

AVIS. — Depuis 1923, les Mémoires publiés par le Musée ne sont plus réunis en Tomes.

Chaque travail, ou partie de travail, recevra un numéro d'ordre. La numérotation prend pour point de départ le 1^{er} fascicule du tome I. — Voir la liste ci-dessous.

BERICHT. — Sedert 1923 worden de door het Museum uitgegeven Verhandelingen niet meer in banden vereenigd.

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MÉMOIRES
DU
MUSÉE ROYAL D'HISTOIRE NATURELLE
DE BELGIQUE

MEMOIRE N° 45

VERHANDELINGEN
VAN HET
KONINKLIJK NATUURHISTORISCH MUSEUM
VAN BELGIË

VERHANDELING N° 45



HYDROMEDUSAE

COLLECTED IN THE SOUTH-WESTERN PART
OF THE NORTHESEA AND IN THE EASTERN PART OF THE CHANNEL
IN 1903-1914

BY

P. L. KRAMP
Zoological Museum, Copenhagen.



BRUXELLES
MUSÉE ROYAL D'HISTOIRE NATURELLE DE BELGIQUE
RUE VAUTIER, 31

1930

Distribué le 15 août 1930.

BRUSSEL
KONINKLIJK NATUURHISTORISCH MUSEUM VAN BELGIË
VAUTIERSTRAAT, 31

1930

Uitgedeeld den 15 Augustus 1930.

HYDROMEDUSAE

COLLECTED IN THE SOUTH-WESTERN PART OF THE NORTH SEA
AND IN THE EASTERN PART OF THE CHANNEL IN 1903-1914

INTRODUCTION

The present paper deals with the regional distribution, seasonal occurrence, and biological features of the Hydromedusae found in the parts of the North Sea and the British Channel, of which the investigation was confided to Belgium as its share in the International Plankton research. The region is limited to the east by a line from the mouth of the river Schelde to Lowestoft in England, to the west by a curved line from Fécamp in France to Newhaven on the south coast of England (see the map, fig. 1). The main part of the material was collected during the quarterly cruises (February, May, August, and November) at a number of fixed stations (indicated by large dots in the map); supplementary collections were made in other localities (the small dots), partly at other seasons. The results of these investigations were published in the International Bulletins; but, as far as the medusae are concerned, only a small part of the material was examined by specialists; the published lists are, therefore, very incomplete. By request of Prof. G. Gilson, late director of the « Musée royal d'Histoire naturelle de Belgique », in which the collections were deposited, I have worked through the extensive material of Hydromedusae collected during the years 1903-1914.

It contains 29 species, one of which is new to science :

Trissocoma brownei n. g., n. sp.

A complete list of the material is given in Table I, comprising dates of capture, position of localities, depths, hydrographical observations, and

number of specimens of the different species captured in each haul. Different appliances were used, and the number of individuals cannot be used for quantitative determinations of any considerable value, but they give some idea of the relative quantities of the various species in different localities and under different conditions. The sizes of the individuals are not given in detail in the present paper, but several of the conclusions, which I have drawn con-

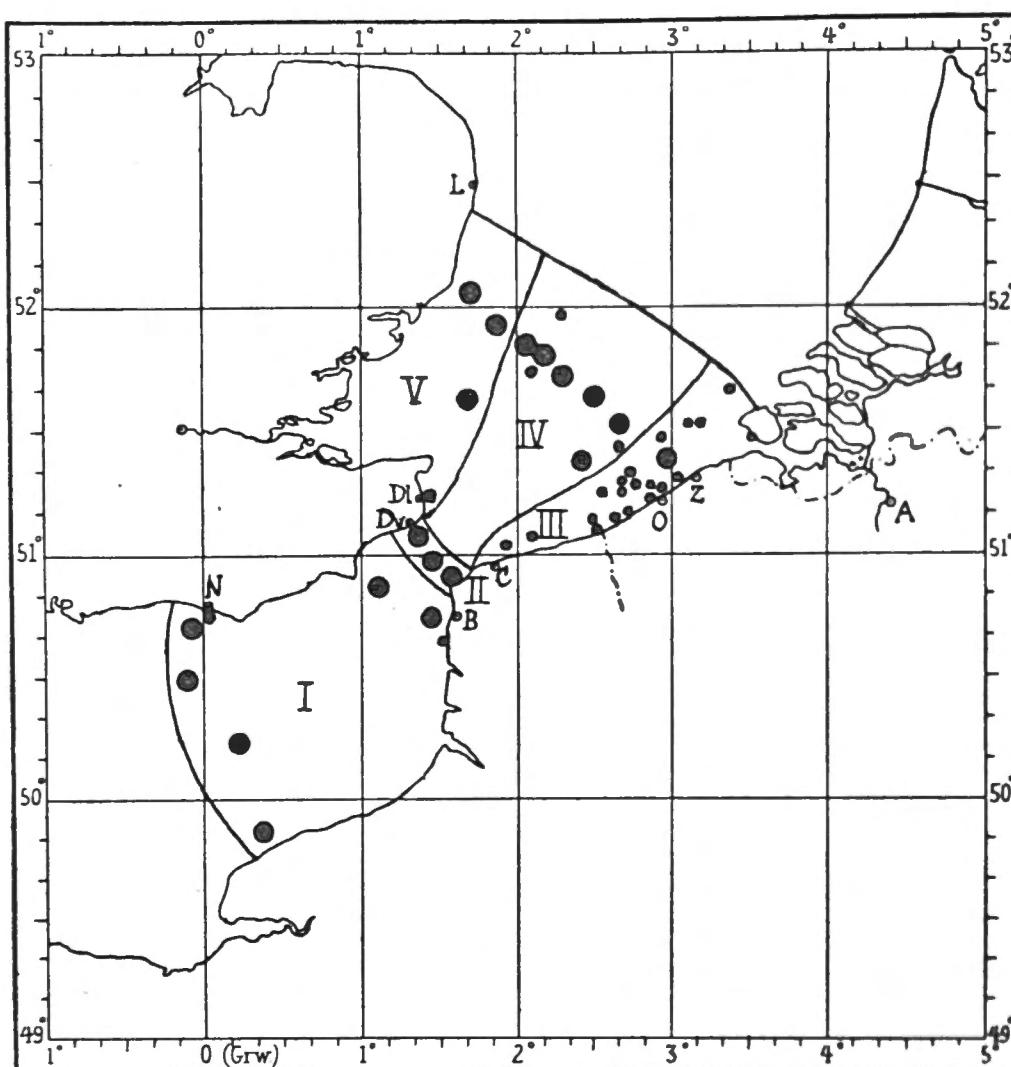


FIG. 1. — The area investigated, with limits of the five sections, I-V.

● International quarterly stations. • Other localities where medusæ were found.

A. Antwerp. B. Boulogne. C. Calais. D_l. Deal. D_v. Dover. L. Lowestoft. N. Newhaven. O. Ostende. Z. Zeebrugge.

cerning the occurrence of the species, are based on measurements of the specimens.

In the lists of localities, which I received from the « Musée royal d'Histoire naturelle de Belgique », information was given on the observations of the surface-water currents; these individual observations are of no great value for the understanding of the occurrence of the medusae, especially here where the

strong tides cause the water masses to move now in one direction, now in another carrying the same organisms to and fro. What counts is the « resulting mean current » for a certain period (see KRAMP, 1927, p. 17), and as to that we have no information in the present instance. The International Hydrographical Bulletins, however, give quarterly information of the distribution of temperature and salinity of the water, showing the extension of the influx of water from the Channel into the North Sea at different times. On the following pages we shall examine how far and in which ways the occurrence of the medusae in the different parts of the area investigated is affected by the variations of the hydrographical conditions.

The area is naturally divided into 5 sections, as follows (see the map, fig. 1) :

SECTION I. — The Channel (International stations B 13-18 and a few supplementary collections).

SECTION II. — The Strait of Dover (stations B 10-12).

SECTION III. — The coastal region from Griz-Nez to the mouth of the Schelde (station B 1 and a considerable number of supplementary collections, especially off the Belgian part of the coast).

SECTION IV. — The mid-water region in the North Sea between the coasts of France-Belgium and England (stations B 2-6 and 9).

SECTION V. — The English coastal region from Dover to Lowestoft (stations B 7, 8, and 9 A, and some supplementary hauls from Deal, Kent).

The sections II-V have been fairly regularly examined at all seasons every year, but the investigations were not always extended into the Channel, section I; in the material examined by me, medusae are, at any rate, only present in 11 samples from section I, collected in November 1905, May and August 1906, and August 1913. The numbers of samples, containing medusae, from each of the five sections are as follows :

Section	I	II	III	IV	V	Total.
Samples. . . .	11	33	56	63	19	182

The division of the area into sections proves very useful, because it helps to obtain a clear view of the distribution of the species within the region investigated. From Table II it is evident that the different species are distributed in various, characteristic ways, and one of our objects is to find out, whether

the differences of distribution correlate with the biological habits of the species and with their dependence on natural conditions. Owing to the fact mentioned above (the five sections not being equally well investigated), the figures in the table may not be supposed to give anything more than a general view, a rough outline, of the distribution, but they certainly give a clear idea of the most essential characteristics, which will be treated in the General Section of the paper.

I am greatly indebted to Prof. G. GILSON for trusting me with the working up of this valuable collection of medusae, which I had seen in the Museum at Brussels during my stay in Belgium 1929. I also wish to thank the present director of the Museum, Dr. V. VAN STRAELEN, for his interest in my work and his kind assistance in answering all my questions and providing me with every kind of desirable information.

Copenhagen in January 1930.

KRAMP, P. L. — HYDROMEDUSAE

SPECIAL SECTION

ANTHOMEDUSAE

Sarsia tubulosa (M. SARS).

HYDROID: *Coryne sarsi* Lovén.

GEOGRAPHICAL DISTRIBUTION AND BIOLOGY: North Atlantic coastal waters from France to the Barents Sea, and from Newport in North America to the northern

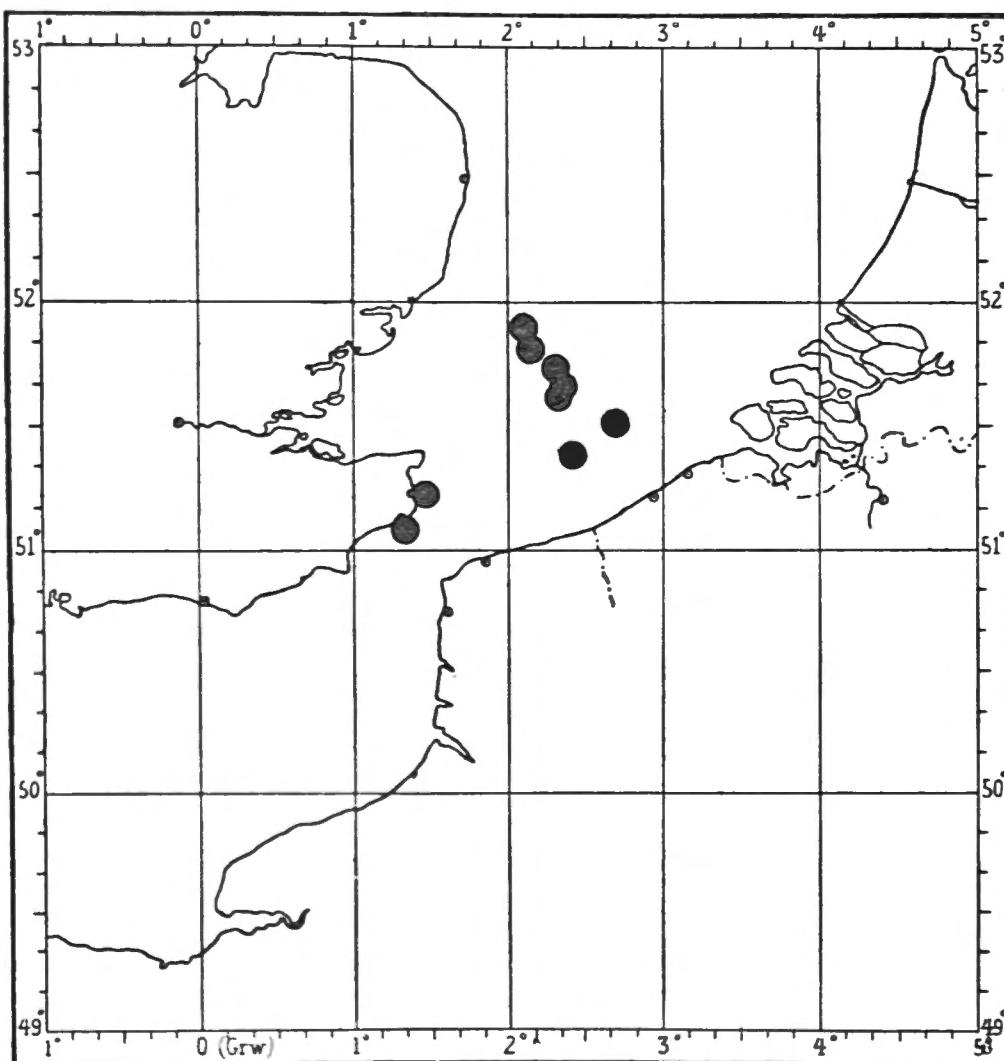


FIG. 2. — Finds of *Sarsia tubulosa*.

parts of the west coast of Greenland. Also found in the Pacific. In boreal and temperate regions the medusa occurs in spring. The medusa attains full size and maturity about two months after being liberated from the hydroid

polyp. The medusa appears in different varieties, more or less distinguished by colour and size. Several varieties are recorded from the Channel where, however, the species is altogether rare.

MATERIAL (see Table I) : 1.V.1905; 30.IV.1906; 29.IV.1907; 30.IV-1.V.1908; 24.VIII.1908; 1-2.V.1909; 3.IV.1910; 28.IV-2.V.1913.

Limits of temperature : 6°8-17°; salinity : 34.16-34.88 °/oo.

Mentioned in the International Bulletins from May 1904, May and August 1907.

Sarsia tubulosa does not seem to be very common in the south-western part of the North Sea. One specimen, 7 mm. high, was found in the Strait of Dover, May 1st 1908; its manubrium is blue as in the Baltic variety. All other specimens belong to a variety with greyish or yellowish manubrium. 10 specimens were taken in a single haul near Deal; the others have all been found in the open sea between Belgium and England (section IV, see the map, fig. 2), none in the neighbourhood of the Belgian coast. As quite small individuals are found, the species is evidently indigenous in the areas where the medusae were captured; the occurrence stands in no apparent relation to the hydrographical conditions, and most probably no importation of any significance has taken place from the Channel into the North Sea. The majority of the specimens have been taken at the end of April and at the beginning of May, and at that time we find individuals of all sizes from 1 to 9 mm. high. We may conclude, therefore, that liberation of medusae takes place at least from the beginning of March to the end of April. A peculiar exception is the find of 3 specimens, 3-6 mm. high, on August 24th 1908.

Purena gemmifera FORBES.

SYN. : *Sarsia gemmifera* autt.

Codonium gemmiferum HAECKEL, 1879.

HYDROID unknown.

DISTRIBUTION AND BIOLOGY : The coastal waters of western Europe from the Mediterranean to the Faeroe Channel and at the west coast of Norway as far north as Bergen. The medusa has its main occurrence in August and September, but may be found as late as in November. It is not very common in the Channel (found near Plymouth from June to September). Medusa buds are developed upon the manubrium, so that the number of individuals increases while the stock is carried hither and thither by the currents.

— MATERIAL (see Table I) : 24.VIII. and 13-14.XI.1905; 22-23.VIII.1906, very abundant; 23-26.VIII.1907. Moreover 5 specimens are found in a sample dated 5th February 1906, together with some other species, the occurrence of which

at this season is equally astonishing. I, therefore, consider this find very doubtful.

Temperature : $14^{\circ}4$ - $16^{\circ}75$; salinity : 33.51 - $35.17 \text{ } ^{\circ}/_{\text{o}}$.

