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Notes on some Pteropods from the North Atlantic

by

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A number of samples collected by the Scotia and Explorer Expeditions in 1950 in the North Atlantic were found among undetermined material left by Dr. J. J. TESCH after his death in 1954. Some interesting specimens in these samples seem to justify their publication. My grateful acknowledgements are tendered to Dr. J. H. FRASER of the Marine Laboratory at Aberdeen, for so kindly giving me full information concerning the samples. The author is also very much indebted to Dr. C. O. VAN REGTEREN ALTENA who lent the material of both expeditions, which is part of the collection of the Leiden Museum.

Table I gives an enumeration of the species met with and the data concerning the stations. In Fig. 1 the stations are given together with surface currents.

The species are discussed below in systematical order.

Limacina helicoides JEFFREYS, 1877

This species was represented by two specimens, both from bathypelagic hauls (1500 m depth), which proves once more that this species is exclusively bathypelagic, found, in this area, only in layers deeper than 800 metres. Only one of the specimens still had its shell. The shell as well as the anatomy of the specimens proved to be so similar to both the descriptions of *Limacina helicoides* and of *Thilea procera* STREBEL, 1908 that I fully agree with the opinion of TESCH (1946) that both species are synonymous. One specimen was a pregnant female with a large number of eggs in the uterus. Three of these contained completely developed young animals. The embryonic shell of these were provided with about 15 spiral rows of small points. These spiral rows of punctation are also found on the adult shell (TESCH, 1946 and 1948). The second animal was not as full grown as the female mentioned and measured only half its size, its sex was still dubious.

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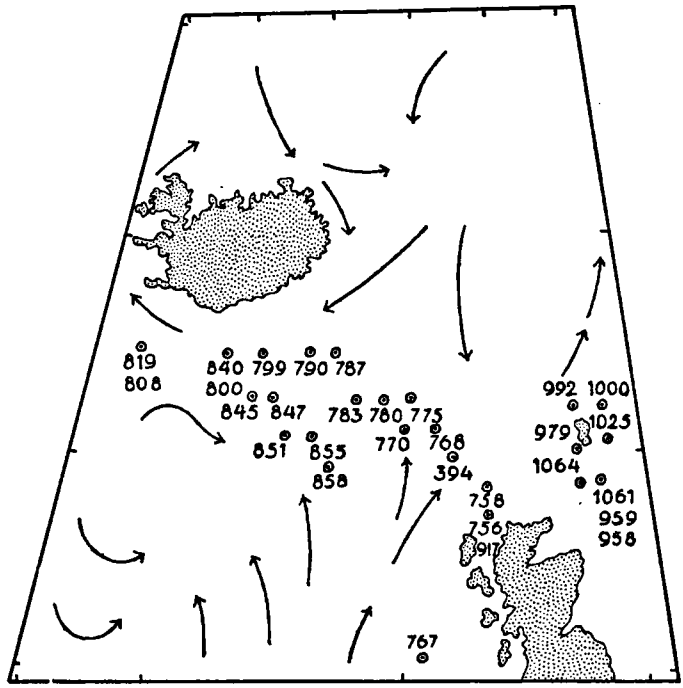


FIG. 1. Sketch map of the area investigated, with stations and surface currents.

Clio pyramidata LINNAEUS, 1767 forma *pyramidata* LINNAEUS, 1767

Only a small number (7) of this forma was collected at two stations, though the forma is very common in the area investigated. The forma *pyramidata* is typical for the North Atlantic and its distribution ranges as far north as 70°N (V. D. SPOEL, 1962).

Clio pyramidata LINNAEUS, 1767 forma *lanceolata* (LESUEUR, 1813)

The nine specimens from station 847 perhaps indicate that here we meet the influence of a northward current of warm water. The forma *lanceolata* is not normally found so far north.

Diacria trispinosa (LESUEUR, 1821) forma *trispinosa* (LESUEUR, 1821)

The find of this species in station 847 is another indication that this sample was taken in a northward current of warm water. The species is common in tropical and subtropical waters up to 40°N and 40°S. Both last mentioned species, only collected in this sample, and together with *Clione limacina* (PHIPPS, 1774) make it evident that in this area (62°O7 'N 16°O 6'W), in autumn, arctic-boreal and subtropical faunas meet; either near the surface or - as *Diacria trispinosa* forma *trispinosa* was collected from deeper water - in separated deep and surface layers.

