californian coast (according to an information by Dr. G.N. NELSON, N. Y., the typus does no longer exist). The authors of the species note that their specimen very closely resembles the larger syntype of H. raleighana, while strongly diverging from the smallest syntype (this one, however, belongs to H. haeckeli, as will be explained further on). Since H. curtissjamesi, according to description and illustration, does not display any noteworthy differences from the juvenile specimens at hand, except for its relatively short 2nd dorsal, this species too has to be regarded as a synonym of H. raleighana. (21

Dispersion: North Atlantic (Northern USA, Iceland, western coast of Scotland, Canary Islands *)[1], Pacific (Japan, California, New Zealand).

*)[1] The specimen described by RODRÍGUEZ-RODA (1961) belongs to Neoharriotta pinnata because it possesses an anal fin; the species mentioned by MAURIN & BONNET (1970) and investigated by the present author is a Rhinochimaera atlantica.

Harriotta haeckeli sp. n. (Abb. 1 B, 3, 4)

Harriotta raleighana (part.) GOODE and BEAN, 1895 (a): 472, pl. 19, fig. 3, 4 (Originalbeschreibung; Syntypus USNM 35520; „ALBATROSS" St. 2210, 39° 38' N, 71° 19' W, 991 fms.). GARMAN (part.), 1904: 265, pl. 5, fig. 8, 9 (Kauplatten) (ergänzende Angaben zu USNM 35520). MURRAY and HJORT (part.), 1912: 76, 394, 416, 417, 420, 432, 433, fig. 307 (nur Fundort: „M. SARS" St. 35, 18. 5. 1910, 27° 27' N, 14° 52' W, 2603 m). KOEFOED (part.), 1927: 29, fig. 5 (Schleimkanäle am Kopf), pl. 3, fig. 2 (Beschreibung des Exemplars der „M. SARS"). Die beiden genannten Exemplare werden, basierend auf den Erstbeschreibungen, später von folgenden Autoren erwähnt: GOODE and BEAN, 1895b und 1896: 33, pl. 11, fig. 39, 40; ANON., 1895: 281, pl. 19 zu p. 376; JORDAN and EVERMANN, 1896: 96; 1900: pl. 19, fig. 42; SCHAUINSLAND, 1903: Fußnote zu S. 11; DEAN, 1904: 1; 1906: 125, fig. 107 (Kauplatten); HOLT and BYRNE, 1910: 20; BEAN and WEED, 1910: pl. 38 (kleines Exemplar); GARMAN, 1911: 95; TOWNSEND and NICHOLS, 1925: 7; ROULE et ANGEL, 1933: 78; FOWLER, 1936: 145; 1941: 505; BIGELOW and SCHROEDER, 1953: 556, 557; 1954: 81, 82; GREY, 1956: 101; IDYLL, 1964: fig. p. 176; MAURIN et BONNET, 1970: 169; GARRICK, im Druck; — möglicherweise auch bei JORDAN and EVERMANN, 1896b: 226.

)1 (original description;))2 (dental plates) (additional data to USNM....))3 (only locality))4 (mucous canals in the head) (description of specimen of "M. SARS").The two named specimens, based on the first descriptions, are mentioned subsequently by the following authors:)5 footnote to p. 11;)6 (dental plates))7 (small specimen))8 ... in the press; - possibly also in JORDAN... etc.

Material
Holotypus: ZMB 22591 — „E. HAECKEL" St. 343, 14. 7. 70, 63° 21' N, 57° 00' W, 1970 — 2020 m; ♂ semiadult, 496 mm TL.
Paratypen: ZMB 22592 — gleiche Daten wie Holotypus; ♀ adult, 650 mm TL. ZMUB 3256 — „M. SARS" St. 35, 18. 5. 10, 27° 27' N, 14° 52' W, 2603 m; ♂ juv., 265 mm TL.

)9 - same data as holotype;

The smaller male was selected as holotype because it possesses an undamaged spine. Since the paratypes diverge but minimally from the holotype, no separate descriptions are given.

Name derived from the research vessel "E. HAECKEL."