Not mentioned in the International Bulletins from this region.

Purena gemmifera has been found in several localities which are fairly evenly distributed over the area investigated (see the map, fig 3), but as a rule it was only found in small numbers; it was abundant only about midway

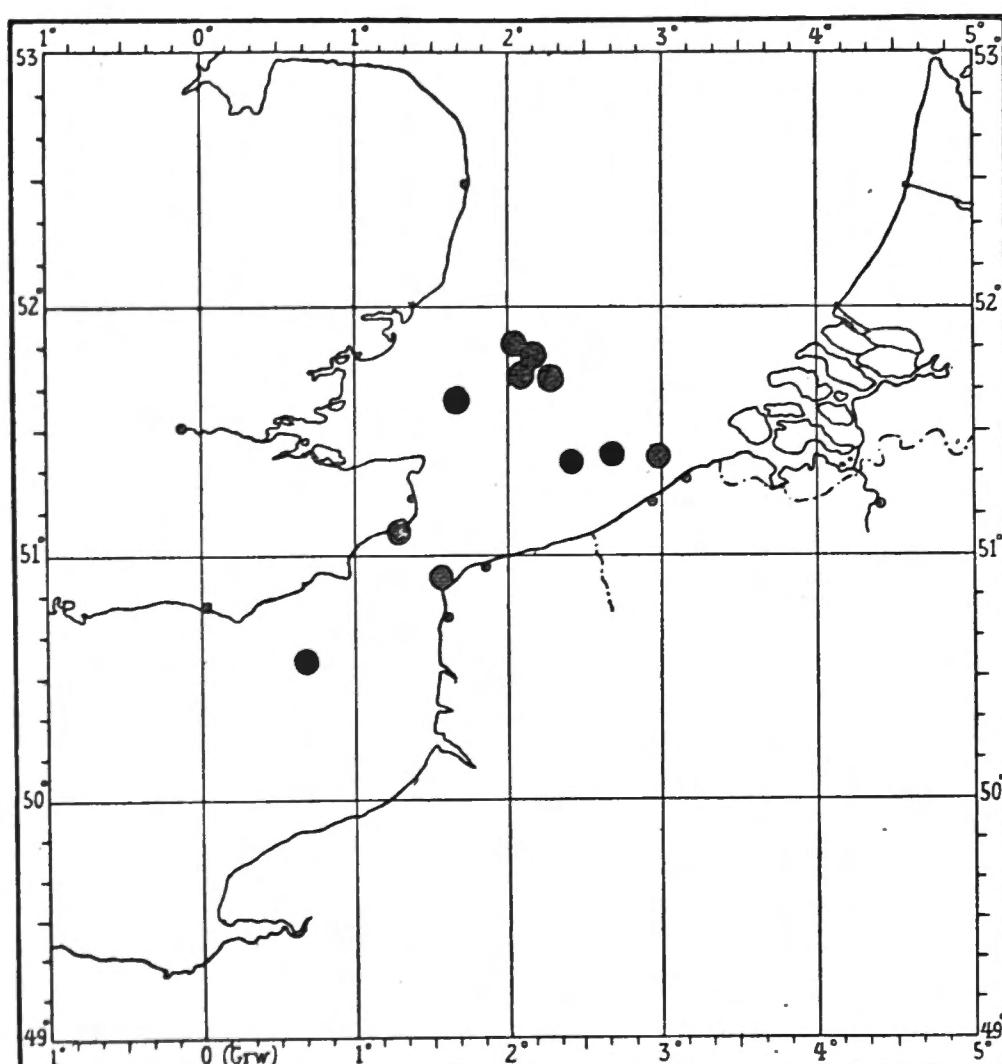


FIG. 3. — Finds of *Purena gemmifera*.

between Belgium and the Norwich peninsula (96 % of the individuals were found in section IV).

The medusa seems to occur regularly in the autumn, being sometimes very abundant in August, sporadically occurring as late as in November. Specimens with medusa buds are found at any time. Several specimens from August 23rd 1906 are sexually mature; some of them have even quite ceased budding off medusae, in others very few and small medusa buds are still present upon the manubrium.

In August 1906, when the medusa was particularly abundant, the "Channel water" had an unusually narrow distribution in the south-western North Sea;

we may assume, therefore, that the stock was not imported from the Channel. The species is evidently indigenous in the deeper parts of the waters between Belgium and England.

Slabberia halterata FORBES.

SYN. : *Dipurena halterata* HAECKEL, 1879.

HYDROID unknown.

DISTRIBUTION : A rare medusa, found in some localities at the southern parts of the British coasts and at Bretagne, from April to November.

MATERIAL : A small specimen, 3 mm. high, was found on August 22nd 1905 in the Strait of Dover, probably carried in from the Channel. Salinity : 35.12 °/oo.

Euphysa aurata FORBES.

HYDROID : *Corymorpha nana* ALDER.

DISTRIBUTION : Northern Europe from the Channel to the Murman coast; rare in the southern British waters, abundant at the coasts of Scotland and Norway.

MATERIAL : 5 specimens, labelled « Exploration de la mer du Nord », without further details.

Ectopleura dumortieri (VAN BENEDEN).

HYDROID : *Ectopleura dumortieri*.

DISTRIBUTION : Found at the coasts of Scotland and Ireland from March to December, at Roscoff, France, in June, at Plymouth in September. Common at Heligoland in July-December.

MATERIAL (see Table I) : 26.VIII.1904; 24-25.VIII.1905, several specimens, 0.5-1 mm.; 23.VIII.1906. Salinity : 34.78-35.01 °/oo.

Mentioned in the International Bulletins from August 1905.

Occasionally occurring in August in the open sea between Belgium and the Norwich peninsula (section IV). Undoubtedly indigenous, though fairly rare.

Hybocodon prolifer L. AGASSIZ.

HYDROID : *Hybocodon prolifer*.

DISTRIBUTION AND BIOLOGY : Northern-boreal, European and American. Distributed from France to Iceland and northern Norway, somewhat rare in the Channel, but common at Heligoland. The medusa appears in early spring, sometimes even in January or February. The number of individuals is rapidly increased by budding from the tentacular bulb, until the stock reaches its maximum in April or the beginning of May; then the asexual propagation is

replaced by sexual reproduction, and in the course of another month the majority of the stock disappears from the plankton, very few specimens being found later than the beginning of June.

MATERIAL (see Table I): 29.VIII.1903 (4 specimens, budding); 7.II and 1.V. 1905 (a few specimens, budding); 30.IV-2.V.1906 (common, most specimens budding); 30.IV.1907 (common, budding); 30.IV.1913 (budding).

Salinity : 34.42-35.26 ‰ .

Not mentioned in the International Bulletins.

A single time *Hybocodon prolifer* was found as early as February 7th (1905, in the Strait of Dover), but it seems to be an exception that the medusa is met

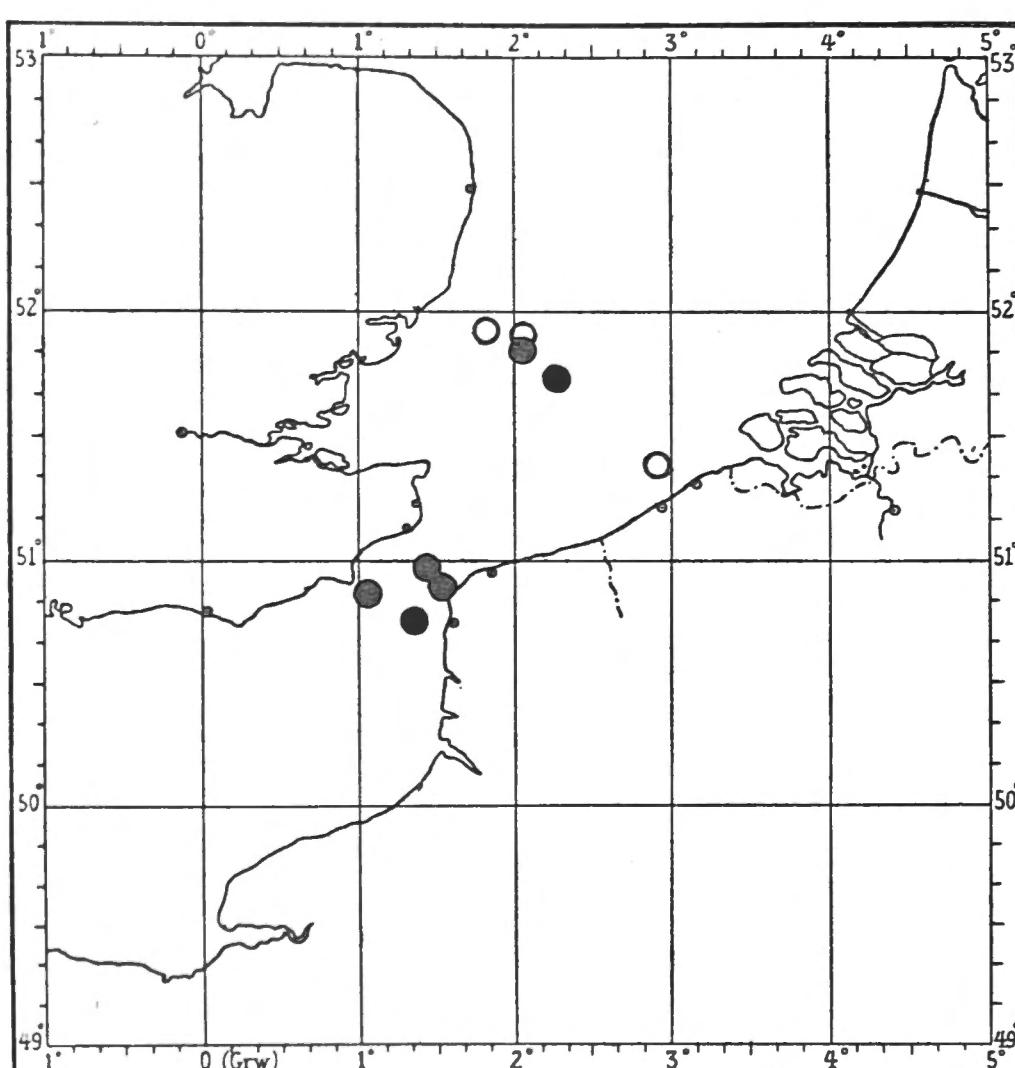


FIG. 4. — Finds of *Hybocodon prolifer*. • 1906, o other finds.

with in February in these waters. It has frequently been found about May 1st, and at this time almost all specimens are still budding; I have only seen mature individuals in two samples, both of which are from the Strait of Dover, or from the Channel just outside the Strait, 1-2.V.1906. One of these samples, taken near the bottom at a depth of 36 m., contained 60 specimens, 50 % of which were sexually mature, partly even with fully developed actinula larvæ; unfortunately, in this very case no observations of temperature in the bottom water

KRAMP, P. L. — HYDROMEDUSAE

are available; we cannot see, therefore, whether an especially high temperature may possibly have accelerated the development. Very peculiar is the find of four specimens, all budding, one also mature, on August 29th 1903; if the record is not due to a mistake, the medusa has stayed unusually long in the plankton that year.

As the material from the spring has almost every year been collected in the course of a few days about May 1st, it gives no information of any possible displacement of the stock towards the east or towards the west. At this season, the stock usually seems to be fairly generally distributed throughout the area investigated (see the map, fig. 4), though especially common in the Strait of Dover and adjacent parts of the Channel; about half of the finds and 2/3 of the individuals are from sections I and II, the others mainly from the open sea between Zeebrugge and Orford Ness (sections IV and V). This might indicate an importation of the medusa from the Channel into the south-western North Sea, but this is, probably, not correct. The species was particularly common in the spring of 1906, when the « Channel water » had a very narrow distribution in the North Sea, whereas the medusa was rare in 1905, when a considerable influx of water took place from the Channel. *Hybocodon prolifer* is, probably, indigenous in the deeper parts of the waters off the coast of Belgium, but it is very likely that some specimens are also sometimes carried thither from the Channel.

Margelopsis haeckeli HARTLAUB.

HYDROID : *Margelopsis haeckeli* HARTLAUB.

DISTRIBUTION : Heligoland, sometimes found in July and August. The Hydroid is pelagonal.

MATERIAL : 19.VI.1906, near Zeebrugge, a considerable number of specimens, partly young. 10-13.VI.1914, near Ostende, more than 2000 specimens in each sample.

No hydrographical observations.

The vast majority of the individuals are mature females with actinula larvæ; there are very few males. It is possible that this peculiar species occurs more regularly off the Belgian coast, but very few plankton samples are at hand from mid-summer's time.

Zanclea implexa (ALDER).

SYN. : *Gemmaria implexa* ALLMAN.

HYDROID : *Zanclea implexa* (ALDER).

DISTRIBUTION : All British coasts, and the west coast of Norway at Bergen and Trondhjem. Occurs from July to September.

MATERIAL (see Table I) : 23.VIII.1906, in the open sea off the Belgian coast, one specimen.

Bougainvillia superciliaris L. AGASSIZ.

SYN. : *Hippocrene superciliaris* L. AGASSIZ.

HYDROID : *Bougainvillia superciliaris* HARTLAUB.

DISTRIBUTION : Very abundant in arctic seas in summer; occurs fairly regularly at Heligoland and in the Danish waters, but only in small numbers, and in early spring. The southernmost locality known up to now was near the island Vlieland, off the Zuider Zee.

MATERIAL : Near the English harbour Deal : 2.V.1907, 1 specimen, 8 mm. wide; 1-2.V.1909, 2 specimens, 4-5 mm. wide.

The large specimen from May 1907 is not quite typical; the stomachal peduncle is unusually large and broad, conical, somewhat resembling that of *Bougainvillia macloviana*; the ocelli are large, as they should be in *B. superciliaris*, but they are shaped like thick, transversal lines at the base of the tentacles, whereas in the typical form the ocelli are round. The oral tentacles and the large marginal bulbs are typical. The endoderm of the oral tentacles consists of several rows of cells, in contrast to *B. macloviana*, in which the oral tentacles have only one row of endodermal cells.

Bougainvillia ramosa VAN BENEDEK.

HYDROID : *Bougainvillia ramosa* (VAN BENEDEK).

DISTRIBUTION : Mediterranean, western Europe, British coasts and the coasts of the North Sea and Kattegat. Occurs in autumn.

MATERIAL : 24.VIII.1905, near Zeebrugge, 2 specimens, a male and a female, both sexually mature.

Turritopsis nutricula MC CRADY.

SYN. : *Turritopsis polycirrha* KEFERSTEIN.

Turris neglecta LESSON.

HYDROID : *Turritopsis nutricula* MC CRADY.

DISTRIBUTION AND BIOLOGY : North America. Mediterranean, northern France, British coasts, and southern part of the North Sea. At the British coasts the medusa occurs in August-September (common in the Channel). HARTLAUB (1911, p. 205), records the medusa from several localities in the south-western part of the North Sea in December 1909, January 1909, and February 1908.

MATERIAL (see Table I) : 22-24.VIII (fairly common), 14.IX, 11-14.XI.1904; 22-24.VIII and 9-12.XI.1905; 31.VIII and 12.XI.1906; 4.IV and 26.VIII.1907; 11.IX.1908; 17.VIII.1909; 18.VIII.1910; 26.VIII and 13.XI.1912; 26-27.VIII.1913; 5.II.1914.

Salinity : 34.61-35.23 °/oo.

Mentioned in the International Bulletins from August and November 1904, August and November 1905, and November 1906.

Turritopsis nutricula is distributed throughout the area investigated (see the map, fig. 5). The youngest individuals seem to occur principally in the vicinity of the coasts, particularly so in the sections I and II.

