

ATLANTIDE REPORT

No. 12

*Scientific Results
of the Danish Expedition to the Coasts
of Tropical West Africa
1945-1946*

PUBLISHED ON BEHALF OF

THE UNIVERSITY
COPENHAGEN

AND

THE BRITISH MUSEUM
(NATURAL HISTORY)
LONDON

BY

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SCANDINAVIAN SCIENCE PRESS LTD.

PRINTED BY
NORDLUNDES BOGTRYKKERI
KØBENHAVN 1977

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Thaliacea from off the Coasts of Tropical West Africa

by

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INTRODUCTORY REMARKS

During the years 1945–46, the "Atlantide" Expedition undertook investigations in the coastal waters off Tropical West Africa. About 170 stations were explored, and plankton was collected at 37 stations (see Table I and BRUUN 1950). Thaliacea occurred at 32 stations situated in the intertropical region, between the Canary Islands and St Paul de Loanda, Angola (27°N and 8°S), mostly within the 1000 m line. The cruise took place during the warm season. Plankton was collected late in the afternoon, generally about sunset, or by night. The "Galathea" (1950) took a few hauls along the West African coast during the short cold season and Thaliacea were collected at eight stations between Dakar and North Angola (see Table II and WOLFF 1964). All stations are beyond the 1000 m line. During these two expeditions observations on salinity, temperature and depth were made at some of the stations only.

Prior to these two expeditions the Thaliacea of the West African region were poorly known. In the meantime the results of more recent investigations were published, and the present paper supplements the papers of GODEAUX 1962, 1969 and GODEAUX & GOFFINET 1969.

Both collections contain Doliolidae, Pyrosomatidae and Salpidae. But owing to the size of the meshes of the nets generally used, the smaller specimens escaped and only the larger were retained. Therefore, small forms like phorozoids and gonozoids of *Doliolina mülleri* and the larvae of the various species are usually missing. Larvae of Doliolidae are present in the few Nansen net samples. Generally, the material was preserved in neutral 4% formalin in seawater; unfortunately, many specimens were not in good condition, which sometimes made identification difficult.

The Doliolidae were identified according to NEUMANN (1906, 1913 a, c) and GARSTANG (1933), the Pyrosomatidae according to NEUMANN (1913 a, b, c) and METCALF & HOPKINS (1919), the Salpidae according to METCALF (1918), THOMPSON (1948), and GODEAUX & GOFFINET (1968).

Abbreviations: larva: L.; oozoid: O. Z.; phorozoid: P. Z.; gonozoid: G. Z.; blastozoid: B. Z.

TABLE I: Atlantide Stations

Stations		Depth to bottom	Temp. (surface) (° C)	Stations		Depth to bottom	Temp. (surface) (° C)
n°	position			n°	position		
25	26°57'N-17°10'W	>2000 m	-	85	5°37'N-0°38'E	50 m	-
26	25°34'N-18°24'W	>2000 m	22.5	86	5°45'N-0°38'E	15 m	23.6
27	24°30'N-19°11'W	>3000 m	22.6	91	5°44'N-1°02'E	-	-
28	22°59'N-20°30'W	>3000 m	23.4	92	6°01'N-2°21'E	-	27.6
30	19°54'N-22°42'W	±4000 m	-	97	6°06'N-3°41'E	100 m	28.1
33	17°11'N-24°52'W	-	24.9	101	5°59'N-4°36'E	17 m	29.6
50	7°16'N-13°29'W	90-350 m	28.1	115	4°01'N-7°23'E	-	28.8
52	6°30'N-11°21'W	97 m	-	119	2°55'N-9°21'E	-	29.1
53a	off Port Marshall	12 m	-	122a	1°29'S-8°50'E	-	-
53b	off Port Marshall	12 m	27.7	122b	1°29'S-8°50'E	-	-
53c	off Port Marshall	12 m	-	132	6°46'S-12°23'E	-	29
62	4°16'N-8°18'W	-	-	134	7°35'S-12°46'E	-	-
67	4°29'N-6°41'W	-	25.9	138	7°40'S-7°56'E	-	28
76	4°50'N-1°17'W	-	24.4	139	1°30'N-10°10'W	-	-
77	Accra	tidal zone	-	140	4°10'N-12°18'W	-	28.7
78	5°32'N-0°08.5'W	tidal zone	-	144	8°22'N-14°08'W	-	-
82	5°27'N-0°07'E	>600 m	22.1	150	10°22'N-16°34'W	-	-
83	5°29'N-0°20'E	-	22.2				

Sts 53a, 78, 82, 85, 86, and 101 operated at daytime, St. 139 at sunrise, the remaining ones at night.

All surface hauls except St. 62 (400 m wire out) and St. 82 (1700 m wire out).

Duration of haul 30-60 minutes, except Sts 140, 150 (15 min.), and 77 (180 min.).

Salinity at St. 82: 35.71‰; St. 86: 35.60‰; St. 115: 29.52‰; St. 132: 24.33‰; St. 134: 32.54‰.

All stations stramin net 100 cm in diameter, except Sts 62, 82, 85, and 101: stramin net 200 cm in diameter, Sts 78 and 86: Nansen net, and St. 122a: dip net used by light.

TABLE II: Galathea Stations

Stations		Depth to bottom (m)	Estimated collecting depth - (m)	Duration of haul
n°	position			
8	16°58'2"N-18°16'W	3.150	600-200	60 min.
17	7°17'N-13°28'W	1.290	1000-0	?
24	3°54'N-8°22'W	3.280	2500-0	?
29	1°19'N-5°48'W	4.900	sea surface	120 min.
30	1°N-5°45'W	5.230	1500-0	127 min.
65	2°17'S-8°10'E	2.840	2250-0	80 min.
66	4°00'S-8°25'E	4.120	2700-0	?
98a	8°52'S-11°09'E	2.810	?	?
98b	8°52'S-11°09'E	2.810	15	12 h.