Body elongate, longer than the tail, caudal filament extraordinarily short; thick; greatest height at the centre, between the paired fins, about 5 times within SL.

Head large, 2.2 times within SL. Eyes small (10.5 - 12.4 times within length of head), positioned laterally and separated by the arched interorbital space that is twice as wide as length of eye. From the mouth forward, the long

and soft snout narrows evenly in the rostrate direction, being laterally compressed posteriorly and dorso-ventrally only at its tip. Mouth below the centre of eye, dental plates - see generic diagnosis. Nostrils directly anterior to the mouth. Gill openings short, their position almost ventral, median interspace not longer than openings themselves.

First dorsal very short, closely posterior to head, approximately at centre of SL. Along with the spine, the first dorsal scarcely higher than 2nd dorsal. Spine sturdy and curved, its length always shorter (in older animals very considerably so) than the distance from origin of first dorsal to 2nd dorsal; rear margins smooth. The soft part of the 1st dorsal not markedly longer than the base of the spine and confluent therewith in its lower third part; the few bundled horny rays are joined to one another and the dorsal line by (212
a membraneous fold. First dorsal and 2nd dorsal entirely separate, interspace between them at least twice as long as the base of the 1st dorsal. Second dorsal short (shorter than snout);its base faintly thickened in the holotype. Both caudals short, about as high as 2nd dorsal (upper caudal minimally higher than lower caudal); they terminate closely anterior to the tip of the tail, so that the caudal filament measures but a few mm. The upper caudal originates directly posterior to the 2nd dorsal and is joined to it by a low membraneous fold. Lower caudal shorter than upper caudal; in the holotype, the upper caudal follows the termination of the 2nd dorsal at a small, in the paratypes at a longer distance, hence, always with a distinct separation; the rays of the lower caudal form a narrow surface of the same shape as that of the upper caudal. Outline of pectorals rounded, more so in the paratypes (see Fig. 1 B) than in the holotype; pectorals short (maximum 4/5 of snout length); they arise

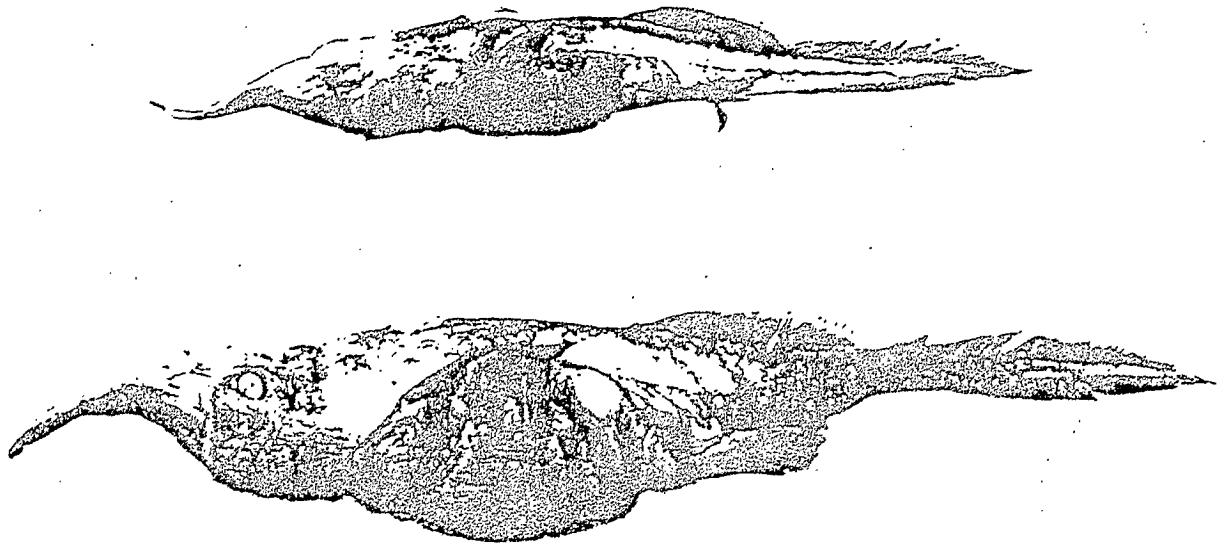
Table 1 : Measurements of the Harriotta specimens (in % of SL; values of strongly bent or injured places in parentheses)