The medusa occurs regularly during late summer and autumn, but it is never abundant. Most of the finds are from August, and the individuals are

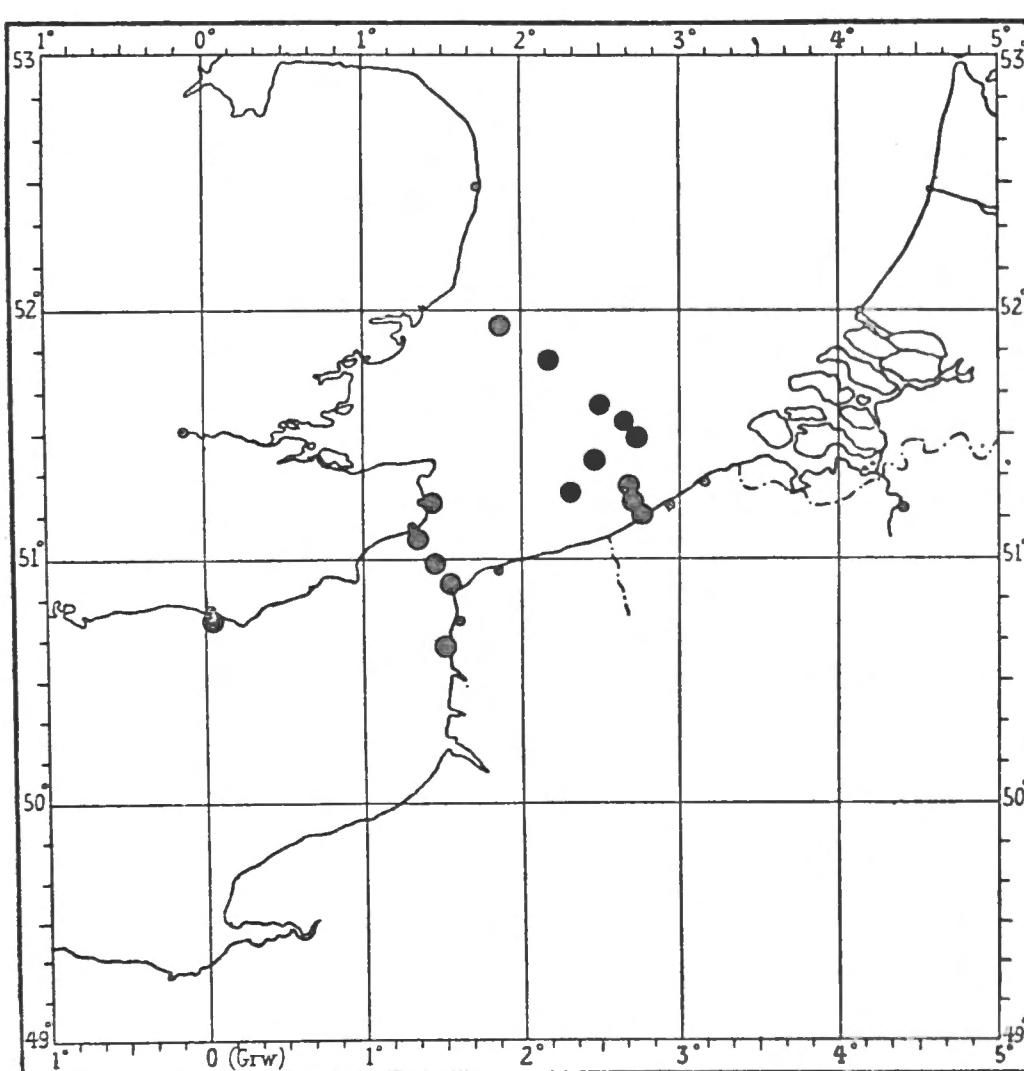


FIG. 5. — Finds of *Turritopsis nutricula*.

then $1\frac{1}{2}$ -4 mm. in diameter, which means that the liberation from the hydroid begins somewhat before that time but is continued at least until August. The specimens found in September and November are 2-4 mm. wide, most of them being 3-4 mm. The life-cycle seems generally to be as follows: liberation from the hydroid takes place from June or July until August; the medusæ are fully developed in the course of about two months; then sexual reproduction takes place, and the medusæ gradually disappear from the plankton, the number being remarkably diminished in November. The hydroid polyp survives the winter and produces a new generation of medusæ next summer. Occasionally the

medusa may appear at other seasons, 3 small specimens (1-2 mm.) being found in February 1914, and one specimen (3 mm.) in April 1907.

The comparatively large number of specimens in the North Sea in 1904 and 1905 may partly be due to importation from the Channel; the medusa was remarkably scarce in 1906, when the North Sea received very little supply of water from the Channel. Most specimens from section IV are fairly large. The specimens from section III are middle-sized, none less than 2 mm.; in this section, however, the collections were mainly carried out in September, when quite young individuals are not to be expected. The species is, probably, indigenous in the sections I, II, III and V (i. e. in the coastal areas), whereas the majority of the specimens found in section IV have, presumably, been imported from the Channel.

Podocoryne areolata ALDER.

SYN. : *Cytæandra areolata* HAECKEL, 1879.

Lymnorea borealis MAYER, 1910.

Limnorea norvegica BROCH, 1905.

HYDROID : *Hydractinia areolata* ALDER, 1857.

DISTRIBUTION : British coasts, west coast of Norway, Heligoland and west coast of Jutland, found at almost all seasons of the year. The medusa seems to be somewhat rare in the Channel, where it has been found in June-September.

MATERIAL : 20.IV.1905, near Zeebrugge, 1 specimen, 3 mm. high; 23.VIII.1908, off Ostende, 2 specimens, about 1 mm. high.

Not mentioned in the International Bulletins from this area.

Rathkea octopunctata (M. SARS).

HYDROID unknown.

DISTRIBUTION AND BIOLOGY : Northern Pacific. Western Atlantic from Newport to west coast of Greenland. The Black Sea and Mediterranean (rare). Very common in North-European waters from the north of France to Iceland and Novaya Zemlya. In the North Sea area and at the British coasts the medusa appears in January or February; during the first two or three months only asexual reproduction takes place, medusa buds being developed upon the sides of the stomach. In April or May the medusæ attain sexual maturity, and in May or June the stock disappears from the plankton.

MATERIAL : 2.V.1906, near Boulogne, 7 specimens; 4.IV.1907, near the coast of Belgium, 17 specimens; 6.II.1908, in the Strait of Dover, 1 specimen; 5.II.1914, near Boulogne, 1 specimen.

Salinity : 34.34-35.05 ‰.

Not mentioned in the International Bulletins from this area.

Rathkea octopunctata is evidently rare in the region investigated; the few finds, however, give a rather clear idea of the life-history of the species in these waters. The two specimens from February 1908 and 1914 are both very small, about 1 mm., and have not yet commenced their asexual reproduction by budding, i. e. they are directly derived from the unknown hydroid which must be supposed to live somewhere in the neighbourhood. The 17 specimens from April 4th 1907 are all in full act of budding off medusæ; among the 7 specimens from May 2nd 1906, 6 are still budding, whereas one specimen has reached sexual maturity. In these waters, the medusæ thus appear in February; they propagate by budding during the subsequent months, and the sexual reproduction commences at the beginning of May.

Amphinema dinema (PÉRON et LESUEUR).

SYN. : *Stomotoca dinema* L. AGASSIZ, 1862.

Amphinema titania HAECKEL, 1879.

HYDROID unknown.

DISTRIBUTION AND BIOLOGY : Southern and western coasts of the British Isles;

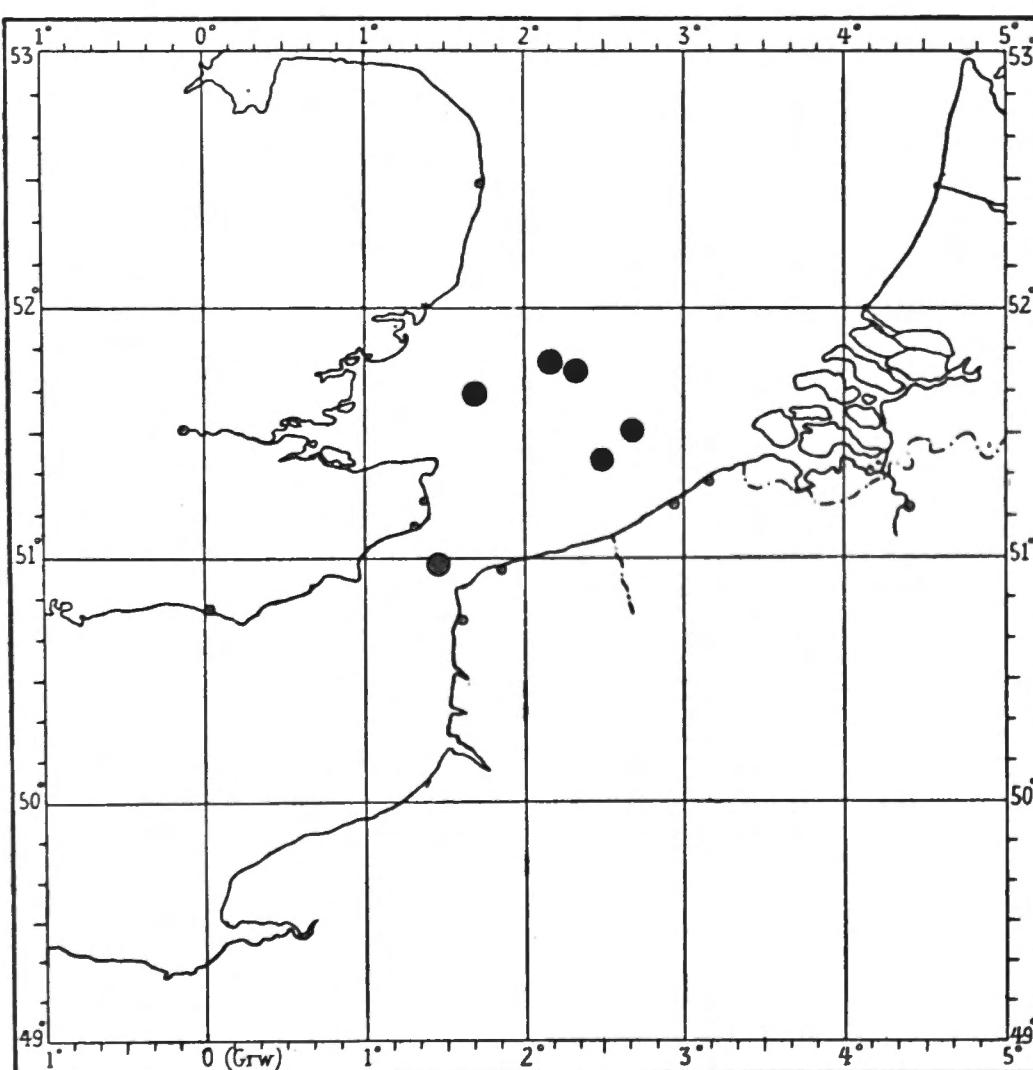


FIG. 6. — Finds of *Amphinema dinema* in August 1905.

Shetland Islands. Very common in the Channel, where the medusa occurs from May to November, being particularly common in July-September.

MATERIAL (see Table I) : 22-25.VIII.1905; 23.VIII.1906.

Salinity : 34.80-35.16 ‰ .

Not mentioned in the International Bulletins from this area.

This species does not seem to occur regularly in the south-western North Sea. It was taken in small numbers in several samples during a short period in August 1905, and one single individual was found in August 1906; from the other years no material is at hand. In 1905, the water coming from the Channel had a considerable extension in the south-western North Sea, and besides one specimen from the Strait of Dover all of the finds are from localities far from land between the coasts of Belgium and the Norwich peninsula (sections IV and V, see the map, fig. 6), i. e. in the inflowing Channel-water. It seems probable, therefore, that the species is not indigenous off the Belgian coast, but is sometimes carried there from the Channel.

Leuckartiara octona (FLEMING).

SYN. : *Tiara pileata* autt. partim.

HYDROID : *Perigonimus repens* (WRIGHT).

DISTRIBUTION AND BIOLOGY : Very widely distributed. In the Norts-East Atlantic area it is a southern-boreal species, very common from the Channel to the south of Iceland and along the west coast of Norway as far north as the Lofoten; very abundant in the North Sea and adjacent waters. The medusa has its main occurrence in summer and autumn, and it may, sometimes, survive the winter. The young medusæ appear off the southern coasts of England in April or May, in more northerly localities not until June.

MATERIAL (see Table I) : 20-22.VIII, 14.IX-11.X, and 14.XI.1904; 22-23.VIII. 1905; 23.VIII-8.IX.1906; 20.VII.1907; 22.VII, 26.VIII, and 24.IX.1908; 17.VIII. 1909; 27.VIII.1913.

Salinity : 33.22-35.12 ‰ .

Mentioned in the International Bulletins under the name of *Tiara pileata* from May and August 1904, August 1905, and May 1907.

Leuckartiara octona is fairly common in the area investigated and may sometimes occur in abundance, as in October 1904 and August 1906. It has been found from July until November. Young specimens, about 2 mm. in diameter, are found in July and August, one also as late as in September, but apart from this single individual all specimens from September are at least 5 mm. wide. Thus the liberation from the hydroid seems, normally, to cease in August, though it may occasionally be continued somewhat later in the year; the only specimen found in November is only 4 mm. wide. As, besides this one,

the medusa was never found in November, in spite of the many hauls taken in that month almost every year, it seems to be the rule that it disappears from the plankton in the course of October. On the other hand, the occurrence evidently begins before July as several individuals from that month are 5-6 mm. wide. Full-grown specimens (8-10 mm.) are found from August to October. From these facts we may conclude that, as a rule, the medusæ are liberated from June until about the middle of August, attain full size (evidently not surpassing

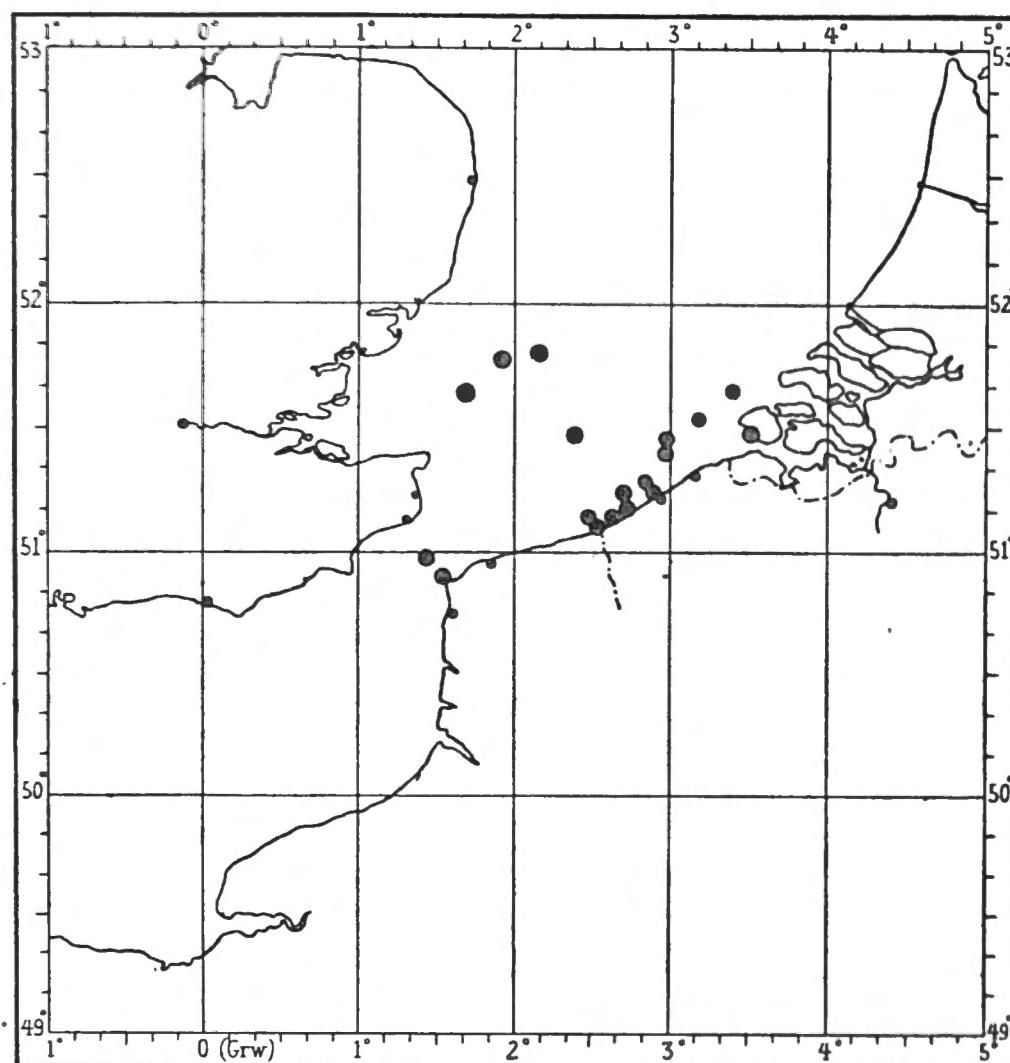


FIG. 7. — Finds of *Leuckartiara octona*.