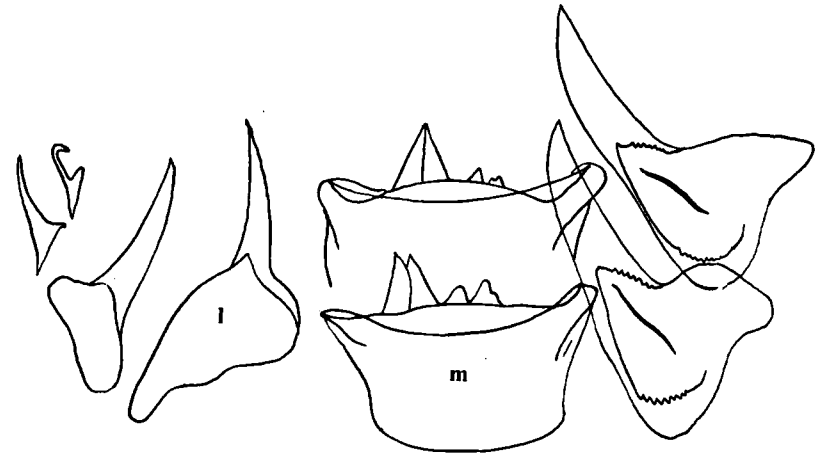
TABLE 1

Station:	Date:	Position North:	Position West:	Depth in m.:	Dur. of Haul in min.:	Species[1]) A	B	C	D	E	F	G	H
S 50/ 394	17- 6-'50	60°12′	07°40′	591	44	—	6	—	—	1	—	1	—
/ 756	4- 9-'50	58°40′	06°10′	100	?	—	—	—	—	—	—	3	—
/ 758	4- 9-'50	59°00′	06°40′	140	16,66	—	—	—	—	—	—	5	—
/ 768	11- 9-'50	61°35′	08°53′	250	?	—	—	—	—	2	—	—	—
/ 770	11- 9-'50	61°48′	09°06′	20	15	—	—	—	—	8	—	—	—
/ 775	11- 9-'50	62°15′	09°30′	550	?	—	—	—	—	4	—	—	—
/ 780	11- 9-'50	62°04′	10°48′	250	15	—	—	—	—	4	—	—	—
/ 783	12- 9-'50	62°39′	12°03′	750	58	—	—	—	—	2	—	—	—
/ 787	12- 9-'50	63°13′	13°40′	20	15	—	—	—	—	—	—	1	—
/ 790	12- 9-'50	63°40′	14°31′	140	11,5	—	—	—	—	—	—	3	—
/ 799	13- 9-'50	63°32′	17°11′	165	11,5	—	—	—	—	—	—	4	—
/ 800	13- 9-'50	63°23′	18°04′	110	8,33	—	—	—	—	—	—	—	2
/ 808	14- 9-'50	63°40′	22°48′	20	15	—	—	—	—	—	—	3	—
/ 819	19- 9-'50	63°52′	22°58′	110	13,5	—	—	—	—	—	—	6	—
/ 840	20- 9-'50	63°00′	18°00′	250	25,5	—	—	—	—	—	—	8	—
/ 845	21- 9-'50	62°33′	17°09′	170	15	—	—	—	—	—	—	2	—
/ 847	21- 9-'50	62°07′	16°06′	1500	90	1	—	9	5	7	—	22	—
/ 851	21- 9-'50	61°40′	15°10′	15	15	—	—	—	—	—	—	2	—
/ 855	21- 9-'50	61°11′	14°14′	1500	145	1	1	—	—	2	—	—	—
/ 858	22- 9-'50	60°45′	13°18′	20-15	?	—	—	—	—	2	—	—	—
/ 917	3-11-'50	58°50′	06°26′	108	11,66	—	—	—	—	—	—	4	1
/ 958	11-11-'50	59°30′	01°29′	20	15	—	—	—	—	—	—	3	—
/ 959	11-11-'50	59°30′	01°29′	75	15	—	—	—	—	—	—	5	1
E 50/ 767	28- 5-'50	56°50′	09°30′	800	110	—	—	—	—	—	1	—	—
/ 979	12-11-'50	60°01′	02°20′	80	?	—	—	—	—	—	—	3	2
/ 992	12-11-'50	61°01′	01°30′	120	15	—	—	—	—	—	—	1?	—
/1000	12-11-'50	61°01′	00°30′	20	15	—	—	—	—	—	—	7	—
/1025	16-11-'50	60°01′	00°20′	100	15	—	—	—	—	—	—	2?	—
/1061	18-11-'50	59°30′	01°20′	65	15	—	—	—	—	—	—	4	—
/1064	18-11-'50	59°30′	02°15′	50	?	—	—	—	—	—	—	4	—
Total number of samples in which the species is represented						2	2	1	1	9	1	21	4
Total number of specimens						2	7	9	5	32	1	93	6