	H. raleighana ISH 88/65		ZMB 22623	MCZ 37614	MCZ 37026	*H. haeckeli* ZMB 22592	ZMB 22591	ZMUB 5256	USNM 35520
TL (in mm)	(704)	826	(650)	201	126	650	496	265	(163)
SL (to end D_2, in mm)	514	502	475	194	81	461	351	174	(68,7)
Height (centre D_1 - D_2)	20,0	20,1	20,4	(18,0)	19,1	22,1	17,6	16,2	—
Head	46,3	46,7	43,3	30,2	29,0	42,3	45,6	47,2	(36,3)
Snout	34,2	35,1	34,4	20,7	19,2	31,7	34,2	35,6	(19,5)
Eye	6,6	5,8	5,7	4,3	4,8	4,0	3,8	4,0	4,7
Interorbital space	6,4	5,7	(4,6)	6,7	7,5	8,7	7,4	(7,5)	10,2
Snout - gill opening	10,5	10,9	9,5	12,5	17,3	8,7	8,5	9,8	10,3
Spine	20,5	20,1	(18,7)	20,9	22,3	(6,6)	9,1	12,6	21,5
D_1 - length	14,9	17,1	16,0	16,7	18,3	7,2	6,6	6,9	8,1
D_2 - length	37,2	36,4	35,8	42,9	42,6	27,1	27,1	27,6	28,2
D_1 begin - D_2 begin	18,1	18,9	20,4	21,0	22,0	27,3	22,8	21,5	27,1
Upper caudal - length	(28,2)	32,3	(28,4)	35,6	(18,5)	37,7	41,0	42,8	34,2
Lower caudal - length	(37,8)	51,4	(36,2)	50,0	(27,2)	32,1	39,3	(39,1)	30,7
Upper caudal - height	1,6	1,7	1,8	1,2	0,4	3,1	4,0	4,0	3,2
Lower caudal - height	5,0	5,8	5,7	2,7	1,1	2,7	2,5	2,8	4,1
Snout - D_1	51,6	48,2	48,0	37,0	37,5	47,4	52,4	52,3	(41,1)
Snout - D_2	67,1	68,1	68,4	58,7	58,1	73,0	74,4	73,0	(68,7)
Snout - P	48,7	46,2	46,3	35,7	(34,2)	44,9	47,0	50,0	—
Snout - V	71,2	77,7	76,2	68,3	(71,6)	79,6	77,8	78,2	—
P - V (dorsal insertion)	(31,4)	(33,8)	32,4	36,6	40,8	36,4	32,2	28,7	—
V - lower caudal	27,2	23,9	25,3	31,3	30,9	30,0	23,6	31,6	—

from the body ventrally, anterior to the 1st dorsal, and terminate before or below (smaller paratype) the origin of the 2nd dorsal; therefore, they do not reach the base of the ventral fins. Ventrals relatively longer than in H. raleighana, arising at the end of the first fourth part of the 2nd dorsal and ending at about the centre between the cloaca and the origin of the lower caudal (since the latter originates relatively far forward in the holotype, the ventral fins appear to be longer).

Skin bare and very smooth. Dermal denticles on either side of the dorsal line in USNM 35 520 (according to the illustration in GOODE & BEAN 1895) and ZMUB 3 256 (in parentheses): on the head 3 (3-5), anterior to the 2nd dorsal 6 (4), between 2nd dorsal and upper caudal 6 (4). In the smaller paratype, they can only just be recognized with the unaided eye (KOEFOED 1927 has evidently overlooked them), and in larger specimens they can only be felt by a stroke of the hand from backward to forward.