10 mm. diameter in this region) in the course of about two months, and disappear in October.

The medusæ were predominantly taken near the bottom, at very different depths, from 3 to 53 m.

Leuckartiara octona was found anywhere in the area from the Strait of Dover eastwards, though by far most commonly in the coastal area between Gris Nez and the Schelde (section III, see the map, fig. 7). There is no characteristical regional distribution of young and full-grown individuals, which is quite natural, as the hydroid is able to live in shallow as well as in fairly deep water.

The species is evidently indigenous anywhere within the area investigated.

Willsia stellata FORBES.

HYDROID : *Lar sabellarum* GOSSE.

DISTRIBUTION : Northern France, all British coasts, and west coast of Norway near Bergen; occurs from March to November. Sometimes common in the Channel in August-September.

MATERIAL : 23.VIII.1905, off the Thames estuary (1 specimen, 3 mm. wide); 27.VIII.1913, near Newhaven in the Channel (2 specimens, 2 mm. wide, both mature females). The specimens were taken near the surface.

LEPTOMEDUSAE**Laodicea undulata (FORBES et GOODSR).**

SYN. : *Laodicea calcarata* AGASSIZ, 1862.

Laodice ulothrix HAECKEL, 1879.

Laodice cruciata autt. partim.

HYDROID : *Cuspidella*.

DISTRIBUTION AND BIOLOGY : Widely distributed. Common off the coasts of north-western Europe from the Channel to southern Iceland and all along the west coast of Norway. Occurs from spring or early summer until late in the autumn. There are, however, certain variations in the development of the medusa in the different geographical regions, which will be further mentioned below.

MATERIAL (see Table I) : 30.IV.1904; 22-24.VIII.1905; 5.II and 22-28.VIII. 1906; 23-26.VIII.1907; 11.IX.1908; 27.VIII.1913.

Salinity : 34.63-35.17 °/oo.

Mentioned in the International Bulletins from August 1905 (*Laodice calcarata*).

On two occasions a few specimens have been found south of Newhaven (28.VIII.1906; 27.VIII.1913); these are the only finds from the Channel in the present material. Several specimens were found in the Strait of Dover (section II, see the map, fig. 8) and in the open sea between Belgium and the Norwich peninsula (section IV). Only once the species was taken near the Belgian coast (section III, in September 1908, middle-sized specimens, 5-8 mm. wide). The medusa was found almost equally common at the surface and near the bottom, but never in very shallow water (found above depths of 24-60 m.).

Laodicea undulata seems to occur regularly in the autumn within the area here concerned, though as a rule only in small numbers; it was particularly common in August 1906. In the north-eastern Atlantic this medusa grows to a considerable size, about 35 mm. in diameter. The largest specimen in the present material is, however, only 17 mm. in diameter, and even this is an exception from the rule, the vast majority of the individuals being less than 8 mm. wide. This might possibly mean that the appliances used have not been able to catch the large specimens, the material thus giving a deficient idea of the development of the species in the region. It must, however, be pointed out

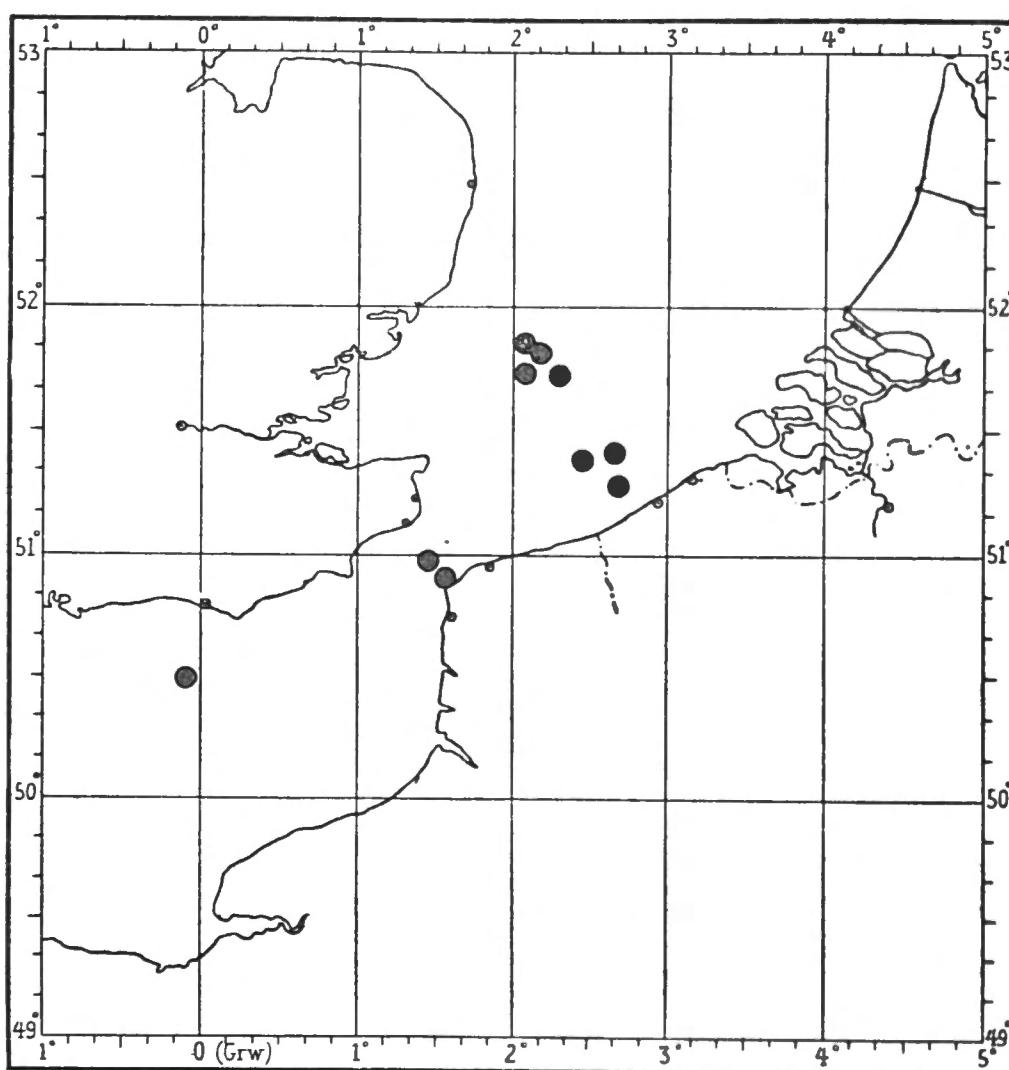


FIG. 8. — Finds of *Laodicea undulata*.

that the largest specimens found have well-developed, though not quite mature gonads. Though only found in rather salt water (sal. more than 34.6 ‰), the species is evidently indigenous in the south-western North Sea (section IV) as very small specimens are frequently found there, some being only 1 mm. wide, with 8 tentacles. This also appears from the fact that the medusa was the most common in 1906, when the influx of water from the Channel into the North Sea was slight.

The seasonal occurrence of *Laodicea undulata* in this region seems to be somewhat irregular. 6 small specimens (1.5-5 mm.) are recorded from

February 1906, which is very peculiar and, probably, incorrect (comp. *Purena gemmifera*, p. 8). In 1904, 10 young specimens (4-6 mm.) were taken at the end of April; this statement agrees quite well with facts observed in the waters west and north of Scotland, where young medusæ appear in spring, attain full size in the hot season, and disappear in autumn. The vast majority of the Belgian specimens are, however, found in August, and from this month several young individuals are at hand. In August 1905 and 1906 the diameter was 1-8 mm., and most specimens were very small. The 5 specimens from August 1907 were 3, 5, 8, 10, 17 mm. wide; in August 1913 only 2 specimens were found, 12 mm. in diameter; 4 specimens from September 1908 were 5-8 mm. The medusa was never found by the investigations in November.

From these observations we may conclude that *Laodicea undulata* is indigenous in the deeper parts of south-western North Sea where, as a rule, the medusæ are liberated in July-August. The comparatively few specimens known from the west coast of Jutland (KRAMP, 1927, p. 104) are likewise small individuals, 5-9 mm.) from the autumn, September-October. In the Skagerrak, on the other hand, the development of the species is as in the waters between Scotland and Iceland. According to the revision carried out by me (KRAMP, 1919) there can be no doubt but that the North-European forms of *Laodicea* all belong to one and the same species.

We have thus, in the North-European waters, two forms of *Laodicea undulata*: a northern form, distributed from southern Iceland to Scotland and Ireland and from northern Norway to the Skagerrak, which appears in spring, grows to a considerable size, and disappears in autumn; and a southern form, indigenous in the southern and eastern parts of the North Sea, which does not, as a rule, appear until July or August; it is possibly a dwarf form which attains sexual maturity in the course of two months, whereafter it disappears. The find, mentioned above, of a number of young specimens on April 30th 1904 is perhaps due to an uncommon distribution of the northern form.

Mitrocoma polydiademata (ROMANES).

SYN. : *Mitrocomella fulva* BROWNE, 1903.

HYDROID unknown.

DISTRIBUTION AND BIOLOGY : Northern-boreal; known from the British coasts, the North Sea and the Kattegat, the Faeroe Islands, and along the entire west coast of Norway. In most localities the medusa occurs in spring and early summer (April-July), but off the west coast of Jutland it is mainly found in September and November.

MATERIAL : 20.VII.1907, near Nieuport, Belgium (1 specimen, diameter 7 mm.); 2.X.1907, near Ostende and near Middelkerke (24 and 2 specimens, diameter 3-13 mm.).

Not mentioned in the International Bulletins from this region.

It is doubtful whether this species occurs in the Channel, and it is evidently only occasionnally found in the south-western North Sea where, however, quite a good number of specimens were found in shallow water near the Belgian coast in the autumn of 1907, in two samples containing no other species of medusæ (salinity unknown).

Genus *TRISSOCOMA* nov. gen.

Mitrocomidae with 4 radial canals, with 8 adradial marginal vesicles, and with two different kinds of marginal cirri. Genotype : *Trissocoma brownei* nov. sp.

In a previous paper (KRAMP, 1919, p. 59) I have given a tabular view of the genera of *Mitrocomidae*. Having examined the new species, described below, I have realized that the column of that table concerning the presence or absence of cirri must be subdivided according to the two different types of cirri occurring within this family, viz. spiral cirri with a terminal club-shaped cluster of nematocysts, and rigid cirri without a terminal club. Common to both types is the solid endoderm consisting of cylindrical or disk-like cells arranged in a single row which communicates with the endodermal epithelium of the circular vessel. The former type is also found in certain species of *Laodiceidae* and *Eucopidae*. Both kinds of cirri are fundamentally different from the cordyli of the *Laodiceidae* which are hollow. The tabular view will now look as follows :

GENERA.	Number of radial canals.	Cirri		Number of marginal vesicles.	Ocelli.
		spiral.	rigid.		
<i>Tiaropsis</i> Romanes	4	0	0	8	+
<i>Cosmetirella</i> Browne	4	0	0	8	0
<i>Cosmetira</i> (Forbes) Hartlaub. . .	4	0	+	8	+
<i>Trissocoma</i> nov.	4	+	+	8	0
<i>Mitrocoma</i> Haeckel	4	(+)	(+)	16 or more.	0
<i>Halistaura</i> Bigelow	4	0	0	Many.	0
<i>Halopsis</i> Agassiz	12-16 or more.	+	0	Numerous.	0

+ = present, 0 = absent, (+) = present in some species, absent in others.

Some of the genera of *Mitrocomidae* have no cirri at all. In *Halopsis* only spiral cirri are found, whereas in *Cosmetira* the cirri all belong to the rigid type.

The genus *Mitrocoma*, as now defined, is characterized by the possession of "cirri" and by the marginal vesicles being present in a number of 16 or more.

According to this definition the new genus here described is only distinguished from *Mitrocoma* by the fixed number of 8 marginal vesicles. Provisionally I find it justifiable to separate the forms with 8 marginal vesicles from those with larger numbers; but it is possible that, in future, it will be considered more correct to lay stress upon the structure of the cirri rather than upon the number of marginal vesicles. In such case the new genus must be classified with what is now called *Mitrocoma polydiademata* (formerly *Mitrocomella*), in which both types of cirri are present, whereas the generic name of *Mitrocomium* will have to be revived for the species *Mitrocoma circrata* (Haeckel) in which the cirri are of the rigid type; *Mitrocoma assimilis* (Browne) and *Mitrocoma lendenfeldi* Mayer probably belong to the same group. *Mitrocoma annae* Haeckel, *M. minervae* Haeckel, and *M. discoidea* Torrey have spiral cirri; as I have not examined these species myself, I cannot say whether rigid cirri are also present; they are not mentioned in the descriptions of the species.

The question of the limitation and classification of the genera *Mitrocomidae* will be taken up for discussion at another occasion. The new species which I am going to describe below, cannot find an appropriate place within any of the genera as they are now defined. It represents a new genus for which I propose the name of *Trissocoma* (from τρισσός and κόμη, i. e. « with three kinds of hair », alluding to the tentacles, the spiral cirri, and the rigid cirri).

Trissocoma brownei nov. sp.

DIAGNOSIS : *Trissocoma* with 16 tentacles, and with short oval gonads in the distal parts of the radial canals.