All stations at daytime, except Sts 8 and 29 at night.

Gear: Stramin net (200 cm in diameter): Sts 8, 66, and 98b. Sledge trawl: St. 17 (1 m wide); Sts 24, 30, and 65 (3 m wide). Dip net: Sts 29 (used by light), and 98a.

ANALYSIS OF THE COLLECTIONS

DOLIOLIDAE

Doliolina mülleri (Krohn, 1852)

Material:

"Atlantide" Sts 53, 62, 85, 115, and 138 (nine old nurses devoid of their viscera).

"Galathea" St. 66 (nurses together with nurses of *Dolioletta gegenbauri* (Uljanin, 1884)).

Of the 180 specimens, about one third belongs to the former species (estimated from counting a subsample). Owing to the difficult identification of the young nurses, the results are not quite reliable.

D. mülleri and the closely related *D. krohni* (Herdman, 1888) were previously collected in the area (GODEAUX 1962). Records: Fig. 1.

Doliolina sp.

Material:

"Atlantide" St. 82 (4 fairly large old nurses, 18, 18, 18, and 10 mm long); St. 150 (1 nurse).

It is a puzzling form with very narrow muscles, widely separated from each other, and not covering the cardiopericard and the stolon. The nerve ganglion is close to the fifth muscle, and always has two anterior nerves; the statocyst is absent. A fifth, fairly similar nurse was obtained at St. 150, above the 200 m line.

Such nurses have been found in different areas, e.g., the North Atlantic (GODEAUX 1973a), eastern Mediterranean (GODEAUX 1973b). According to GARSTANG (1933), specimens from the North Atlantic and the Antarctic Ocean might belong to the species *D. intermedium* (Neumann, 1911) and *D. resistibile* (Neumann, 1913), respectively. The nurses found in the tropical Indian Ocean probably were nurses of *D. indicum* (Neumann, 1906) (GODEAUX & MEURICE 1975) due to the "Nächstverwandtschaft" of the three species, as admitted by NEUMANN (1913c). GARSTANG considered the two former species cold water (or deep water) species; this seems to be the case with the four specimens from St. 82, where the net was towed with a 1700 m wire at an estimated depth of about 600 m. Therefore, the four nurses could be assigned to the species *D. intermedium*.

As regards the last specimen, caught right below the surface (St. 150) where the temperature was approximately 20°C, the relationship cannot be decided since *D. indicum* was never reported from the Atlantic; it should, however, be borne in mind that also the young nurse of the rare *Dolioloides rarum* Grobben, 1882 possesses narrow muscles (NEUMANN 1913c). This species was recorded by the

Tiefsee-Expedition (NEUMANN 1906) from a station near the equator. Due to our lack of knowledge of the biological cycle of *D. rarum* it can only be suggested that the nurse from St. 150 might belong to this species. Records: Fig. 1.

***Doliolum nationalis* Borgert, 1893**

Material:

"Atlantide" St. 53 a, b (more than 500 P.Z. and 14 G.Z.); Sts 76, 77, 78, 82, 83, and 85 (a few P.Z.).

D. nationalis is known as a neritic species locally abundant (see St. 53), and is able to subsist under severe temperature and salinity conditions. It was often caught off the West African coast (GODEAUX 1962). It is noteworthy that no more specimens were obtained, which may be due to the large meshes of the net used. Records: Fig. 1.

***Doliolum denticulatum* Quoy & Gaimard, 1835**

Material:

"Atlantide", L. and O.Z.: Sts 78 (14 L., 1 O.Z.), 85 (2 O.Z.), and 86 (80 L., 14 O.Z.). Nurses: Sts 67 and 82 (ab. 100 spec. each); Sts 53 (34 spec.), 76, 78, 83, 91, 92, 101 (35 spec.), 139, and 140 (total: 88 animals). P.Z. and G.Z.: Sts 27, 28, 33, 139, and 140 (total: 23 animals: 12 P.Z., 11 G.Z.).

The species was found throughout the area of investigation and generally at stations where *D. nationalis* did not occur.

It is yet not possible to separate the larvae of the two species of the genus *Doliolum* (BRACONNOT 1974), therefore some larvae, and even some oozoids, may belong to *D. nationalis* rather than to *D. denticulatum* (e.g., at Sts 78 and 85). *D. denticulatum*, less neritic than *D. nationalis*, is widespread in the intertropical belt of the three oceans and is more common in the Mediterranean (GODEAUX 1962, 1972, 1973a, b). Records: Fig. 1.

***Dolioletta gegenbauri* (Uljanin, 1884)**

and its closely related subspecies *D. gegenbauri tritonis* (Herdman, 1888)

Material:

"Atlantide", L and fullgrown O.Z.: Sts 53 a, 77, 78, 85, and 91. Nurses: Sts 53 b, 62, 67, 76, 77, 78, 85, 91, 97, 115, 122, 132, 134, 138, 139, 140, 144, 150 (less than 20 each), 101 (68 spec.), and 82 (300 spec.). P.Z. and G.Z.: Sts 33, 53 b, 67, 76, 101, 115, and 144 (less than 50 spec.), 53 a, 91, 122, and 134 (less than