Mucous canals in head never undulate, their individual courses as follows: aural canal approximately from the centre of the rear margin of eye to the first dorsal almost straight. The cranial - anteriorly rostral - canals on either side approach each other gradually, proceeding from their origins; they do not show a conspicuous narrowing between the eyes. Occipital canal very short, running laterally; at the beginning of the lateral line it forms an obtuse angle with the orbital canal. Orbital canal steeply ventrate; point of departure of the jugular canal not recognizable in any of the investigated animals and its further course towards the region of the gill openings indicated by pores. The branching off of the oral + angular canals posterior to the eye. Separation of the two canals below the posterior margin of eye. At a



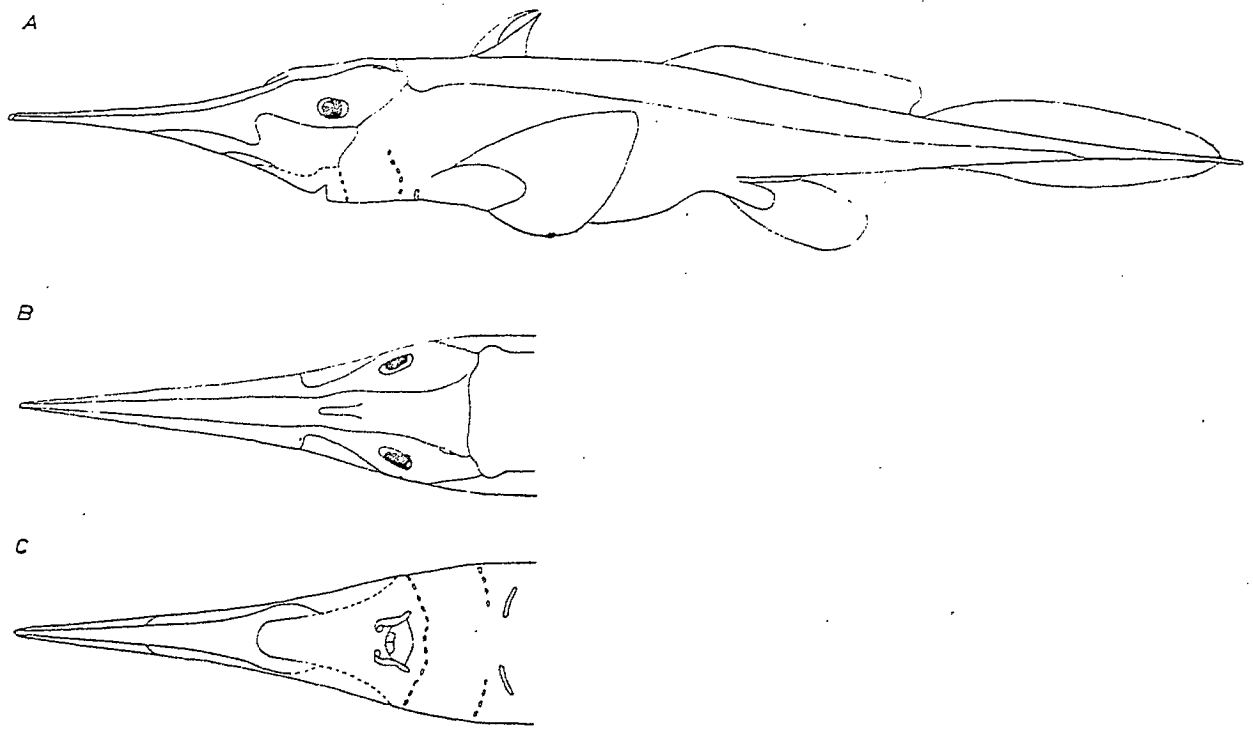
F i g . 3 . Harriotta haeckeli sp. n. On top: Holotype ZMB 22 591; below: Paratype ZMB 22 592, 1/4 natural size. (Phot. V. KOPSKE)

distance exceeding the diameter of the eye, the suborbital canal forms a conspicuous sigmoid curve in front of the eye; at the centre between the nasal loop and the tip of the snout, the suborbital canal joins the subrostral canal. The nasal canals enclose a wide rounded surface which tapers in the forward direction. The subrostral canals originate on either side approximately at the centre of the distance mouth - nasal loop; they gradually approach each other forward of the tip of the nasal loop. The underside of the snout displays numerous mucous pores.