DESCRIPTION (see, fig. 9) : Bell in adult medusa 4 mm. wide, watch-glass shaped; gelatinous substance fairly thin, gradually tapering towards the bell margin. Stomach small, short, prismatical, attached to the subumbrella along the borders of a perradial cross. Mouth very expansive, with 4 faintly developed, simple perradial lips. 4 radial canals, very narrow though somewhat funnel-shaped in their proximal parts. Circular vessel a little wider than the radial canals. The gonads are oval, swollen, placed on the radial canals near their distal ends; the length of the gonads is about 1/5-1/6 of the length of the radial canals, the latter measured from the centre of the stomach to the circular vessel. The form and size of the gonads are equal in both sexes. Marginal organs (fig. 10) : 16 long marginal tentacles with broadly rounded basal bulbs without spurs; the endoderm of the tentacles is solid except in the basal bulb; the tentacles may be coiled up into a close spiral; when expanded they are longer than the diameter of the bell. They are provided with small warts of nematocysts, forming incomplete rings better developed on the adaxial than on the abaxial side of the tentacle. Upon the bell margin, between the tentacles, there are two different kinds of cirri (fig. 11) : a) long, spirally coiled, and b)

fairly short, rigid. The long cirri have a distinct though not very conspicuous, conical basal bulb, the ectoderm being somewhat thickened; the cells of the solid endoderm contain a good amount of protoplasm; the distal end is dilatated, club-shaped, and contains a number of very large nematocysts. The whole cirrus may be coiled into a close spiral; when expanded, its length is about 2-3 times that of the tentacular bulbs. The rigid cirri are inserted a little higher up upon the margin of the bell (fig. 11); they are about half as long as the spiral

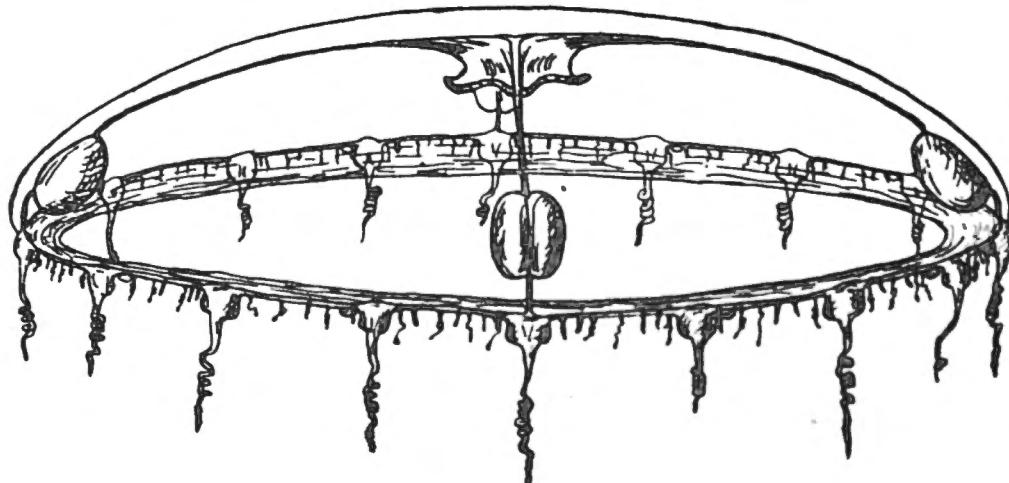


FIG. 9. — *Trissocoma browniae* n. g., n. sp.

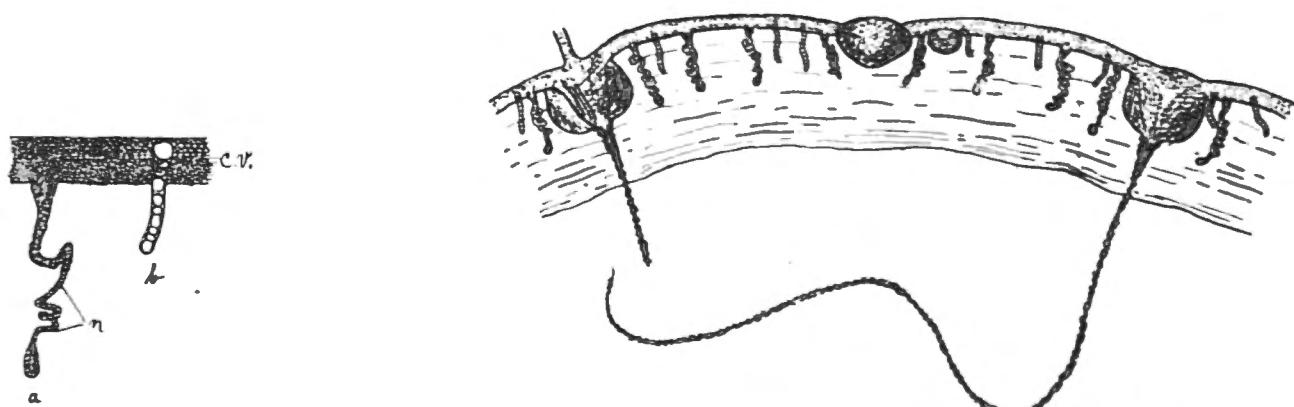


FIG. 11. — *Trissocoma browniae* n. g..

n. sp.—a. spiral cirrus. b. rigid cirrus. c. v. circular vessel. tentacle not yet developed. Seen from the aboral side.

FIG. 10. — *Trissocoma browniae* n. g., n. sp. — Part of bell margin of a young specimen (diam. 1 3/4 mm.), the adradial n. nematocysts. c. v. circular vessel. tentacle not yet developed. Seen from the aboral side.

cirri, cylindrical or slightly tapering towards the distal end; they consist of a row of large endoderm cells with very little protoplasm, covered by a very thin ectoderm in which may be found a few scattered nematocysts. The arrangement of the two kinds of cirri upon the bell margin is somewhat irregular (fig. 10). As a rule there are 3 or 4 of the long, spirally coiled cirri between each successive pair of tentacles, but they are not quite equidistant; there are about the same number of rigid cirri, apparently irregularly distributed among the others; it is, however, possible that the irregularity of arrangement, as observed in the present material, is due to some of the rigid cirri having fallen off without leaving any visible traces on the bell margin.

There are 8 marginal vesicles, fairly large, in open connection with the subumbrella cavity as in the other members of the family. In most specimens the concretions are dissolved owing to many years' preservation in formaline; in a few cases I have been able to count 5-7 concretions in each vesicle. The vesicles are placed between the interradial and the adradial tentacles, very near the latter; sometimes a cirrus of one kind or the other is situated between the vesicle and the adradial tentacular bulb.

The velum is fairly broad.

Colour of tentacular bulbs bright yellow in living specimens (communicated by BROWNE).

I have named this species in honour of Mr. E. T. BROWNE, who has seen it several years ago and realized that it was a new species. During one of my visits to his home in Berkhamstead in England I saw his drawings of the medusa and put down a note on it, in case I should come across the same species before his description of it was published. When now I found the species in the present material, I wrote a letter to Mr. Browne who, in his reply, kindly asked me to undertake the description.

DEVELOPMENT : I have examined 37 specimens of this new medusa, varying in size from 1.5 to 4 mm. in diameter. Even in the smallest specimens observed, the perradial and interradial tentacles are fully developed and all alike. The development of the adradial tentacles, on the other hand, is late; in the small individuals, 1.5-2.5 mm. in diameter, they are seen as tiny rudiments; in specimens 3 mm. wide some of the adradial bulbs may be somewhat pointed, but the complete number of 16 fully developed tentacles are not seen in specimens less than 4 mm. in diameter, and even then some of the adradial tentacles can be behind in development. When the diameter of the medusa is about 1.5 mm., the gonads are already quite distinct, though very small, and placed in the middle of the radial canals, whence they gradually move towards the bell margin while the medusa increases in size; the gonads reach their final situation when the specimen is about 3.5 mm. wide, and are then fairly large, much swollen, sometimes fully developed.

MATERIAL (see Table I) : 23.VIII.1906, two localities in section IV, between Zeebrugge and Orford Ness : 51°24'5 N, 2°41' E, and 51°43'5 N, 2°06' E, fairly abundant at the surface, less common at the bottom.

Salinity : 34.78-34.87 °/oo. Temperature : 15°4-15°8.

Previously found in the Channel and at the south-west coast of Ireland, May-September (Browne).

Cosmetira pilosella FORBES.

SYN. : *Euchilota pilosella*.

HYDROID unknown.

DISTRIBUTION : British coasts, the northern part of the North Sea, the Ska-

gerrak, and the west coast of Norway as far north as Bergen. The medusa occurs from April or May to October or November.

MATERIAL : 23.VIII.1905, off the Thames estuary, 1 specimen, diameter : 10 mm.; 27.VIII.1913, off Newhaven in the Channel, 3 specimens, diameter : 15-23 mm.

Salinity : 35.01 °/oo in both samples.

Not mentioned in the International Bulletins from this region, but frequently from the English part of the Channel.

It seems rather peculiar that this species, which is very common in the Channel from May to September, is so rarely met with in the area investigated.

Agastria mira HARTLAUB.

HYDROID : *Campanularia integra* MC GILLIVRAY = *caliculata* HINCKS.

DISTRIBUTION AND BIOLOGY : The medusa has been found at Heligoland and near Valencia harbour on the south-west coast of Ireland in May and August. The hydroid is a littoral, cosmopolitan species; its gonophores are usually sessile, but they occasionally break away from the polyp and swim about as free, but defective medusæ.

MATERIAL : 22.VIII.1905, near Dover, 1 specimen.

Obelia spp.

HYDROIDS : *Laomedea geniculata* (L.).

Laomedea dichotoma (L.).

Laomedea longissima (PALLAS).

DISTRIBUTION : The above three species of hydroids are all very widely distributed, almost cosmopolitan. The medusæ which are reared from these species, cannot be distinguished from one another.

MATERIAL (see Table I) : 29.IV and 22.VIII.1905; 30.IV, 1.V., and 23.VIII. 1906.

Salinity : 29.65-35.12 °/oo.

Mentioned in the International Bulletins from May 1905, 1906, and 1907.

The *Obelia* medusæ seem to be rare in the area investigated. As in other localities, the liberation of medusæ evidently takes place during a prolonged period; full-grown specimens (about 3 mm. in diam.) have been found as early as in April, young individuals both in May and August.

Phialidium hemisphaericum (L.).

SYN. : *Thaumantias hemisphærica* FORBES, 1848.

Phialidium variabile HAECKEL, 1879, partim.

Phialidium temporarium BROWNE, 1896.

HYDROID : *Campanularia johnstoni* ALDER.

DISTRIBUTION AND BIOLOGY : The hydroid is widely distributed. The medusa is very abundant all round the British Isles, in the whole of the North Sea area, and at the southern part of the west coast of Norway, more sparingly occurring as far north as the Lofoten and southern Iceland. In the North Sea area, the medusæ may be met with throughout the year; they are liberated from May or June to November; specimens from the summer propagate in the same year, specimens reared in autumn may survive the winter.

MATERIAL (see Table I) : 30.IV, 14.IX, 12-14.XI.1904; 22-25.VIII.1905; 5.II, 1.V, 20-28.VIII 12.XI.1906; 4.II, 23.VIII.1907; 5.II, 26.VIII, 11.IX, 10.XI.1908; 23.VIII.1911; 25.VIII.1912; 30.IV, 25-27.VIII.1913.

Salinity : 33.22-35.17 °/oo.

Mentioned in the International Bulletins, under the name of *Phialidium temporarium*, from February, May, August, and November 1904, 1905, 1906, and 1907.

Phialidium hemisphaericum is indigenous anywhere within the area investigated (see the map, fig. 12), but it is not equally common in every part of the area, and the number of individuals is also varying from one year to another. The medusa was particularly abundant in August 1906 and 1913, when sometimes several hundreds of specimens were found in a single haul.

In the Strait of Dover the medusa has been found about May 1st (in 1904, 1906, and 1913) but in the North Sea the liberation of medusæ seems to begin somewhat later, continuing throughout the summer until late in autumn; there is a pronounced maximum in summer, but young specimens, 2-3 mm. wide, are frequently found as late as in November. In August the medusa is very abundant and occurs anywhere, though it is remarkably scarce in the neighbourhood of the sandy coast of Belgium where, apparently, the conditions are not very favourable for the hydroid. Besides quite young ones we find, in August, numerous individuals 7-9 mm. wide, and some even larger, until 12 mm. in diameter. The same sizes are observed in November, but now the species is less numerous, though still evenly distributed. Some specimens, reared in autumn, survive the winter; specimens 5-10 mm. wide are found in February both in 1906, 1907, and 1908, in 1907 even in considerable numbers; in February, however, the medusa has only been found in the northern part of section IV (see the map), which probably means that the ability to survive the winter is limited to the

stock originating in the Channel, whereas the individuals reared in the south-western part of the North Sea, all die before the coldest season sets in.

In certain respects the development of the species in this region differs from that in the Danish waters (KRAMP, 1927) : the liberation of medusæ begins

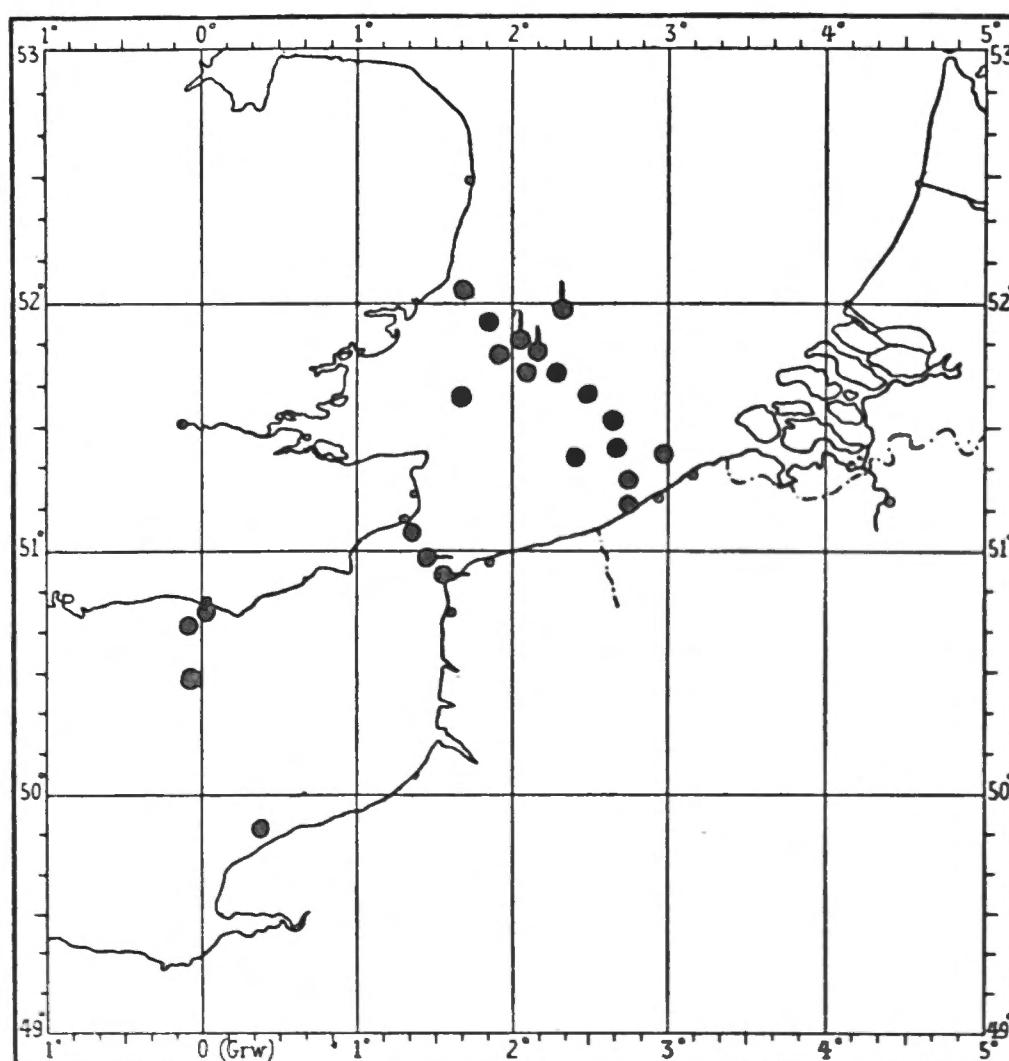


FIG. 12. — Finds of *Phialidium hemisphaericum*.

● February. • April-May. • August-November.

about one month earlier, and the summer-individuals attain a conspicuously larger size than they do in Denmark. On the other hand, the individuals which survive the winter do not seem to reach as considerable a size as those at the west coast of Jutland.

Eucheilota maculata HARTLAUB.

HYDROID unknown.

DISTRIBUTION : Heligoland; off the west coast of Jutland, and in the Kattegat. Occurs from July to October.

MATERIAL (see Table I) : 20.VIII and 14.IX.1904; 22.VIII.1905; 22-23.VIII. 1906; 14-16.IX.1908.

Salinity : 33.64-35.14 °/oo, only known in few cases.

The specimen from 22.VIII.1905, near Dover (sal. 35.14 °/oo), is mentioned in the International Bulletins.