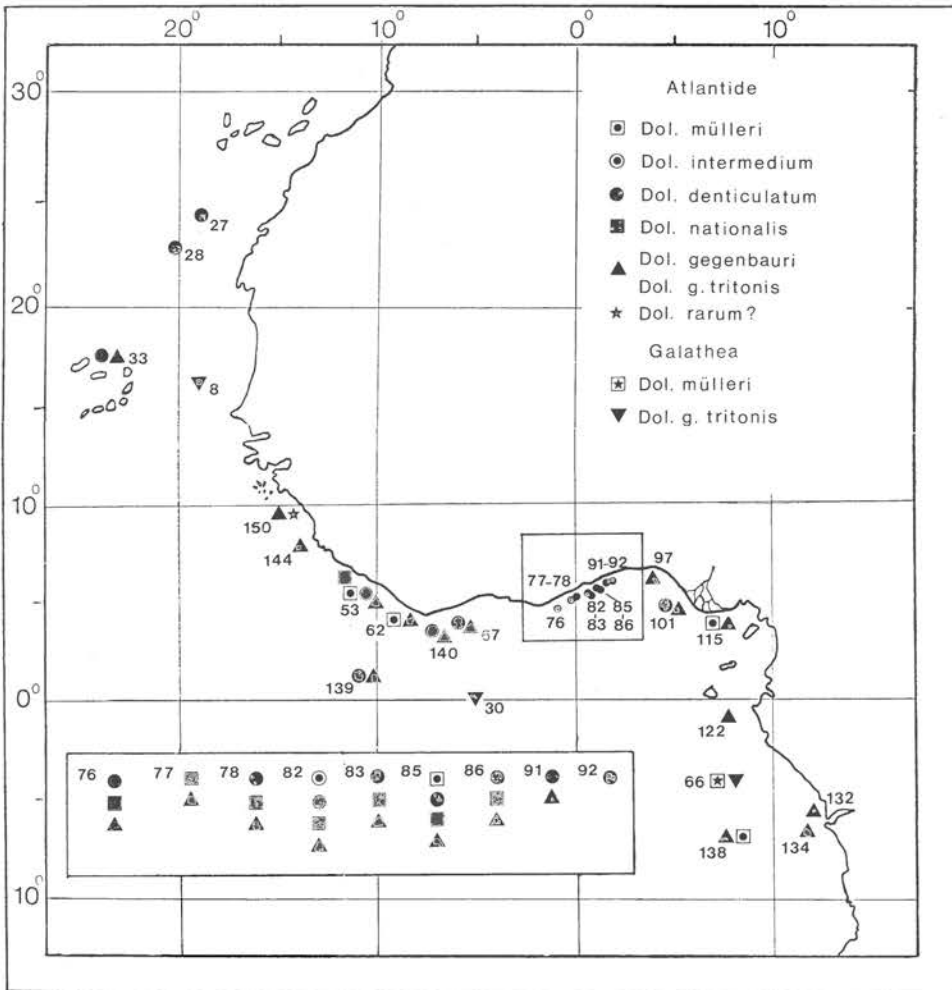


Fig. 1. Stations where Doliolids were collected. Inset: species caught at Sts 76 to 92.

100 spec.), 77, 78, 83, 132, and 150 (several hundred each), 82 (450 P.Z., 350 G.Z.), 85 (over 3500 B.Z.), and 86 (over 2500 B.Z.).

"Galathea", Nurses: Sts 8 (40 spec.), 30 (a single animal), and 66 (ab. 100 spec.). G.Z.: St. 8 (a single individual).

Owing to the poor condition of the B.Z., both taxa are considered together; *D. tritonis* is probably a little more common. The catches were made offshore rather than above the shelf. Their abundance at some places indicates the presence of swarms. With the exception of the small trophozooids, all the forms of the biological cycle of the species are contained in the Atlantic collection.

D. gegenbauri and *D. gegenbauri tritonis* are usually observed both in the tropical Atlantic, off the western British coasts (in summer), and throughout the Mediterranean. In the ocean south of the Gulf of Guinea, off Congo and Angola, more than 1000 B.Z. were collected by the Belgian Expedition 1948–1949 (GODEAUX 1962). Records: Fig. 1.

PYROSOMATIDAE

Pyrosoms were obtained only at three "Atlantide" stations and at six "Galathea" stations. All the colonies belong to the genus *Pyrosoma*.

Pyrosoma aherniosum Seeliger, 1895

Material:

"Atlantide" Sts 62 and 138 (2 young colonies, with only 3 and 2 rows of zooids, respectively).

"Galathea" Sts 8, 66 (12 spec.), 17, 24, 30, 65 (43 spec. taken in sledge trawl during ascent, probably between 1000 m depth and the surface).

The shape of the B.Z. is characteristic: Buccal siphon long and truncate, cloacal cavity highly reduced, endostyle almost straight, lining a rectangular pharyngeal cavity, ripe testis overlapping the intestinal loop, and either an ovule or a tetrazooid colony in the right peripharyngeal chamber. The colony is ready to reproduce as soon as it has 3 or 4 rows of fullgrown zooids. Therefore populations are able to grow very fast, which explains why the species is common in the Atlantic, especially in the meso- or infrapelagic layers, most catches made between 725 m and 60 m. About 11 damaged colonies, caught at "Galathea" St. 24, belonging to the same genus have not been identified. The adult zooids bear about 30 stigmata and 18 gill bars, they are more rounded than the zooids of *P. aherniosum* and evidently protandrous. Tetrazooid colonies are absent. Records: Fig. 2.

Pyrosoma atlanticum Peron, 1804

Material:

"Atlantide" St. 25 (in the open sea): a 16 cm long, 3.5 cm broad colony, bearing tetrazooid embryos. Record: Fig. 2.