Because the occipital canal has a lateral course, the branching off of the lateral line from the head canals lies far forward of the spine and forward of the gill openings. The lateral line begins with a sloping movement (more conspicuous than that in Rh. atlantica), runs a straight course in the upper half of the body to the centre of the caudal fin and, thereafter, along the base of the lower caudal to the tip of the tail.

The frontal tenaculum and ventral tenacula (pockets about as long as (213
the gill openings) are still undeveloped in the males; in the holotype, however, the frontal tenaculum is already indicated by a projection of the skin. Claspers still short, in the holotype half the length of the ventrals, in the smaller paratype one fourth thereof. Small warts (knobs) characterizing the (21
stiffened and upward curved tip of the snout in mature males of H. raleighana are not recognizable in either of the two still sexually immature specimens. In the female both oviducts and ovaries are developed, and the right ovary contains an egg of a 3 cm size. Nidamental organs large, quadrangular, their posterior corners extending into laciniform tips.

The smallest syntype of H. raleighana (USNM 35 520, inadvertently designated as 25 520 in the original description) has to be assigned to H. haeckeli



F i g . 4 . Harriotta haeckeli sp. n., Holotype ZMB 22 591; A: lateral view (1/3 natural size); B, C : head dorsally and ventrally, nomenclature of mucous canals

see F i g . 2

because of the following characters (according to GOODE & BEAN 1895a, plus additional data and the measurements of the specimen; Dr W.R. TAYLOR has remarked in this respect that the specimen is very poorly preserved; the snout is damaged, numerous parts have detached themselves from the body and similar features; among them also the lack of most of the dermal denticles): (1) The tail is shorter than the body and there is no long tail filament; (2) the snout tapers evenly from the mouth forward; (3) the spine does not reach the origin of the 2nd dorsal and its rear margins are smooth; (4) the first and 2nd dorsals are short, both fins separated by an interspace much longer than the base of the first dorsal; (5) both caudals approximately of the same height, the lower one originating posterior to the upper one; (6) pectorals rounded; (7) mucous canals in the head: cranial canals on the cranial crown not undulate; direction of the orbital canal and the branching off of the angular + oral canals posterior to the eye; the nasal loop tapers in the forward direction, and in front of it the subrostral canals gradually approach each other; (8) slope at the beginning of the lateral line. Apart from the general juvenile characters, the obviously newly hatched animal displays only one striking divergence in comparison with the older types: the spine is proportionally much longer and scarcely curved as yet. The paratypeZMUB 3256 illustrates the shortening and more distinct curving of the spine with growing age; its spine is somewhat more clearly curved than represented in the illustration of KOEFOED (1927).

Colour of the deep-frozen fish chocolate brown, underside darker, paired fins blue-black; spine whitish.

Maximum size unknown.

So far captured only in depths of 1813 - 2603 m. Jointly with H.haeckeli

the following were caught at station 343 on the "E. HAECKEL:" Bathysaurus agassizi GOODE & BEAN, Eurypharynx pelecanoides VAILLANT, Lycodonus mirabilis GOODE & BEAN and Alepocephalids. MURRAY & HJORT mention a similar deep sea fauna for the "M. SARS," station 35 (1912, p. 76).

Distribution: North Atlantic (NE of the USA, at the southern outlet of Davis Strait and at Canary Islands).

D I S C U S S I O N

BIGELOW & SCHROEDER (1954) point out that the courses of the mucous head canals vary so strongly in H. raleighana and Rh. atlantica (not only in different individuals but also in both sides of the body) that they cannot claim to be of a taxonomic significance. The variability of the elements on either side of a fish, concerning both the cranial bones and the otoliths, usually remains within limits not exceeding the specific differences. This holds also true for the case at hand, as noted already by HOLT & BYRNE (1910) who state that the (216)
courses of the mucous canals were relatively stable in eight specimens of Hydrolagus mirabilis (COLLETT) of various sizes. When comparing the Harriotta illustrations of the literature with the specimens investigated by the author, it results that, despite irregularities here and there (for example in the holotype of H. haeckeli), a precise determination is possible even in very young individuals, if all the characters are considered. For this reason, BULLIS & CARPENTER (1966) figure the undersides of the snout of the thus far known Atlantic species.