Mainly found along the Belgian coast, not far from land (section III, see the map, fig. 13). The medusa has been found in August and September, usually only one single individual in a haul, but on August 20th 1904 and September 16th 1908 it was fairly common off Nieuport and Ostende (salinity unknown in both cases). No quite young specimens are present; full-grown individuals (15 mm. diam.) as well as fairly young ones (4-5 mm.) are found

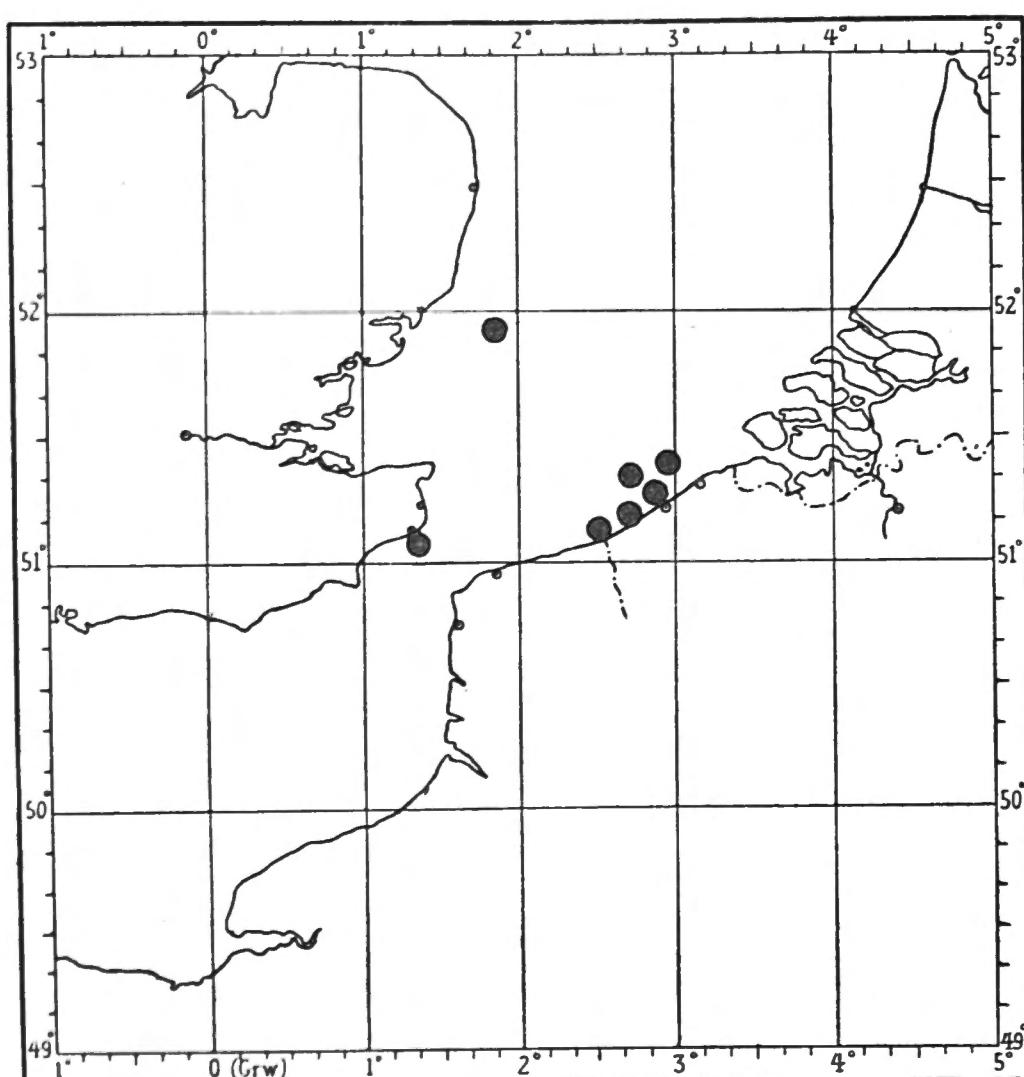


FIG. 13. — Finds of *Eucheilota maculata*.

both in August and September. The liberation of medusæ, accordingly, takes place in summer, continuing until August but not later, and the medusa disappears before November. At the west coast of Jutland the development takes place about a month later.

The species is, undoubtedly, indigenous near the coast of Belgium. It is interesting that both of the two areas, where this medusa is known to be more or less common, Belgium and the west coast of Jutland, are such where the bottom mainly consists of sand, unfavourable to most species of hydroids, but evidently the kind of bottom which is required by the unknown hydroid of *Eucheilota maculata*.

Octorchis gegenbauri HAECKEL.

SYN. : *Octorchis campanulatus* HAECKEL, 1879.
Octorchandra germanica HAECKEL, 1879.
Eutima campanulata MAYER, 1910.

HYDROID : *Campanopsis* GEGENBAUR.

DISTRIBUTION AND BIOLOGY : Canary Islands and Mediterranean; British coasts and the North Sea. In the Channel the medusa occurs from July to September, in the other localities somewhat later, from August to October or November.

MATERIAL : 22.VIII.1905, Strait of Dover, 8 specimens, diameter 11-15 mm.; 23.VIII.1906, midway between Belgium and the Norwich peninsula, 1 specimen, 12 mm.; 11.IX.1908, off Ostende, 3 specimens, 7-15 mm.

Salinity unknown in all cases.

Mentioned in the International Bulletins from August 1904.

This is a somewhat rare medusa in the area investigated; full-grown individuals are found in August and September. As no summer samples are at hand, we cannot state with certainty, whether the absence of young specimens means that the species is not indigenous in the area, or whether it is due to the liberation from the hydroid taking place in the middle of the summer. The latter supposition seems to me the most probable, but specimens are undoubtedly also sometimes carried from the Channel into the North Sea (1905 and 1908).

Eirene viridula (PÉRON et LESUEUR).

SYN. : *Irene pellucida* HAECKEL.

HYDROID unknown.

DISTRIBUTION AND BIOLOGY : Common in the Mediterranean; somewhat rare at north-western Europe, though sometimes occurring in considerable numbers. The medusa occurs regularly in the Channel from August to October. Moreover found in the Firth of Clyde in September, at Heligoland in August and October, and off the west coast of Jutland in September and October.

MATERIAL : 31.IX.1905, off the mouth of Schelde, 2 specimens, diameter 15-22 mm.; 29.VIII.1908, Strait of Dover, 12 specimens, 9-18 mm.; 11.IX.1908, off Ostende, 1 specimen, 10 mm.; 10.XI.1908, midway between Belgium and the Norwich peninsula, 1 specimen, 18 mm.

Salinity : 34.83-35.14 ‰.

Mentioned in the International Bulletins from August 1905, under the name of *Irene pellucida*.

A rare medusa in the area investigated, some medium-sized and large specimens being found in August, September, and November, particularly in 1908,

when 12 specimens were found in a haul at the surface in the Strait of Dover. The species is indigenous in the eastern parts of the North Sea, and most probably also in the south-western part.

Eutonina indica ns (ROMANES).

SYN. : *Eutonina socialis* HARTLAUB.

HYDROID unknown.

DISTRIBUTION AND BIOLOGY : Northerly-boreal : Iceland in June; west coast of Norway as far north as Aalesund, April to July; east coast of Scotland from May to August; very abundant in the eastern parts of the North Sea from March to July, and in the Kattegat and the western part of the Baltic from April to July. Also known from northern Pacific.

MATERIAL (see Table I) : 29.VI.1906; 14.V.1908; 19.V.1909; 12.IV., 18.IV., and 18.V.1910; 1.V.1911; 25.IV., 5-8.V., and 27.V.1913. Moreover I have seen a large specimen taken near Blankenberghe in April 1914.

Salinity unknown in most cases.

Not mentioned in the International Bulletins from this area.

The medusa grows to a considerable size in this part of the North Sea, the largest specimen being 34 mm. wide (12.IV.1910), about same size as in the eastern part of the North Sea.

The find of a good number of comparatively small individuals (11-19 mm.) at the end of June 1906 is peculiar and in disaccordance with all other observations from the area.

The localities where this species has been found, are almost all in the immediate neighbourhood of the Belgian coast between Ostende and Zeebrugge (section III) where the medusa was found in several samples in April and May in the years 1908-1913, sometimes in fairly large numbers. Only middle-sized and large specimens have been found (12-34 mm.), no small ones, which is probably due to the fact that no investigations were carried out during the previous months, when the medusæ are liberated. The species is undoubtedly indigenous in the Belgian coastal region, and the liberation of medusæ must take place mainly in March and must be ended not later than the middle of April, thus beginning and terminating earlier here than off the west coast of Jutland where full-grown medusæ are never found until May, middle-sized specimens still dominating in June. In the Kattegat the occurrence and development of the medusa take place a month later still (KRAMP, 1927).

It seems peculiar that this species, which is evidently quite common off the coast of Belgium, was not found there at all until 1908 (setting aside the somewhat doubtful find in June 1906). Probably, the small appliances used

during the preceding years have not been able to catch the larger specimens of *Eutonina*, and when, in those years, the collections with the small nets commenced towards the end of April, no young specimens were present.

Aequorea forskalea PÉRON et LESUEUR.

HYDROID unknown.

DISTRIBUTION : Mediterranean and Atlantic coasts of Europe; probably the species has a much wider distribution, but it cannot be stated exactly owing to our deficient knowledge of the limitation of the various species or varieties of *Aequorea* described.

MATERIAL : 21.VI and 26.VIII.1907; 25.VIII and 24.IX.1908; 27.VIII.1913.

Salinity : 31.11-35.17 $^{\circ}/_{\text{oo}}$.

Not mentioned in the International Bulletins from this area.

The localities are all near the coast between Gris-Nez and Zeebrugge (section III).

Eight young specimens (8-45 mm. wide) of this large medusa have been found in the months June, August, and September. The smallest individual is only 8 mm. in diameter (August 1908, near Zeebrugge), which proves that the species must be indigenous not far from the area investigated. The material is too small to serve as base for a discussion of the biology.

TRACHYMEDUSAE

Gossea corynetes (GOSSE).

SYN. : *Gossea circinata* HAECKEL.

DISTRIBUTION : The Channel and adjacent parts of the Atlantic and of the North Sea. The records in the literature are all from August, September, or November.

MATERIAL (see Table I) : 24.VIII and 14-17.IX.1904; 22-24.VIII.1905; 11.XI.1906; 11-29.IX and 10.XI.1908; 21.X.1909; 25-27.VIII.1912; 26-27.VIII.1913.

Salinity : 33.39-35.14 $^{\circ}/_{\text{oo}}$.

The finds from August 1904 and 1905 are mentioned in the International Bulletins.

Some of the localities are about midway between the coast of Belgium and the Norwich peninsula (sections IV and V); but the majority of the finds are from

the Strait of Dover or from the neighbourhood of the coast between Gris-Nez and Zeebrugge (sections II and III. See Table II and the map, fig. 14).

In the area investigated this medusa is fairly common in autumn, being found almost every year in a number of localities, though usually only rather few specimens (1-12) in each sample; at one occasion as many as 49 specimens were taken in one haul, at the surface near Newhaven in the Channel, 27. VIII.1913. Otherwise the medusa was particularly found near the bottom at depths between 24 and 53 m., a few times also in more shallow water, 10-17 m.

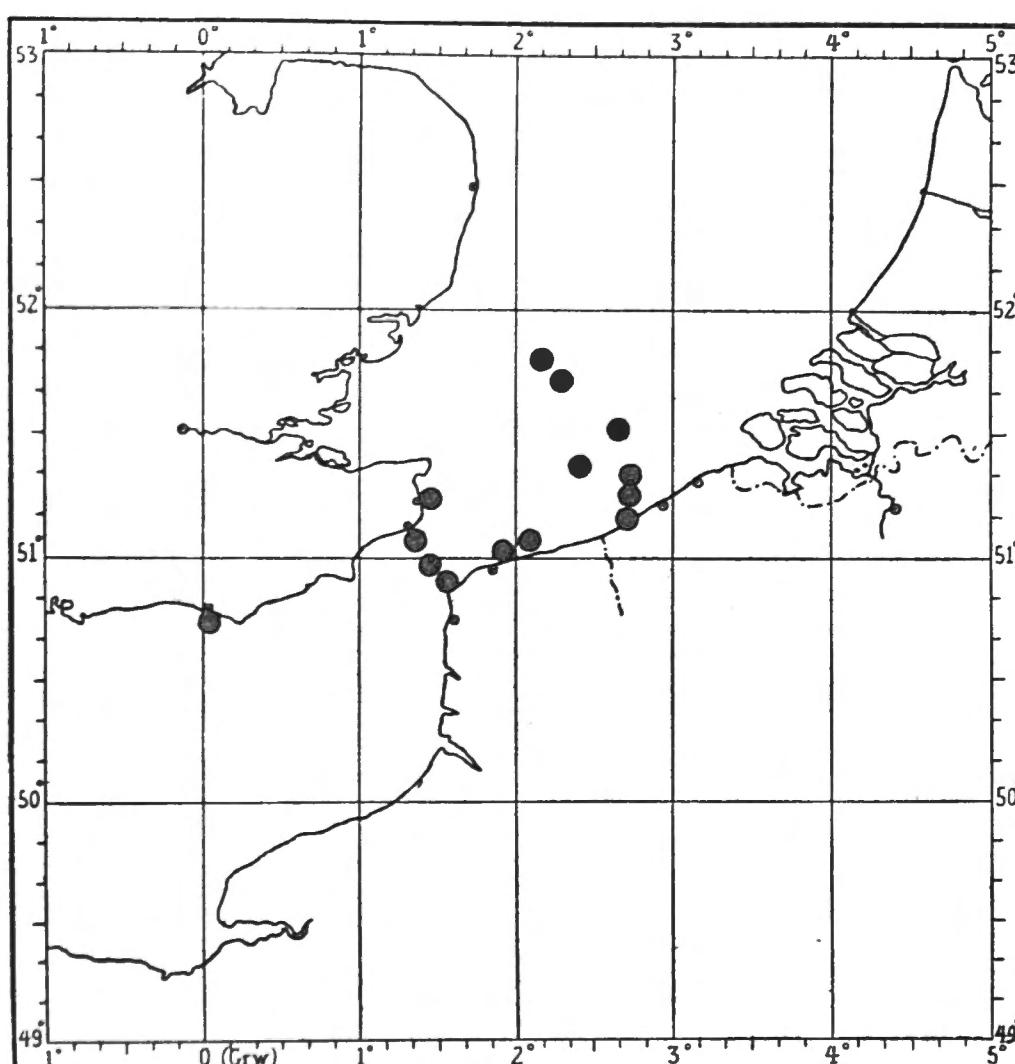


FIG. 14. — Finds of *Gossea corynetes*.

Most specimens have been found in August and September, some few also in October (1909), but very few samples are at hand from that month. Though numerous hauls have been made in November almost every year, only three specimens are found in that month; the medusa, thus, evidently decreases considerably in number before November.

In August both young and fairly large individuals are found (diam. : 2-8 mm.); from September we have one individual 3 mm. wide, the others measuring 5-8 mm.; the specimens from October and November are 5-9 mm. wide.

The records in the literature are all from the same period, August to

November; the medusa has nowhere been observed at other seasons. We must conclude, therefore, that the species is meroplanktonic, part of its development being passed on the sea-bottom, possibly as a fixed polyp as in some related forms (e. g. *Gonionemus*). According to the measurements given above together with previous records (KRAMP, 1924, p. 21) free-swimming medusæ are probably liberated from July to September; during the autumn they grow to full size and maturity, discharge their sexual products, and disappear in October-November. The presumed bottom-stages survive the subsequent winter and spring and give origin to a new stock of free-swimming medusæ next summer.

The occurrence of this species in the area investigated is subject to some variation from one year to another, indicating that in the region east of the Strait of Dover the medusa is mainly found when a considerable influx of water takes place from the Channel into the North Sea. The medusa was remarkably rare in 1906 when the influx was slight throughout the summer. In 1908 the influx was very slight in August, increasing later on and very considerable in November; this year the medusa was wanting in August, but fairly common off the Belgian coast about the middle of September (the hydrographical data from that month are, unfortunately, very incomplete), a few specimens still being found in November, midway between Zeebrugge and Lowestoft. In 1912 the salinity was very low in the south-western North Sea; *Gossea* was then only found in the middle part of section IV (salinity about 33.4 ‰) and in the vicinity of Dover (salinity : 34.64 ‰). The individuals found in section III are all middle-sized or large.