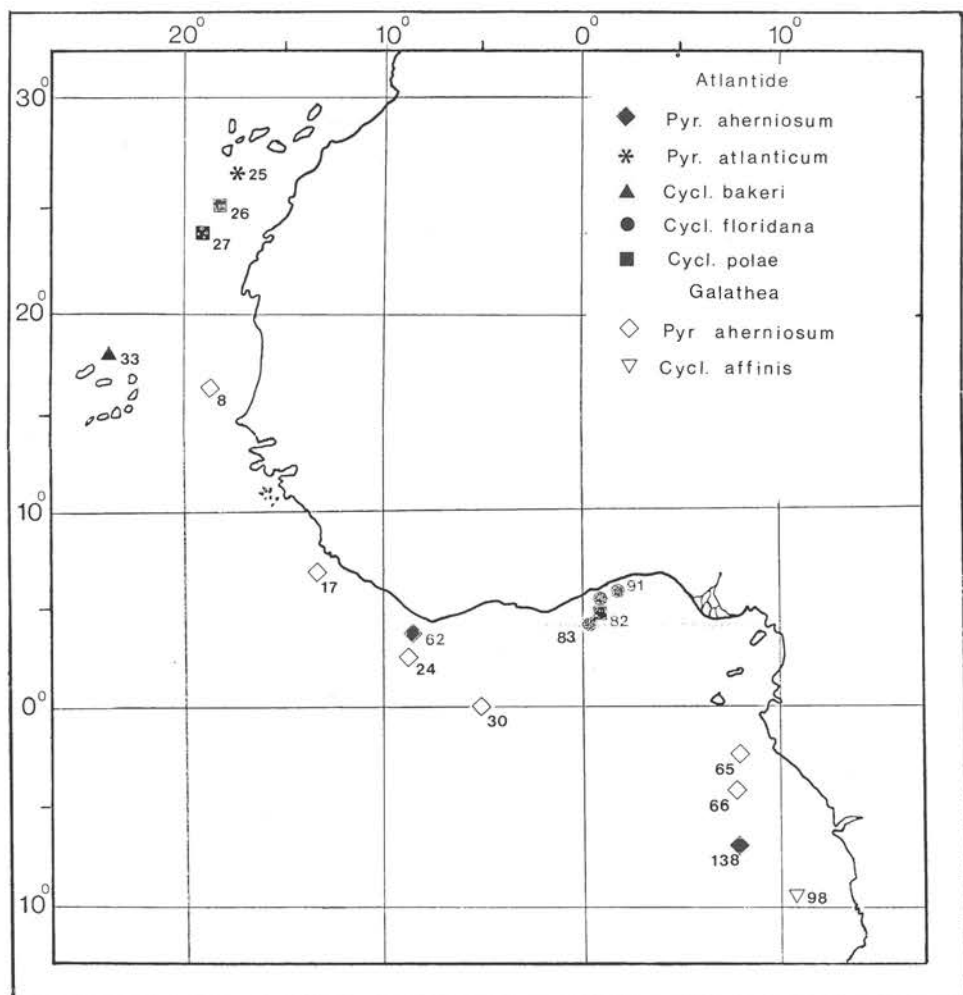


Fig. 2. Stations where Pyrosoms and Cyclosalps were collected.

SALPIDAE

Most of the Salpidae are common species, including 4 species of Cyclosalpiniae and 11 species of Salpiniae.

CYCLOSALPINAE

Cyclosalpa polae (Sigl, 1912)

Material:

"Atlantide" Sts 26, 27 (a single B.Z. at each station), and 82 (14 B.Z. and empty tunics of O.Z. with stolon present).

It is sometimes considered a subspecies of *C. pinnata* (Forskål, 1775), with dorsal connections of muscles I and II and III and IV. *C. polae* is a very common species with numerous records from the Atlantic and the Mediterranean. It prefers high salinities ($S \geq 35\text{‰}$), but is less exacting as regards temperature (GODEAUX & GOFFINET 1968; GODEAUX 1973a). Records: Fig. 2.

***Cyclosalpa affinis* (Chamisso, 1819)**

Material:

"Galathea" St. 98 (a single O.Z.).

The O.Z. has 112 muscle fibres; it carries well-developed B.Z. The specimen was caught in the subsurface layer. The species has a worldwide distribution, occurring in the warm regions of the three oceans. It was previously recorded from the waters off Tropical West Africa (GODEAUX & GOFFINET 1968). Record: Fig. 2.

***Cyclosalpa floridana* Apstein, 1894**

Material:

"Atlantide" Sts 82, 83, 91.

The specimens from Sts 82 and 83 are in poor condition. They were identified by carefully examining the stolon and the most advanced embryos. The sample from St. 91 was well preserved. It contained 13 O.Z. with a well-developed stolon and 6 B.Z. having an identifiable embryo. The species was previously collected in the equatorial Atlantic Ocean (GODEAUX 1962, GODEAUX & GOFFINET 1968). Records: Fig. 2.

***Cyclosalpa bakeri* Ritter, 1905**

Material:

"Atlantide" St. 33 (2 B.Z.).

The two B.Z. are tied together, and one carries an embryo. The specimens were caught below the surface at a temperature of 24.9° C. The species is fairly rare, but widely distributed. It has been captured as far north as off Scotland at about 59°N (FRASER 1949), and off the west coast of South Africa (DE DECKER 1973). Record: Fig. 2.