[1]) A = *Limacina helicoides* JEFFREYS, 1877
B = *Clio pyramidata* LINNAEUS, 1767 forma *pyramidata* LINNAEUS, 1767
C = *Clio pyramidata* LINNAEUS, 1767 forma *lanceolata* (LESUEUR, 1813)
D = *Diacria trispinosa* (LESUEUR, 1821) forma *trispinosa* (LESUEUR, 1821)
E = *Pneumodermopsis ciliata* GEGENBAUR, 1855)
F = *Pneumodermopsis michaelsarsi* BONNEVIE, 1813
G = *Clione limacina* PHIPPS, 1774) forma *limacina* (PHIPPS, 1774)
H = *Clione limacina* PHIPPS, 1774) forma *gracilis* (MASSY, 1909)

Pneumodermopsis ciliata (GEGENBAUR, 1855)

This species, rather cosmopolite in distribution, was present in large numbers in the North Atlantic, where it occurs together with *Clione limacina* according to the investigations of the Dana Expedition (TESCH, 1950). The specimens of the Scotia and Explorer Expeditions were all easy to determine, by the typical acetabuliferous arms, the large lateral gill and the radula teeth



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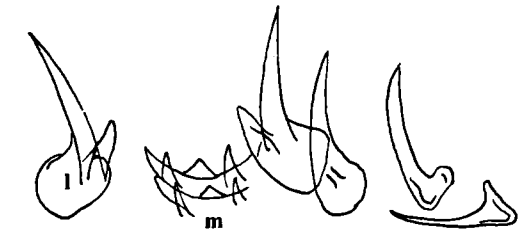

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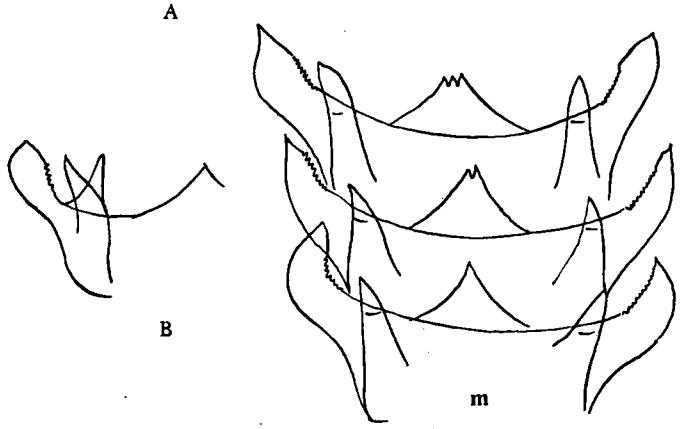

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FIG. 2. *Pneumodermopsis ciliata* (GEGENBAUR, 1855); radula teeth, l. lateral teeth, m. median teeth (x 270 approx.)

FIG. 3A. *Pneumodermopsis michaelsarsi* BONNEVIE, 1913; radula teeth, 1. lateral teeth m. median teeth (x 65 approx.)

3B. Four median teeth of same radula (x 270 approx.)