I am inclined to think that the individuals of *Gossea corynetes* found east of the Strait of Dover have immigrated from the Channel. As fairly small individuals, 2-3 mm. in diameter, are found rather far east in section IV, the place of origin cannot be far away. Probably, the species is indigenous throughout the Channel, but not in the North Sea inside the Strait of Dover.

GENERAL SECTION

I. — The Medusa Fauna in the different Sections of the Area investigated.

(Table II and the map, fig. 1, p. 4.)

As mentioned in the Introduction, the five sections into which I have divided the area, were not equally well investigated. From *Section I* (eastern part of the Channel) only 9 species of medusæ are at hand, all of which were also found in other sections. *Section II* (the Strait of Dover) is a transitional area; the 17 species found there might all have been found in *Section I*, except, perhaps, *Eucheilota maculata* which has never been recorded from the Channel; the single specimen of this species, which has been found in the Strait of Dover, has probably been carried there from the North Sea.

Section III (the shallow-water region along the North Sea coasts of France and Belgium) has a sandy bottom which is unsuitable to most hydroids. 18 species of medusæ are found in that section, but few of them are considered indigenous (see Table II). Characteristic of this section are the following species : *Margelopsis haeckeli*, *Mitrocoma polydiademata*, *Bougainvillia ramosa* (not found in other sections); *Eutonina indicans*, *Eucheilota maculata* (rare in the other sections); *Leuckartiara octona*, *Turritopsis nutricula*, *Obelia* (also more or less common elsewhere). With the exception of *Margelopsis* and *Turritopsis*, these are the same species which characterize the indigenous medusa fauna of the sandy coastal area off the west coast of Jutland. *Phialidium hemisphaericum* is probably indigenous off the Belgian coast, but the hydroid is rare. Several other species which have their principal occurrence in *Section IV*, are sometimes met with in *Section III*, which is quite natural in a region like this with its powerful tidal currents rushing forwards and backwards, great quantities of water rising towards the coast twice a day. It is rather more astonishing that these species are not found in much greater numbers in the coastal region (comp. the numbers of specimens of the following species found in *Sections III* and *IV* : *Purena gemmifera*, *Hybocodon prolifer*, *Laodicea undulata*, *Phialidium hemisphaericum*, *Sarsia tubulosa*, *Amphinema dinema*). If the uncommon conditions of September 1908, mentioned in the next chapter, were kept

out of regard, the difference would have been even more conspicuous; the comparatively large number of *Gossea corynetes* recorded from Section III is almost entirely due to its occurrence in 1908). As a matter of fact, the species which abound in the open sea are remarkably scarce in the coastal region. This seems to demonstrate that the tide only causes a slight horizontal displacement of the water volumes towards the coast; the tidal wave carries a volume of water from the Channel into the North Sea, but that water does only to a very slight degree approach the coast; the rising of the coastal water is due to the pressure of the tidal wave. On the other hand, when the tide retreats, the coastal water does not run out into the open sea; this appears from the fact that most of the species which are abundant in Section III are strikingly scarce in Section IV (*Leuckartiara octona*, *Eutonina indicans*, *Eucheilota maculata*).

The medusa fauna of Section IV (the mid-water region) is a mixture of indigenous forms and visitors from the Channel. 17 species are found. The most important among the indigenous species are : *Phialidium hemisphaericum*, *Purena gemmifera*, *Laodicea undulata*, and *Sarsia tubulosa*. When *Turritopsis nutricula* is found in Section IV it is not carried out from the coastal sections (III and V) where the species is indigenous, but is derived from the Channel. *Amphinema dinema* and *Gossea corynetes*, both of which are very common in the Channel, are only found in Section IV as visitors when a considerable influx of water takes place from the Channel. The stocks of the indigenous species are also sometimes recruited by importation of specimens from the Channel. When, e. g., specimens of *Phialidium hemisphaericum* are found in Section IV in February, they have come from the Channel. As a matter of fact, it seems peculiar that medusæ which are known to be abundant in the Channel (*Turritopsis nutricula*, *Amphinema dinema*, *Cosmetira pilosella*, *Eirene viridula*, *Gossea corynetes*, *Slabberia halterata*, *Lizzia blondina*, *Eutima insignis*, *Saphenia gracilis*) are so scarcely, or not at all, met with in Section IV. This does not imply a particularly great influx of water from the Channel, a peculiarity which will be further discussed in the next chapter.

The fauna of Section V (the English coastal region and the Thames estuary) is in the main a diminution of that in Section IV. The material from Section V is altogether small; it contains 11 species, among which *Phialidium hemisphaericum* is by far the most abundant; most other species were only found in very small numbers. *Turritopsis nutricula* is indigenous in Section V, not in Section IV. Only one species was found in Section V which did not occur in any of the other sections, viz. *Bougainvillia superciliaris*; it was found on two occasions near Deal; the species belongs to the northern seas, and Deal is the southernmost locality where it has ever been found.

II. — The Medusa Fauna in the different Years.

(Table I.)

The extent at different times of the 35 °/oo isohaline from the Strait of Dover towards the North-East gives an image of the intensity of the influx of salt water from the Channel into the southern part of the North Sea. This influx is subject to very considerable variations: thus in November 1907 the 35 °/oo isohaline of the southern part of the North Sea was confluent with that of the northern part, whereas in August 1908 and May 1910 water of 35 °/oo salinity did not even reach from the Channel into the Strait of Dover.

In the Special Section we have examined the influence of the greater variations upon the occurrence of the separate species of medusæ. In the present chapter we shall try to compare the variations of salinity with the composition of the medusa fauna altogether (see Table I).

In 1904 the influx of salt water was above the normal throughout the year, though gradually decreasing from February (when it was very considerable) until November. Among the indigenous species of medusæ *Leuckartiara octona* was common in August, September, and October, especially in Section III, and several *Phialidium hemisphaericum* were found in Sections IV and V in November. As imported from the Channel some few *Gossea corynetes* were found in Sections IV and III in August and September, and several *Turritopsis nutricula* occurred in Sections II and IV in August and November.

In 1905 the influx was likewise above the normal throughout the year, and in accordance herewith several species of medusæ were carried in through the Strait of Dover, though only in small numbers. From February and May we have very little material. In August and November we find in Sections II, IV, and V : *Turritopsis nutricula*, *Amphinema dinema*, *Slabberia halterata*, *Octorchis gegenbauri*, *Cosmetira pilosella*, and *Gossea corynetes*. The indigenous species, on the other hand (*Leuckartiara octona*, *Phialidium hemisphaericum*, etc.), were very scarce.

In 1906 the hydrographical conditions were entirely different from those of the preceding years. In February, when the influx of salt water was considerable, some specimens of *Phialidium* were found in Section IV, undoubtedly originating from the winter population of the Channel. In May the 35 °/oo isohaline did not reach inside the Strait of Dover, and only indigenous forms were found in the various sections. Also in August the influx was below the normal, and with the exception of one single *Amphinema dinema* no medusæ of the Channel water were found in the North Sea. Some of the indigenous species, on the other hand, were exceptionally abundant: *Purena*

gemmifera, *Phialidium hemisphaericum*, *Laodicea undulata*, *Trissocoma browni*, partly also *Leuckartiara octona*. In November the influx increased again and reached above the normal, but very few medusæ were carried into the North Sea this time; a single *Gossea* was taken in the Strait of Dover and two specimens of *Turritopsis* in Section IV.

In 1907 the influx of water was slight at the beginning of the year, increasing later on, until it reached an exceptionally great extent in November;

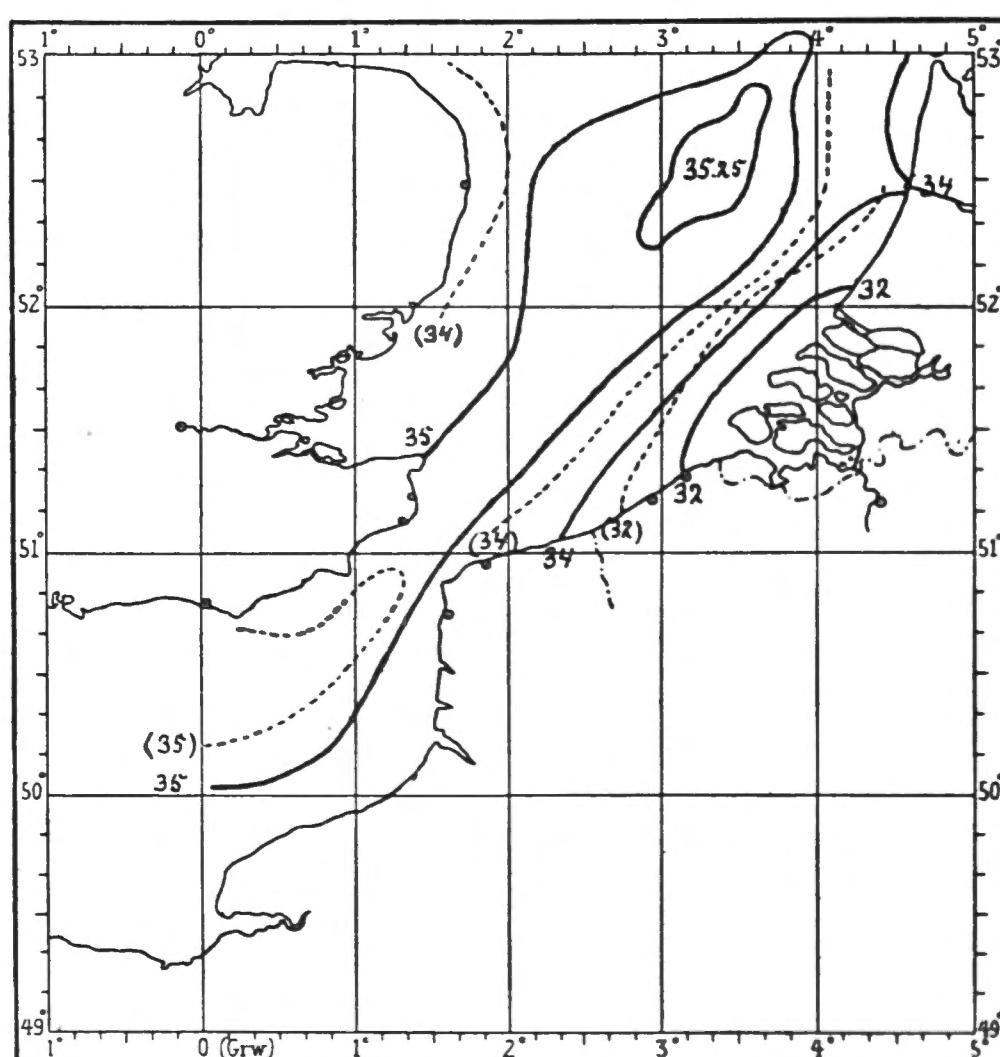


FIG. 15. — Distribution of salinity in August and November 1908.
 — Isohalines in August.
 — — — November.

unfortunately we have no material of medusæ from that month. There are altogether rather few samples from 1907, and they contain practically only indigenous forms.

1908. In February the salt water had still an extensive distribution in the south-western North Sea, but in May it retired, and in August the 35 ‰ isohaline was restricted to the Channel, not even reaching as far as into the Strait of Dover. In August, *Phialidium hemisphaericum* was abundant in Sections IV and V. The medusa fauna of the previous months presents nothing of special interest. From September we have a number of samples collected in Section III

near Ostende and Calais. Besides some *Eucheilota maculata*, *Phialidium hemisphaericum*, and *Turritopsis nutricula* which may have been indigenous in the area, these samples contain some specimens of *Laodicea undulata*, *Octorchis gegenbauri*, *Eirene viridula*, and *Aequorea forskalea* besides several *Gossea corynetes* which were, undoubtedly, imported from the Channel. As mentioned in the previous chapter, medusæ of the Channel water are usually scarce in Section III; their occurrence in September 1908 must, therefore, be considered an exceptional case, indicating an unusual movement of the inflowing Channel water towards the coast. Unfortunately, these samples are not accompanied by observations of salinity of the water. We can only judge from the conditions in November (see the map, fig. 15), when the tongue of water with a salinity above 35 ‰ reached somewhat far into the North Sea and, besides, was comparatively broad, including an isolated area in its north-eastern part, where the salinity was more than 35.25 ‰. This isolated patch of particularly salt water indicates that the Channel water was now in the act of retreating after a considerable influx some time before. I do not hesitate to assert that the medusa fauna shows this influx to have taken place in September and, moreover, to have reached comparatively far into the coastal region off Belgium and France east of Calais. We have only one sample from November 1908 (section IV); it contains a few specimens of *Gossea*, *Eirene*, and *Phialidium*.

The material of medusæ from the years after 1908 is too small to serve as base for a discussion of the relation between medusa fauna and hydrographical conditions.

A comparison between the distribution of the « Channel water » and the occurrence of the medusæ at different times gives the following general results:

The species which are indigenous in the North Sea sections are particularly abundant there, when the Channel water has a narrow distribution, or when it is retiring after a previous influx.

The medusæ which are imported from the Channel are almost only found in the North Sea sections, when the 35 ‰ isohaline has a particularly extensive distribution in the North Sea, and even then they are impressively scarce, which shows that the volume of water carried in through the Strait of Dover is, in fact, rather inconsiderable : a fairly slight influx of salt water from the Channel is sufficient to increase to a considerable extent the distribution of the 35 ‰ isohaline in the North Sea.

TABLE I. — GENERAL

NUMBER OF SAMPLE	SECTION	DATE	POSITION	Depth m.	Salinity ‰		Temperature °C		Depth of haul (1).
					surface.	bottom.	surface.	bottom.	
1903									
33	III	29.VIII	51°22' N. 2°57'5 E.	16.5	34.47	..	16.8	..	s
1904									
132	II	30.IV	50 54 5 N. 1 31 5 E.	41	34.92	..	8.9	..	s
3077	III	20.VIII	51 08 N. 2 29 5 E.	..	..	..	18.4	18.4	s
185	IV	22. —	51 32 N. 2 40 5 E.	32	34.75	..	18	..	s
189	II	— —	50 55 N. 1 32 E.	47	..	34.94	..	17.2	b
192	II	23. —	50 59 N. 1 27 5 E.	54	..	35.05	..	16.5	b
197	IV	24 —	51 37 5 N. 2 30 E.	36	34.99	..	17.3	..	s
203	IV	— —	51 47 N. 2 09 5 E.	45	35.05	..	16.9	..	s
214	IV	26. —	51 23 N. 2 27 E.	30	34.79	..	17.2	..	b-s
3205	III	14.IX	51 11 N. 2 43 E.	7	..	..	16.3	16.3	b
3206	III	— —	51 09 5 N. 2 43 E.	10.5	..	..	16.5	16.5	b
3207	III	— —	51 09 N. 2 40 E.	4	..	..	16.0	16.0	b
3234	IV	17.IX	51 21 N. 2 29 E.	3	..	..	17.0	17.1	b
3274	III	28. —	51 15 N. 2 47 E.	10	..	..	14.6	14.8	b
3282	III	11.X	51 40 N. 3 22 E.	26	..	..	13.3	13.5	b
3283	III	— —	51 31 5 N. 3 40 E.	28	..	..	..	..	.
222	II	11.XI	50 55 N. 1 32 E.	38	..	34.88	..	12.7	b
225-227	II	— —	50 59 N. 1 27 E.	35	34.94	..	12.3	..	s
231	II	— —	51 04 N. 1 21 E.	31	..	35.07	..	12.4	b
236-237	V	12. —	51 56 5 N. 1 50 E.	45.5	34.92	..	12	..	s
246	IV	— —	51 48 N. 2 09 5 E.	37	35.02	..	12.2	..	b-s
247	—	— —	— —	47	..	35.01	..	11.7	b
249-250	IV	14. —	51 43 N. 2 48 E.	38	35.16	..	12.1	..	s
255-256	IV	— —	51 38 N. 2 29 E.	31	34.97	..	12.9	..	s
259-260	IV	— —	51 32 N. 2 41 E.	33	34.02	..	12	..	s
261	—	— —	— —	—	—	..	—	..	b-s
266	III	— —	51 23 5 N. 2 58 E.	48	..	33.22	..	9.5	b
270	—	— —	— —	—	..	—	..	—	b

(1) s = surface. b = bottom.