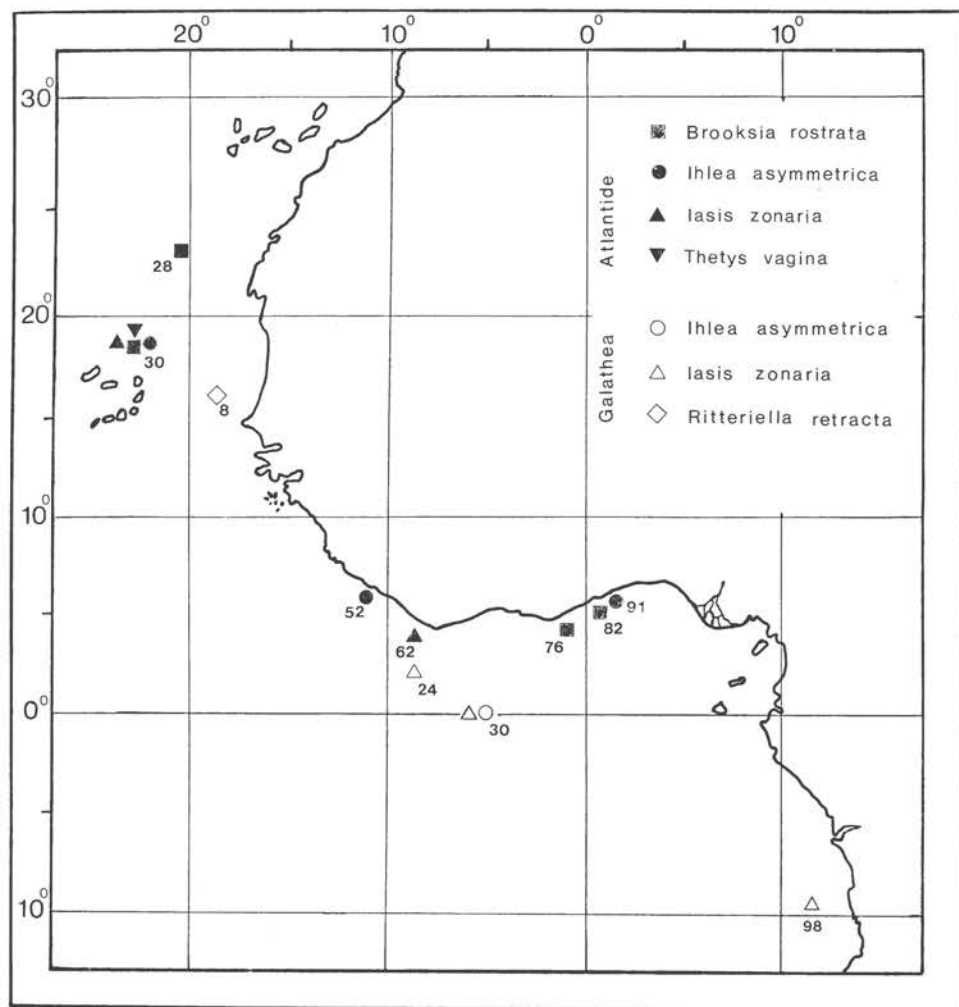


Fig. 3. Stations where Salps were collected.

SALPINAE

Brooksia rostrata (Traustedt, 1893)

Material:

"Atlantide" Sts 28, 30, 76, 82.

The material collected consists of 6 O.Z. and 2 B.Z. The O.Z. is easily identified by its long proboscis protruding below the buccal siphon and a typical dorsal arrangement of the intermediate muscle and the first three body muscles (v. SOEST

1975a). The B.Z. is very small and usually strongly contracted; it is not easily distinguished from the corresponding form of *Thalia democratica*. The relatively few number of stations, from which the B.Z. of *B. rostrata* were recorded, may be due to the difficulty in separating the two forms. *B. rostrata* is a very eurythermic and euryhaline species occurring in warm waters, from the Gulf of Elat to the Moçambique Channel (GODEAUX 1972, 1973b). THOMPSON (1948) states the species in the Australian waters to be epiplanktonic, living in the upper 50 m, with a temperature range from 15.4°C to 24.5°C. In Tropical Atlantic waters the species was previously found between 130 m (14.2°C) and 10 m (27.7°C) (GODEAUX & GOFFINET 1968). Its presence off the European coasts seems to be exceptional (GODEAUX 1973a). Records: Fig. 3.

***Ihlea asymmetrica* Fowler, 1896**

Ihlea punctata (Forskål, 1775), see BRACONNOT 1973.

Material:

"Atlantide" Sts 30 (1 O.Z.), 52 (21 O.Z.), 91 (2 O.Z.).

"Galathea" St. 30 (2 O.Z.).

The specimens are in poor condition, but are easily recognizable by the three pairs of longitudinal muscles, running along the flanks of the animal. The species is widely distributed and occasionally reaches the British Isles (FRASER 1949); it was recently found in the Indian Ocean (GODEAUX 1972), and in the eastern Mediterranean (GODEAUX 1973b). It is locally common off the coast of Central Africa. The species seems to be restricted to the northern hemisphere. Records: Fig. 3.

***Salpa maxima* Forskål, 1775**

Material:

"Galathea" Sts 8 (11 B.Z.), 98 (1 O.Z.).

The B.Z. from St. 8 carry recognizable embryos. They were collected between 300 m depth and the surface. The O.Z. was collected just below the surface. The species is widely distributed in the three oceans, including the Mediterranean and the Red Sea. With a few exceptions the catches are generally scarce (GODEAUX 1972, 1973a). Records: Fig. 4.