(Fig. 2). One specimen, however, from station 767, gave me some trouble as the lateral gill was not very well developed and, moreover, TESCH sectioned the animal. The caudal part of the body and some fragments of the cranial part only were recognizable; all these fragments were kept together in one glass tube. One of the fragments of the head still contained the radula, which was recognized as belonging to the following species.

Pneumodermopsis michaelsarsi BONNEVIE, 1913

This species was mentioned by TESCH (1950) in just a footnote that it is closely related to *Pneumodermopsis ciliata.* As TESCH dissected the animal of the Scotia Expedition it was not possible for me to study its anatomy, nor its outer shape; the only fact worth mentioning is that the lateral gill is smaller than in *P.ciliata* and that it is not hanging free from the body, moreover, the median foot-lobe is shorter than in *P. ciliata.*

The radula, however, was available for description and it proved to be so different from that of *P. ciliata* (Fig. 2 and 3) that in my opinion it is absolutely impossible to bring the species to which it belongs (*P. michaelsarsi*) under the synonymy of *P. ciliata.* The median plate of the radula of *P. michaelsarsi* has at its lateral sides cusp-like corners which are slightly dentated. In the middle of the plate a large cusp is found which is sometimes divided at its top into three or two smaller denticles. Between the central cusp and the cusp-like corners a large, somewhat laterally projecting cusp is present, which is found composed of two parts, a posterior and an anterior part. The corners of the median plate of *P. ciliata* are, on the contrary, more rounded and not provided with denticles.

In the two investigated animals of *P. ciliata* the cusps projecting from the median plate were found to be asymetrical; the largest one on the left is composed of two parts and the smaller ones on the right, two or three in number, are no more than tubercles. The lateral teeth in *P. ciliata* are about the same size as the median plate, while the median plate in *P. michaelsarsi* is only half as large as the lateral teeth. Another clear difference is that in *P. michaelsarsi* the lateral teeth are much more slender than in *P. ciliata.* And, moreover, these lateral teeth are dentated at their base and middle in the last mentioned species. The most characteristic difference between the radula of both species is that in *P. michaelsarsi* the median plate, half as large as the lateral teeth, is provided with two cusps near the corners of the plate, whereas in *P. ciliata* the median plate, of the same size as the lateral teeth, is never equipped with these lateral cusps. To me, the differences seem to be of specific value.

The occurrence of *P. ciliata* and *P. michaelsarsi* in the North Atlantic without one specimen of *P. paudicens* (BOAS, 1886) among them is another affirmation of the absence of this species before 1955, as reported by COOPER and FORSYTH (1963).

Clione limacina (PHIPPS, 1774)

C. limacina is frequently met with in the expeditions mentioned as well as

in other expeditions. The occurrence in this area proves, as has been said, that arctic-boreal water is brought here by southward surface currents.

Young specimens smaller than 5 mm with ciliated grooves around the trunk were found in samples taken in September and November 1950. In comparing the description of *Clione kincaidi* AGERSBORG, 1923 and of *Trichocyclus hansineënsis* AGERSBORG, 1923 with the young specimens of *Clione limacina,* it seems very likely that the two former species are synonymous with *C. limacina.* There is no doubt that *C. kincaidi* and *T. hansineënsis* are juvenile stages , which is denied by AGERSBORG (1923) as they are found between July and August, the period in which *Clione* is breeding (LEBOUR, 1931) and as they have one or more ciliated grooves. For a very good description of this juvenile stage of *Clione limacina* I refer to LEBOUR (1931).

Between the specimens of *C. limacina* some very slender ones were observed and they proved to belong to the following species.