When the two Harriotta species are compared (the most important differentiating characters have been summarized in T a b l e 2), it is striking

Table 2. Characters of the two *Harriotta* species

	H. raleighana	H. haeckeli
Body	smaller than tail	larger than tail
Caudal filament	long	very short
Eye	large	small
Interorbital space	flat, narrow	arched, wide
First dorsal	long, high	very short, low
Spine	long, straight; rear margins serrate	short and curved, rear margins smooth
Interspace 1st to 2nd dorsal	always smaller than base of 1st dorsal	much greater than base of first dorsal
Lower caudal fin	longer and much higher than upper caudal fin	shorter and as high as upper caudal fin
Suborbital canal in front of the eye	insignificant elevation	S-shaped curve
Front part of nasal loop	widened	pointed
Beginning of lateral line	arched	sloping

that some proportional dimensions do not change during the individual development of H. haeckeli, while, in H. raleighana the same proportions undergo modifications; thus the short caudal filament, the caudal fins of a nearly equal height and the sigmoid curve of the suborbital canal. Together with the slope of the lateral line at its beginning, we find these same characters in the Chimaeridae which, most certainly, share ancestors with the Rhinochimaeridae. The persistence of these features in H. haeckeli might indicate that this species ought to be regarded as the original and H. raleighana as a derived form. The extraordinarily short and curved spine in H. haeckeli should be valued as a secondary character, because in juvenile animals its shape and length resembles the spines of the other Rhinochimaeridae.

The phylogenetic relationships of the three Rhinochimaeroid genera are unknown. The presence of an anal fin and a relatively short snout as well as the lack of secondary sexual characters in Neoharriotta would point to primordial characters. Compact dental plates with grinding ridges (Neoharriotta, Harriotta) are common among the Chimaeriformes in a general way, but the shape and structure of the jaws in Rhinochimaera are unique within the order and must be regarded as a special adaptation to a mode of life unknown to us; DEAN (1906) has already refuted the opinion of GARMAN (1901) that the jaws of Rhinochimaera should be regarded as primary. An amalgamation of one (GARMAN 1911) or of both Rhinochimaera species (SCHNACKENBECK 1929, 1931) with Harriotta is not admissible under any circumstances. (217

H. haeckeli was captured in very great depths in all of the three localities, separated by huge distances. This might justify an assumption that the biosphere of this species lies deeper than that of H. raleighana. Information obtained from the Rostock colleagues states that all of the 23 Rhinochimaerae