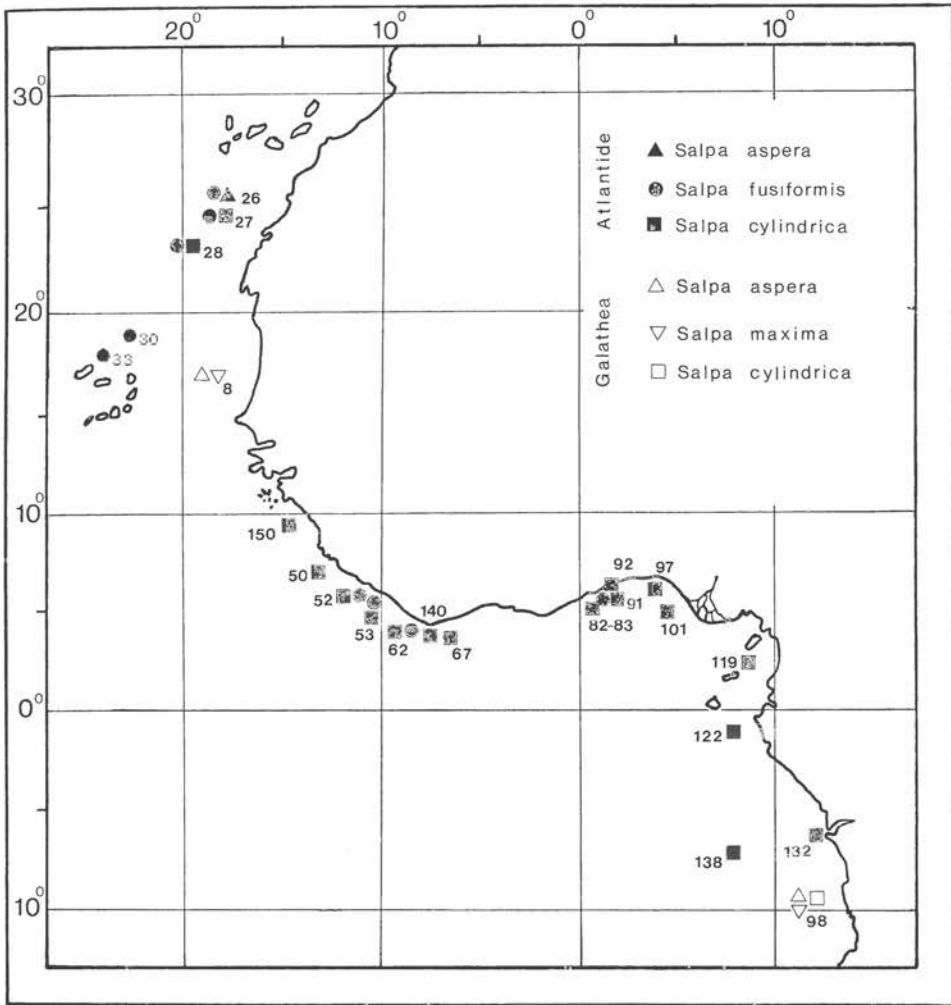


Fig. 4. Stations where the various species of the genus *Salpa* were collected.

Salpa fusiformis Cuvier, 1804

Material:

"Atlantide" Sts 26 (2 P.S., 1 P.G.), 27 (13 P.G.), 28 (34 P.G.), 30 (4 P.G.), 33 (15 P.G.), 52 (31 P.G.), 53c (1 P.S.), 62 (2 P.S., 91 P.G.) and 91 (1 P.S.).

Except at three stations only small numbers were found. Records: Fig. 4.

Salpa aspera Foxton, 1961

Material:

"Atlantide" St. 26 (1 O.Z.).

"Galathea" Sts 8 (3 O.Z., 4 B.Z.), 98.

The O.Z. is identified by the spiny test and the lack of contact on the dorsal side between muscles VIII and IX which are running parallel. In the B.Z. the average number of fibres of the trunk muscles is 105 on the left side and 103 on the right side; the lateral connections between muscles IV and V are loose (FOXTON 1961). The species was considered a southern form, but recent observations proved that it is able to penetrate into the northern hemisphere up to 45° N (GODEAUX 1973a). Records: Fig. 4.

Salpa cylindrica Cuvier, 1804

Material:

"Atlantide" Sts 27 (2 P.S., 34 P.G.), 28 (20 P.G.), 50 (202 P.S., 1243 P.G.), 52 (25 P.S., 403 P.G.), 53 (1 P.G.), 62 (43 P.S., 230 P.G.), 67 (372 P.S., numerous B.Z.), 82 (24 P.S., 30 P.G.), 83 (6 P.S., 30 P.G.), 91 (3 P.S., 107 P.G.), 92 (3 P.S., 3 P.G.), 97 (1 P.S.), 101 (12 P.S., 4 P.G.), 119 (86 P.S., 17 P.G.), 122 (37 P.S., 79 P.G.), 132 (5 P.S., 51 P.G.), 138 (1 P.G.), 140 (1 P.S.), and 150 (1 P.G.).

"Galathea" Sts 98a (27 P.S.), 98b (3 P.S., 1 P.G.).

It is a very common warm water species, widespread throughout the whole intertropical belt. The species is the second most common of the area explored, obtained at 19 "Atlantide" stations throughout the whole area investigated. The catches are locally abundant. Records: Fig. 4.

Iasis zonaria (Pallas, 1774)

Material:

"Atlantide" Sts 30 (1 P.S., 4 P.G.), 62 (8 P.G.).

"Galathea" Sts 24 (1 chain of 7 B.Z.), 30 (empty tunics of both forms), 98 (1 P.S., 5 P.G.).

The species is protected by a rigid tunic, adhering to the whole ectoderm, an exceptional feature in the Salpidae. *I. zonaria* is widespread but fairly rare, each catch usually yielding few animals. In the Atlantic it has been sporadically recorded, from 60° N to 40° S. In the tropical zone it was taken at a depth of 880 m upwards (GODEAUX & GOFFINET 1968, GODEAUX 1973a). Obviously, the species seems able to tolerate fairly low temperatures. Records: Fig. 3.