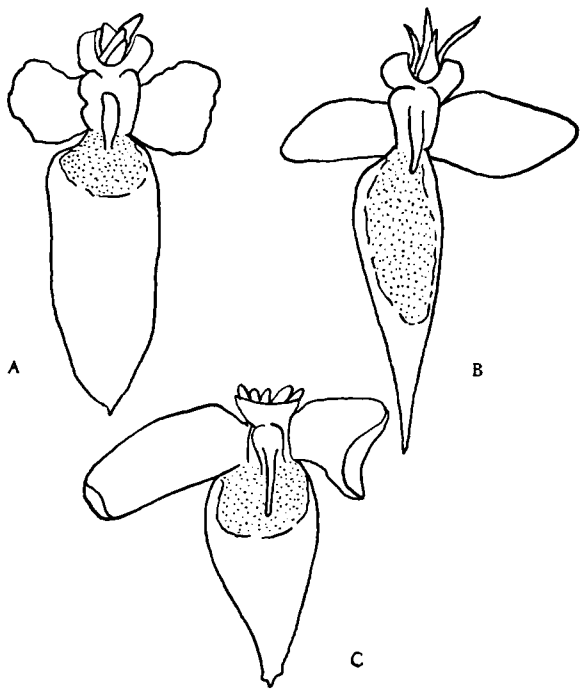

FIG. 4A. *Clione limacina* (PHIPPS, 1774) forma *limacina* (PHIPPS, 1774)
4B. *Clione limacina* (PHIPPS, 1774) forma *gracilis* (MASSY, 1909)
4C. *Clione limacina* (PHIPPS, 1774) forma *minuta* (PRUVOT-FOL, 1926)

Clione gracilis MASSY, 1909

TESCH (1950) is of the opinion that *C. gracilis* is a variety, or a synonym of *C. limacina.* The occurrence, however, of *C. gracilis* as well as *C. limacina* in the same samples makes this rather dubious, the more so as there are, in all probability, no intermediate forms among the 99 animals of both. MASSY

(1909) stated that *C. gracilis* is more slender than *C. limacina,* this difference is also found in the examined material as the average length of *C. gracilis* was 7,75 mm and its average width 1,66 mm, whereas the average length of *C. limacina* was 8,77 mm with an average width of 3,24 mm; all measurements have been obtained from preserved specimens.

Another species which has to be mentioned here is *Clione minuta* PRUVOT-FOL, 1926, occurring also in the area investigated (TESCH, 1950), though not present in the samples of the Scotia and Explorer Expeditions. TESCH still doubted if *C. minuta* is a distinct species, but he believed *minuta* to be more a distinct species than *C. gracilis.* In Fig. 4 a rough sketch is given of the three species to demonstrate the differences in their outer shape. As *minuta* was not represented in the samples of the expeditions mentioned, the differences

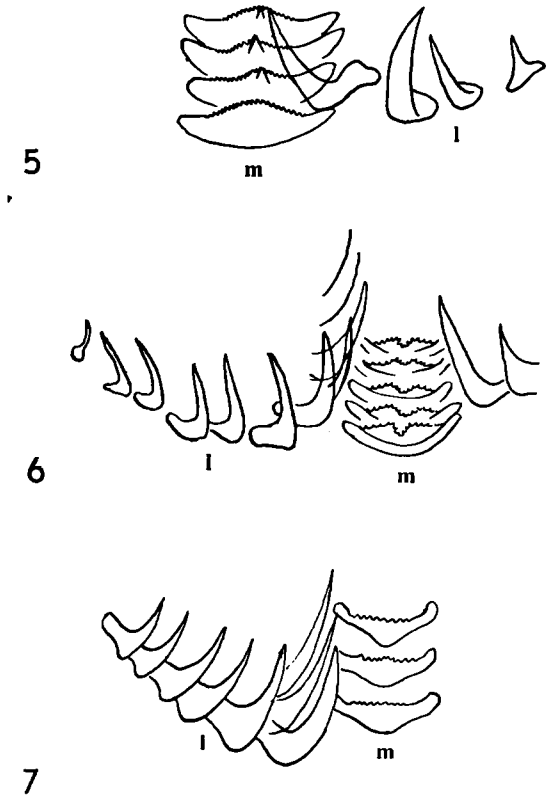

FIG. 5. *Clione limacina* (PHIPPS, 1774) forma *limacina* (PHIPPS, 1774) radula teeth, l. lateral teeth, m. median teeth (x 270 approx.)

FIG. 6. *Clione limacina* (PIPPS, 1774) forma *gracilis* (MASSY, 1909) radula teeth lateral teeth, m. median teeth (x 270 approx.)