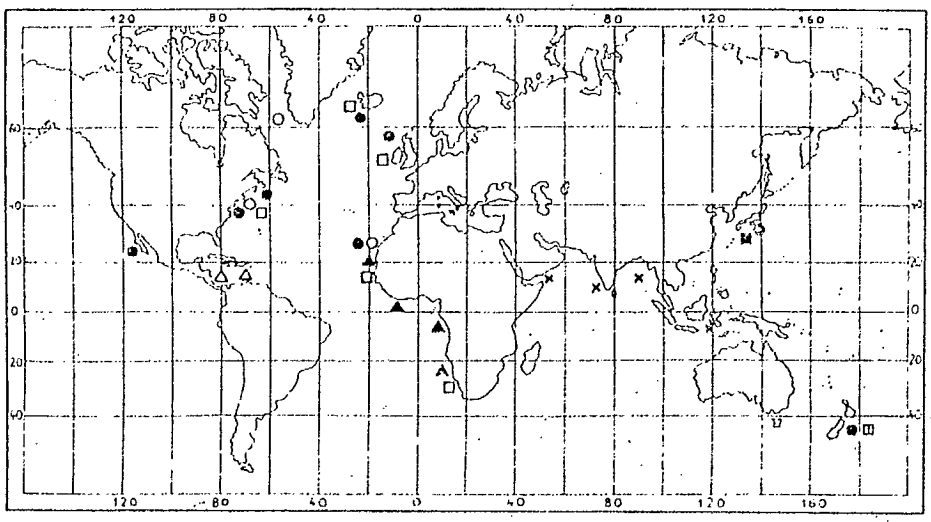


Abb. 5. Verbreitung der Rhinochimaeridae
• *H. raleighana* (Literatur s. S. 206)
○ *H. haeckeli* (Literatur s. S. 210)
▲ *N. pinnata* (SCHNAKENBECK 1929, POLL 1951, BARNARD 1952, RODRIGUEZ-RODA 1961, SMITH 1965, BULLIS and CARPENTER 1966, KREFFT 1968, „HAECKEL" St. 234/68)
△ *N. carri* (BULLIS and CARPENTER 1966)
■ *Rh. pacifica* (MITSUKURI 1895, GARMAN 1904, DEAN 1904)
□ *Rh. athantica* (HOLT and BYRNE 1909, BIGELOW and SCHROEDER 1954, KREFFT 1966, 1967, „HAECKEL" 1965, PENRITH 1969, JÓNSSON 1969, MAURIN et BONNET 1970)
▣ *Rh.* sp. (IWAI et al. 1970)
· Funde von Eikapseln im Indischen Ozean (ALCOCK 1891, SMITH 1912, SEWELL 1912, NORMAN 1939)

F i g . 5 . Dispersion of the Rhinochimaeridae

Finds of egg cases in the Indian Ocean

of the "E. HAECKEL," station 343/70, belong to one species; this fact as well as the captures reported by BIGELOW & SCHROEDER (1954) and IWAI et al. (1970) would suggest that the Rhinochimaeridae are not rare at all. Most recent reports prove furthermore that the areas of dispersion of the Rhinochimaeroid species are more extended than known heretofore (see F i g . 5).

Several reports in the literature tell of egg cases of the Rhinochimaeridae. They are of a typical shape; the approximately fusiform, somewhat flattened egg chamber is elongated into a long stem. At the two longitudinal margins, they display wide flaps with numerous parallel folds arranged crosswise (in Callorhyncus, according to DEAN 1906 and POLL, 1951, these folds proceed (218

radially from the egg chamber; the specimen mentioned by SCHNACKENBECK 1929 as N. pinnata belongs also to this group). Since up to now almost exclusively empty egg cases have been found (the specimen figured by DEAN in 1906, Fig. 19, evidently contains an undeveloped egg; the embryo described by SEWELL in 1912 as Rhinochimaera sp. does not as yet allow a determination of the genus), specific identifications appear questionable for the following reasons: only the specimens of egg cases assigned to Neoharriotta (BULLIS & CARPENTER 1966; POLL 1951; KREFFT 1968, figured in BRUUN 1950, Fig. 14; here, the egg case shown on top totally equals the illustration in POLL, while the lower one is not quite the same) originate from localities where, up to now, no other species of Rhinochimaeridae have been ascertained. The other finds, assigned in the given cases to the species having become known as the first ones in the corresponding area are unjustified because, subsequently, more species, mostly belonging to the other genus have been captured in all cases in the same waters. The elongate forms with a narrow stem pictured by DEAN (1904; 1906, Fig. 23), HOLT & BYRNE (1910, Pl. 4, Fig. 5, pictured again in SCHNACKENBECK 1931), KOEFOED (1927, Fig. 8) and probably also ALCOCK (1891) (the stem is relatively wider in Neoharriotta), surely belong to one genus. The somewhat wider specimens, more strongly constricted in the upper part of the case, shown in DEAN (1906, Fig.19), HOLT & BYRNE (1910, p. 4, Fig. 4, shown again in SCHNACKENBECK 1931), BIGELOW & SCHROEDER (1953, Fig. 126) and KOEFOED (1927, Fig. 7) diverge somewhat from the above; the last-named specimen seems to be shorter than the three other ones and, moreover, the number is lower of its cross-wise folds. The specific identification will be possible only subsequent to cases having been found with embryos ready to hatch, or females with fully developed cases. The remark in DEAN (1904, p. 18) that the oviduct of a Rh. pacifica contained "a small portion of a lateral flap of an

egg case" cannot be accepted as a proof that the egg cases he describes belong to this species, because, in all of the three genera, the lateral flaps are developed in the same manner and, in Japan, Harriotta occurs also besides Rhinochimaera.