Thalia democratica (Forskål, 1775)

Material:

"Atlantide" Sts 27 (35 P.S.), 50 (empty tunics of P.S.), 52 (1 P.S.), 53a (42 P.S.), 53b (26 P.S.), 53c (3 P.S.), 62 (12 P.S.), 67 (120 P.S.), 76 (14 P.S.), 77 (11 P.S.), 82 (300 P.S.), 83 (146 P.S.), 85 (400 P.S.), 86 (1 P.S.), 91 (9 P.S.), 92 (1 P.S.), 101 (14 P.S.), 119 (1 P.S.), 122 (6 P.S.), 138 (1 P.S.), and 150 (4 P.S.).
 "Galathea" St. 8 (1 O.Z.).

The O.Z. of this species were identified by the simple atrial palps and the number of muscle fibres. This species is the most frequent of the collection being obtained at 19 stations. Usually only few specimens were obtained except at a few neritic stations where more than 100 O.Z. were obtained. The small catch by the "Galathea" is probably due to inadequate sampling methods.

For a long time the genus *Thalia* Blumenbach, 1810 was considered monospecific with the species *T. democratica* and a subspecies *T. d. orientalis* Tokioka, 1937, but recently VAN SOEST (1973) split it into five taxa, based on the oozoids: in addition to *T. democratica* and *T. d. orientalis* (pro partem), three species were recognized: *T. rhomboides* (Quoy & Gaimard, 1827), alias *T. orientalis* Tokioka, 1937 (pro partem), *T. cicar* van Soest, 1973 and *T. sibogae* van Soest, 1973. Records: Fig. 5.

Thalia orientalis Tokioka, 1937

Material:

"Atlantide" Sts 26 (2 O.Z.), 101 (some spec. in poor condition).

The two O.Z. from St. 26 have two bifid atrial palps, a tunic with longitudinal rows of spines and few muscle fibres.

The species occurs in tropical waters (VAN SOEST 1973) and even in the eastern Mediterranean (GODEAUX 1974). Records: Fig. 5.

Thalia cicar van Soest, 1973

Material:

"Atlantide" Sts 33 (1 P.S.), 67 (17 tunics), 91 (70 P.S.), 101 (P.S.), 139 (7 P.S.).

In this species the atrial palps are bifid, the number of muscle fibres is smaller than in the other species of *Thalia*, at lateral and posterior processes of the tunic are spiny and almost equally long. *T. cicar* lives in the waters of the intertropical belt (VAN SOEST 1973, GODEAUX 1973b). Records: Fig. 5.

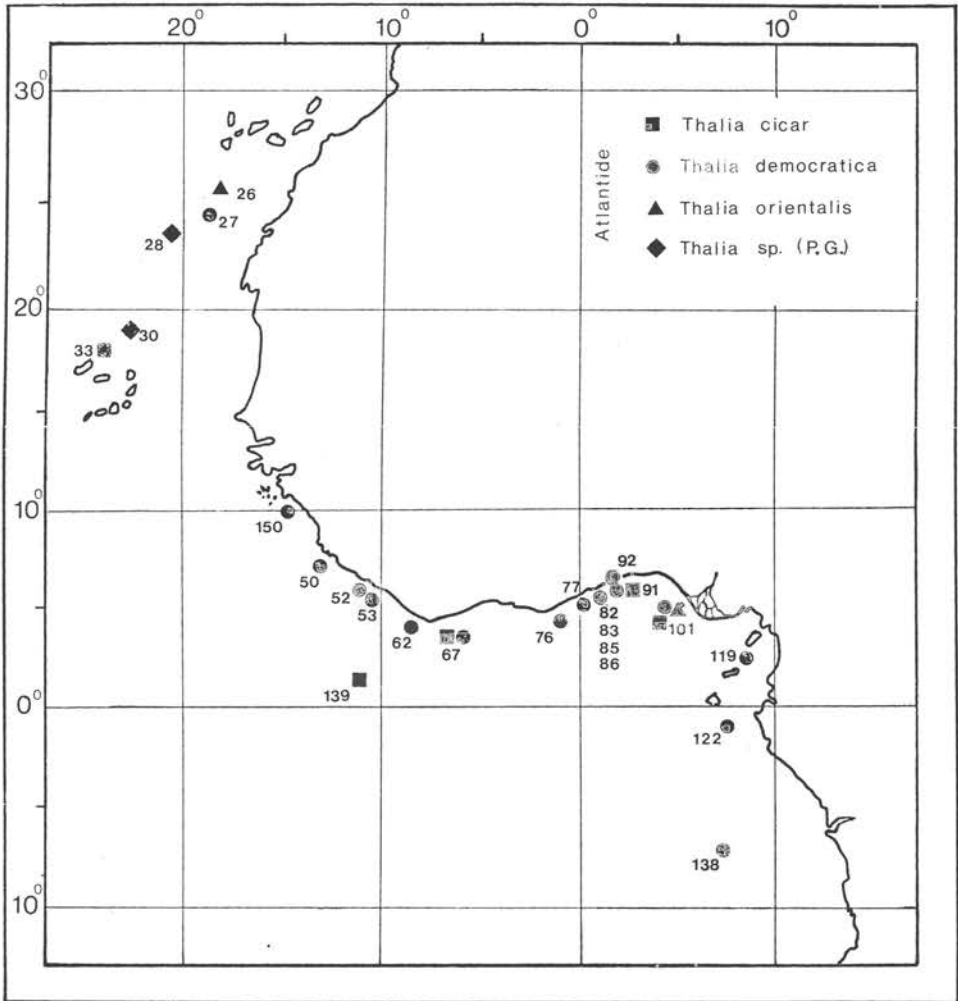


Fig. 5. Stations where the various species of the genus *Thalia* were collected.