FIG. 7. *Clione limacina* (PHIPPS, 1774) forma *minuta* (PRUVOT-FOL, 1926) radula teeth l. lateral teeth, m. median teeth (x 335 approx.)
(After TESCH, 1950)

visible in the preserved animals and their radula (Fig. 5, 6 and 7), given in table II, are only based on my own observations for *C. gracilis* and *C. limacina.*

From table II it is clear that there are differences between the three species. A number of these differences, however, are often said to be discussable as shrinkage may induce deformation of the body and examination of the radula under variable angles may give rise to disputable results. It is well known that *C. limacina* as well as *C. gracilis* change considerably during fixation. Both, however, were distinguishable at first glance, never minding the different fixations of the samples which have induced a shrinkage and contraction of the animals which were not equal in the various samples. During the examination of the radula, special attention was given to the presence of cusps or holes in the anterior rim of the median plate. This, in my opinion, excluded all difficulties caused by examination of the radula under different angles, as the results of the investigation could be only positive or negative.

TABLE II

Clione limacina	*Clione gracilis*	*Clione minuta*
Buccal cones twice as long (1 mm) as wide	Buccal cones more than twice as long (2 mm) as wide	.....
Wings short (±4 mm) and wide	Wings long (±5 mm) and slender	Wings longer than in both other species
Body nearly cylindrical, rounded caudal top	Body slender, pointed caudal top	Body neither slender and pointed as in *gracilis* nor cylindrical as in *limacina*
Visceral mass occupies less than half the body volume	Visceral mass occupies half the body volume	Visceral mass occupies less than half the body volume
Median plate with denticled anterior border, provided with a small but evident cusp, in the anterior rim	Median plate with denticled anterior border not provided with a cusp but with a hole in the central part of the anterior rim	Median plate with a denticled anterior rim without a hole or a cusp in this rim
A line running parallel to the posterior rim of the median plate separating the plate into two parts is not found, in most animals	A line running parallel to the posterior rim of the median plate, separates the plate into two parts	A line running parallel to the posterior rim of the median plate separating the plate into two parts is not found

As I had only a small number of *C. gracilis* at my disposal it was impossible to compare enough material to come to a well based opinion whether or not both species are definite. The only admissable proposition is to separate *C. limacina, C. gracilis* and *C. minuta.*

Clione antarctica SMITH, 1902, not yet mentioned above, is another distinctly separable member of this group of species. *C. limacina* and *C. antarctica* are often considered as subspecies of one species. *C. antarctica* is easily recognizable by the opening left between the median and dorsal buccal cones, the absence of the median plate except for the hindmost rows of the radula, the visceral mass reaching farther caudally than half the length of the body and the larval rings of cilia still present in the larger animals, as long as 15 mm.

The status of *Clione limacina* (PHIPPS, 1774) forma *meridionalis* PRUVOT-FOL, 1926 needs no discussion as PRUVOT-FOL properly separated it only as a variety.

As far as I know, no sufficient data are available concerning distribution and interbreeding of the species mentioned, except, perhaps, for *C. antarctica* which is only found in the antarctic waters, so that it seems preferable to give them the following systematic status:

Clione limacina	(PHIPPS,	1774)	forma	*limacina*	(PHIPPS, 1774)
„	„	„	„	*minuta*	(PRUVOT-FOL, 1926)
„	„	„	„	*gracilis*	(MASSY, 1909)
„	„	„	„	*antarctica*	(SMITH, 1902)
„	„	„	„	*meridionalis*	(PRUVOT-FOL, 1926)

Summarizing, it can be said that the Scotia and Explorer Expeditions only collected rich samples at station 394, 847 and 855 (more than two species each). The sample of station 847 proves that the arctic-boreal and subtropical species meet each other in this area. The presence of *Pneumodermopsis michaelsarsi* in sample 767, recognized by its radula, was a welcome affirmation that this species has, at least, a radula completely different from that of *Pneumodermopsis ciliata,* which is against the opinion of TESCH (1950) that both are synonymous. The presence of *Clione limacina* and *Clione gracilis* together in the same samples, and the differences in shape of their bodies and radulae are an indication that both are separable. It is, therefore, proposed to accept *C. gracilis* as a form of *C. limacina,* and not as a distinct species as nothing is known about exact distribution and interbreeding of *C. limacina* and *C. gracilis.*

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