So far, no Rhinochimaera are known from the Indian Ocean, although four egg cases have been found in different localities; they represent at least two species (in ALCOCK 1891, about 70 crosswise folds, according to the figure; in SEWELL 1912, according to the text, 48-50). ALCOCK has des-cribed the specimen from the Bay of Bengal as Callorhynchus ? sp., GARMAN (1899) designated it as Callorhyncys indicus; DEAN (1906) carries it partly as Rhinochimaera indica (p. 6, Table A; p. 29, Table C; p. 36, Fig. 20), partly as Harriotta indica (p. 30, Table E; p. 37). NORMAN (1939) mentions a second egg case as H. (?) indica from the Gulf of Aden; the specimens are mentioned again in MISRA (1947) and FOWLER (1956). For the reason explained above, it is not justified at the present time to establish a species on the exclusive basis of an egg case. If it is confirmed that the two discovered specimens belong to Harriotta, it is, to judge by the extensive dispersion of H. raleighana, quite possible that the species will also be encountered in the Indian Ocean.

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Zusammenfassung

Die Gattung *Harriotta* GOODE and BEAN, 1895, wird neu definiert, gegen *Rhinochimaera* abgegrenzt und mit ihren beiden Arten, *H. raleighana* und *H. haeckeli* sp. n., beschrieben; zwei juvenile Exemplare von *H. raleighana* (GOODE and BEAN, 1895; KOEFOED, 1927) gehören der neuen Art an. Die Untersuchung ergab ferner, daß juvenile Rhinochimaeridae nur in wenigen, bei allen Genera konstanten Merkmalen von adulten Tieren abweichen. Trotz individueller Variabilität ist der Verlauf der Schleimkanäle artspezifisch. Nach der neueren Literatur sind die Rhinochimaeridae weiter verbreitet und wesentlich häufiger, als man es vermutete. Abschließend wird diskutiert, daß es bis jetzt nicht möglich ist, die in ihrer Form deutlich verschiedenen Eikapseln von *Harriotta* und *Rhinochimaera* den Gattungen zuzuordnen, weil noch keine bestimmbaren Embryonen bekannt sind und alle Fundstücke aus Gebieten stammen, in denen mehrere Arten vorkommen.

SUMMARY

The genus Harriotta GOODE & BEAN 1895 is redefined, is set apart from Rhinochimaera and is described with its two species H. raleighana and H. haeckeli n. sp.; two juvenile specimens of H. raleighana (GOODE & BEAN 1895; KOEFOED 1927) belong to this new species. The investigation establishes furthermore that juvenile Rhinochimaeridae diverge from adult animals in but few characters, constant in all genera. Despite individual variations, the courses of the head canals are species-specific. To judge by the more recent literature, the Rhinochimaeridae are more widely distributed and considerably more frequent than thus far assumed. As a conclusion, the author of the paper postulates that, up to now, an attribution of egg cases - although they distinctly differ in their shapes - either to Harriotta or Rhinochimaera is impossible, because no identifiable embryos are known as yet and all the localities where egg cases have been found belong to areas having yielded several species.

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TRANSLATED TITLES

1. Some new fish species from near Iceland.
2. Fishes from the northwest coast of Africa (campaigns of the "THALASSA" 1962 and 1968).
3. Fishes and the aquatic living world.
4. Fishes from the campaigns of Prince Albert I of Monaco.
5. Contributing data to the anatomy and developmental history of vertebrates. I.
6. Some marine fishes from SW Africa.

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