Thalia spp. B.Z.

Owing to difficulties in identification of the B.Z. in the species of *Thalia* they have been considered together.

Material:

"Atlantide" Sts 27 (35 spec.), 50 (8 spec.), 52 (5 spec.), 53a (24 spec.), 53b (14 spec.), 62 (12 spec.), 76 (5 spec.), 77 (73 spec.), 82 (10 spec.), 83 (79 spec.), 85 (10 spec.), 92 (1 spec.), 139 (2 spec.), and 150 (2 spec.).

Thetys vagina Tilesius, 1802

Material:

"Atlantide" St. 30 (one large embryo).

The body length without posterior appendages is 11 cm. The eleoblast is always present, although reduced. The species seems to tolerate fairly cold water (THOMPSON 1948). According to recent literature (GODEAUX 1962, GODEAUX & GOFFINET 1968) specimens of *T. vagina*, despite their large size, were locally found in relatively large numbers, e.g., the Congo river mouth, at the border of the continental slope. Record: Fig. 3.

Ritteriella retracta (Ritter, 1906)

Material:

"Galathea" St. 8 (2 O.Z.).

The specimens are symmetrical, having 13 trunk muscles on each side. They were caught between 600 and 200 m depth (mesoplanktonic). Our knowledge of this Salp was recently summarized by MEURICE (1974) and v. SOEST (1974). The species is far from common; the main records are from the intertropical zone. Record: Fig. 3.

CONCLUSIONS AND SUMMARY

The species collected by the two expeditions have all previously been reported from the area. A few rare species known from the area have not been obtained by the two expeditions, e.g., *Ritteriella amboinensis* (Apstein, 1904) and *Traustedtia multitentaculata* (Quoy & Gaimard, 1835), the latter occurring in the open sea from a depth of a few hundred meters to the surface.

Doliolum denticulatum, *Dolioletta gegenbauri tritonis*, *Thalia democratica*, and *Salpa cylindrica* are the only well represented species in the collections. The other species are either scarce or occur at a few stations. The following species occur:

- a) True tropical (stenotherm) species: *Pyrosoma aherniosum*, *Cyclosalpa floridana*, *Brooksia rostrata*, *Salpa cylindrica*, *Thalia cicar*.
- b) Slightly more eurytherm species, reaching somewhat higher latitudes (although remaining in warm waters): *Doliolum denticulatum*, *Pyrosoma atlanticum*, *Cyclosalpa polae*, *Ritteriella retracta*, *Salpa maxima*, *Iasis zonaria*, *Thalia orientalis*, *Thetys vagina*.
- c) Eurytherm species, tolerating lower temperatures and maybe reaching high latitudes, at least during summer (cosmopolitan oceanic or Lusitanian species):

Doliolina mülleri, *Dolioletta gegenbauri tritonis*, *Cyclosalpa bakeri*, *Ihlea asymmetrica*, *Salpa fusiformis*, *Thalia democratica* (FRASER 1961, v. SOEST 1975b).

Salpa aspera, with origin in the southern hemisphere, is able to spread widely up into the three main oceans.

A single cold water form, occurring as nurses caught in deep water, was tentatively identified as *Doliolina intermedium*.

CONCLUSIONS ET RESUMÉ

Les différentes espèces récoltées par les 2 Expéditions sont toutes des espèces capturées par les Expéditions précédentes qui explorèrent la région. Manquent quelques espèces rares, e.g. *Ritteriella amboinensis* (Apstein, 1904) et *Traustedia multitentaculata* (Quoy & Gaimard, 1835), une Salpe observée en haute mer et qui a été récoltée de la surface à quelques centaines de mètres de profondeur.

Doliolum denticulatum, *Dolioletta gegenbauri tritonis*, *Thalia democratica* et *Salpa cylindrica* sont les seules espèces bien représentées dans les collections; les autres espèces ne se rencontrent qu'en petit nombre ou en un nombre réduit de stations.

Les populations de Thaliacés rencontrées par les 2 Expéditions confirment le caractère mélangé des eaux de l'Océan Atlantique tropical.

Sont présentes:

- a) des espèces purement tropicales (sténothermes): *Pyrosoma aherniosum*, *Cyclosalpa floridana*, *Brooksia rostrata*, *Salpa cylindrica*, *Thalia cicar*,
- b) des espèces un peu plus eurythermes, atteignant des latitudes assez hautes (quoique demeurant dans des eaux chaudes): *Doliolum denticulatum*, *Pyrosoma atlanticum*, *Cyclosalpa polae*, *Ritteriella retracta*, *Salpa maxima*, *Iasis zonaria*, *Thalia orientalis*, *Thetys vagina*,
- c) des espèces eurythermes, capables de supporter une température plus basse et d'atteindre de hautes latitudes, au moins durant l'été (espèces océaniques cosmopolites ou lusitaniennes): *Doliolina mülleri*, *Dolioletta gegenbauri tritonis*, *Cyclosalpa bakeri*, *Ihlea asymmetrica*, *Salpa fusiformis*, *Thalia democratica* (FRASER 1961, v. SOEST 1975b).

Salpa aspera, originaire de l'hémisphère austral, s'avance loin dans les Océans atlantique, indien et pacifique.

Une série de nourrices ramenée des eaux froides profondes, pourrait appartenir à l'espèce *Doliolina intermedium*.

The author wishes to express his sincere thanks to Dr. J. Knudsen, Curator (Zoological Museum, University of Copenhagen), for his kindness to supply material and information. The author is much indebted to Miss Ch. Breuer for her technical assistance.

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(Ms received September 11, 1974, revision received March 15, 1975).