VIEW OF THE MEDUSAE

KRAMP, P. L. — HYDROMEDUSAE

4

Table I,

NUMBER OF SAMPLE	SECTION	DATE	POSITION	Depth m.	Salinity ‰		Temperature °C		Depth of haul (1).
					surface.	bottom.	surface.	bottom.	
1905									
300	II	7. II	50°58'5 N. 1°26'5 E.	53	..	35.26	..	6.4	b
313	II	29. IV	50 54 N. 1 32 E.	45.5	34.33	..	9.7	..	s
327	IV	1. V	51 53 5 N. 2 04 E.	33	34.88	..	9.1	..	s
1156	III	20. VI	51 20 N. 3 03 E.	7	..	..	..	..	b
352	II	22. VIII	50 59 N. 1 27 5 E.	53	..	35.12	..	16.5	b
353	II	— —	51 04 5 N. 1 20 5 E.	31	35.14	..	17.1	..	b-s
354	—	— —	— —	—	—	..	—	..	s
357	V	23. —	51 39 N. 1 41 E.	24	35.01	..	16.7	..	s
358	—	— —	— —	—	—	..	—	..	b
365	IV	24. —	51 51 N. 2 03 E.	29	..	..	17.1	..	b-s
368	IV	— —	51 47 5 N. 2 09 E.	46	35.16	..	17.1	..	b-s
369	—	— —	— —	—	—	..	—	..	s
370	—	— —	— —	—	..	35.12	..	16.8	b
372	IV	— —	51 44 5 N. 2 18 E.	36	..	..	17.1	..	s
373	—	— —	— —	—	..	..	..	17.6	b
374	IV	— —	51 38 5 N. 2 31 E.	31	..	..	17.35	..	b-s
375	—	— —	— —	—	..	..	—	..	s
379	IV	— —	51 32 N. 2 41 E.	36	..	34.84	..	17.6	b
380	III	— —	51 23 N. 2 58 5 E.	48	33.32	..	17.5	..	b-s
381	—	— —	— —	—	—	..	—	..	s
383	IV	25. —	51 23 N. 2 28 E.	31	35.01	..	17.15	..	b-s
384	—	— —	— —	—	—	..	17.6	..	s
385	—	— —	— —	—	..	34.97	..	17.5	b
3652	III	31. IX	51 31 5 N. 3 06 E.	21	..	..	..	15.9	b
387	IV	9. XI	51 23 N. 2 27 E.	31.5	34.94	..	11.2	..	b-s
393	IV	— —	51 31 N. 2 43 E.	36	34.72	..	10.9	..	s
409	V	10. —	51 57 N. 1 51 E.	33	..	35.05	..	10.4	b
421	II	12. —	50 58 N. 1 27 5 E.	60	..	35.23	..	12.2	b

(1) s = surface. b = bottom.

continued

Table I,

NUMBER OF SAMPLE	SECTION	DATE	POSITION	Depth m.	Salinity ‰		Temperature °C		Depth of haul (¹).
					surface.	bottom.	surface.	bottom.	
1905									
435	I	13 . XI	50°34' N. 0°41' E.	47	35.26	..	11°8	..	s
439	II	14 . —	Near Dover.	..	34.96	..	10.1	..	s
1906									
456	IV	5 . II	51 51 N. 2 03 E.	35	34.94	34.94	5.5	5°45	b-s
483	III	30 . IV	51 23 N. 2 58 5 E.	48	..	..	..	..	..
484	—	— —	— —	—	29.65	..	7.85	..	b-s
494	IV	— —	51 44 N. 2 18 E.	36	..	34.69	..	6.75	b
498	IV	— —	51 51 N. 2 03 E.	29	34.70	..	6.5	..	b-s
515	II	1 . V	50 54 N. 1 32 E.	47	..	34.42	..	7.2	b
516	II	— —	50 59 N. 1 27 5 E.	56	34.49	..	7.8	..	b-s
517	—	— —	— —	—	..	34.54	..	7.03	b
518	—	— —	— —	—	..	34.54	..	7.3	b
523	I	2 . —	50 40 N. 1 32 E.	22	34.34	..	7.7	..	s
527	I	— —	50 45 5 N. 1 22 E.	?	..	34.56	..	7.7	b
530	I	— —	50 52 N. 1 05 5 E.	37	34.72	..	7.8	..	b
3936	III	19 . VI	51 16 5 N. 2 58 E.	5	..	..	..	..	b
3997	III	29 . —	51 15 N. 2 56 E.	5	..	..	15.4	..	b
4133	III	20 . VIII	51 16 5 N. 2 48 E.	12	..	..	17.2	..	b
538	IV	22 . —	51 23 N. 2 27 E	33	34.65	..	16.1	..	s
540	III	— —	51 23 N. 2 56 E.	12.5	33.51	..	16.75	..	b-s
541	—	— —	— —	—	—	..	—	..	s
542	—	— —	— —	—	..	33.64	..	16.7	b
543	IV	23 . —	51 26 N. 2 22 5 E.	33	34.67	..	16.25	..	b-s
544	—	— —	— —	—	—	..	—	..	s
545	—	— —	— —	—	..	34.67	..	16.4	b
547	IV	— —	51 24 5 N. 2 41 E.	35	34.78	..	15.8	..	s
548	—	— —	— —	—	..	34.78	..	15.7	b
549	IV	— —	51 43 5 N. 2 06 E.	38.5	34.87	34.87	15.4	15.4	b-s
550	—	— —	— —	—	—	..	—	..	s

(¹) s = surface. b = bottom.

continued.

	<i>Sarsia tubulosa.</i>	<i>Purena gemmifera.</i>	<i>Hybocodon prolifer.</i>	<i>Turritopsis nutricula.</i>	<i>Amphinema dinema.</i>	<i>Leuckartiara octona.</i>	<i>Iadicea undulata.</i>	<i>Obelia</i> spp.	<i>Phididium hemisphaericum.</i>	<i>Eucheilota maculata.</i>	<i>Eutonina indicans.</i>	<i>Gosse Coryneles.</i>	OTHER SPECIES
8	.	1	1	.	.	.	.	6	6	.	.	.	
	.	5	.	.	.	.	.	19	.	.	.	.
	.	.	19	.	.	.	.	.	.	.	.	.
	.	1	.	.	.	.	.	.	.	.	.	.
	.	4	.	.	.	.	.	.	.	.	.	.
	.	2	.	.	.	.	.	.	.	.	.	.
	.	30	.	.	.	.	.	3	1	.	.	.	
	.	9	.	.	.	.	.	.	.	.	.	.
	.	60	.	.	.	.	.	.	.	.	.	.
	19	.	1	.	.	7 Rathkea octopunctata.
	Margelopsis haeckeli.
	.	1	.	.	.	.	.	.	.	.	.	.	1 Mitrocoma polydiademata.
	.	1	.	.	.	.	.	.	.	.	.	.
	.	1	.	.	.	.	.	.	.	.	.	.
	.	1	.	.	.	.	.	.	2	.	.	.	
	.	4	.	.	.	.	.	1	.	.	.	.
	c. 130	.	.	1	.	.	18	2	70	.	.	.	2 Podocoryne areolata.
	21	.	.	.	.	.	6	.	2	.	.	.	26 Trissocoma brownei.
	19	.	.	.	.	.	22	.	40	.	.	.	3 Ectopleura dumortieri.
	2 Trissocoma brownei.
	1 Zanclea implexa, 1 Octorchis gegenbauri, 5 Trissocoma brownei.
	4 Trissocoma brownei.

Table I,

NUMBER OF SAMPLE	SECTION	DATE	POSITION	Depth m.	Salinity ‰		Temperature °C		Depth of haul (1).
					surface.	bottom.	surface.	bottom.	
1906									
552	IV	23 . VIII	51° 48' N. 2° 40' E.	50	34.99	..	15.4	..	b-s
555	V	— —	51 48 N. 1 55 E.	35	34.92	..	15.9	..	b-s
556	—	— —	— —	—	—	..	—	..	..
558	V	— —	51 56 5 N. 1 55 E.	33	34.72	34.74	17.2	17.0	b-s
559	—	— —	— —	—	—	..	—	..	s
560	—	— —	— —	—	—	..	..	—	b
566	—	24 . VIII	51 38 N. 1 40 5 E.	24	34.90	..	16.3	..	s
567	—	— —	— —	—	..	34.90	..	16.25	b
568	II	— —	51 04 N. 1 23 E.	35	35.01	34.99	15.4	15.4	b-s
569	—	— —	— —	—	—	..	—	..	s
570	—	— —	— —	—	..	—	..	—	b
575	II	— —	50 55 N. 1 32 E.	55	34.63	..	15.8	..	s
583	I	27 . —	49 51 N. 0 21 E.	33	..	33.84	..	17.5	b
590	I	28 . —	50 30 N. 0 07 W.	60	..	35.03	..	15.96	b
591	—	— —	— —	—	..	—	..	—	b
593	I	— —	50 42 N. 0 05 W.	24	35.01	..	16.8	..	s
4137	III	31 . —	51 27 5 N. 2 57 E.	?	..	..	18.3	..	b
4170	III	7 . IX	51 45 N. 2 52 5 E.	8.5	..	34.40	..	18.2	b
4183	—	— —	— —	—	..	34.41	..	—	b
4238	—	8 . —	— —	—	..	33.99	..	—	b
606	II	11 . XI	50 55 N. 1 32 E.	46	34.67	..	12.9	..	s
617	IV	12 . —	51 52 N. 2 03 E.	30	35.08	35.07	12.9	12.93	b-s
618	—	— —	— —	24	—	..	—	..	s
621	IV	— —	51 47 5 N. 2 09 5 E.	55	35.10	..	13.3	..	s
624	IV	— —	51 43 5 N. 2 18 E.	36	35.01	..	13.25	..	s
630	IV	— —	51 32 5 N. 2 40 5 E.	40	34.67	..	12.6	..	s
1907									
649	IV	4 . II	51 58 N. 2 18 E.	45.5	35.10	..	5.3	..	s
4290	III	4 . IV	51 40 5 N. 2 46 E.	?	..	..	8.4	..	b

(1) s = surface. b = bottom.

continued

Table I,

NUMBER OF SAMPLE	SECTION	DATE	POSITION	Depth m.	Salinity ‰		Temperature °C		Depth of haul (1).
					surface.	bottom.	surface.	bottom.	
1907									
4292	II	4. IV	51°13' N. 2°51' E.	..	..	..	8°2	..	b
681	IV	29.—	51 23 N. 2 27 E.	34.5	..	34.43	..	8°10	b
703	V	30.—	51 57 N. 1 51 E.	33	..	34.54	..	7 3	b
714	V	2. V	Near Deal.		..	34.87	..	8	..
4337	III	21. VI	51 14 5 N. 2 35 E.	..	..	..	..	..	s
4353	III	20. VII	51 09 N. 2 40 E.	3	..	..	16 2	..	b
4356	III	— —	51 06 N. 2 32 5 E.	6	..	..	16 2	..	b
750	V	23. VIII	51 57 N. 1 50 5 E.	34	35.01	..	16 2	..	s
758	IV	— —	51 43 N. 2 48 E.	38	35.17	35.16	15 45	15 48	b-s
759	—	— —	— —	—	—	—	—	—	s
760	—	— —	— —	—	—	—	—	—	b
740	II	26.—	50 54 5 N. 1 32 E.	51	..	34.83	..	16 0	b
776	II	— —	50 59 N. 1 27 5 E.	60	35.17	..	15 3	..	s
4427	III	2. X	51 11 N. 2 46 E.	4.5	..	..	15 7	..	b
4428	III	— —	51 11 5 N. 2 48 E.	4	..	..	15 5	..	b
1908									
831	IV	5. II	51 48 N. 2 09 E.	49	..	35.28	..	6 4	b
846a	II	6.—	51 01 N. 1 24 E.	35	35.05	..	5 8	..	s
866	IV	30. IV	51 51 N. 2 03 E.	31	..	34.70	..	6 8	b
877	II	1. V	51 04 5 N. 1 20 E.	27	34.88	34.88	7 4	7 4	b-s
4707	III	14.—	Flushing harbour.		..	..	..	..	s
4851	IV	22. VII	51 28 5 N. 2 25 E.	9	..	..	..	16 8	b
889	IV	24. VIII	51 22 N. 2 27 E.	31	..	34.16	..	17 1	b
892	III	25.—	51 23 N. 2 29 E.	16	..	31.11	..	17 2	b
898	IV	26.—	51 48 N. 2 09 5 E.	45.5	34.70	34.76	16 6	16 7	b
901	V	— —	51 57 N. 1 52 E.	47	..	34.41	..	16 5	b
904	V	— —	52 02 N. 1 40 E.	23	..	34.05	..	16 4	b
917	II	29.—	50 54 N. 1 33 E.	35	..	34.83	..	17 3	s
4908	III	11 IX.	51 17 5 N. 2 42 E.	24	..	..	15 5	..	b

(1) s = surface. b = bottom.

continued.

	<i>Sarsia tubulosa.</i>	<i>Parena gemmifera.</i>	<i>Hibocodon prolifer.</i>	<i>Turritopsis nutricula.</i>	<i>Amphinema dinema.</i>	<i>Leuckartiara octona.</i>	<i>Laodicea undulata.</i>	<i>Obelia</i> spp.	<i>Phialidium hemisphaericum.</i>	<i>Eucheilota maculata.</i>	<i>Eulonina indicans.</i>	<i>Gosseu cornetes.</i>	OTHER SPECIES
24	17 Rathkea octopunctata.
.	.	30	.	.	.	.	.	.	.	.	.	.	1 Bougainvilia superciliaris
.	4 Aequorea forskålea.
.	21	.	.	.	.	.	.	1 Mitrocoma polydiademata.
.	14	.	.	.	.	.	.
.	2	.	.	.	.	1	.	.	4	.	.	.	
.	3	.	.	.	.	1	.	.	1	.	.	.	
.	2	.	.	.	.	1	.	.	1	.	.	.	
.	.	.	6	.	.	3	.	.	.	.	.	.	1 Aequorea forskålea.
.	3	.	.	.	.	.	.	24 Mitrocoma polydiademata.
.	3	.	.	.	.	.	.	2 Mitrocoma polydiademata.
.	3	.	.	.	.
.	1 Rathkea octopunctata.
12	
1	
.	4	.	.	.	.	7	.	
3	3	.	.	14	.	.	.	1 Aequorea forskålea.
.	3	.	.	25	.	.	.	
.	100	.	.	.	.	12 Eirene viridula.
.	4	.	3	.	.	7	.	1 Eirene viridula.

Table I,

NUMBER OF SAMPLE	SECTION	DATE	POSITION	Depth m.	Salinity ‰		Temperature °C		Depth of haul (1).
					surface.	bottom.	surface.	bottom.	
1908									
4909	III	11 IX	51°47' 5 N. 2°42' E.	24	..	..	15°5	..	b
4910	—	— —	— —	28	..	..	15 6	..	b
4911	—	— —	— —	—	..	..	—	..	b
4915	III	16 . —	51°49' 5 N. 2°44' E.	17	..	..	15	..	b
4987	III	24 . —	51 47 N. 2 52 E.	7.5	..	..	15 7	15°7	s
5008	III	29 . —	51 02 N. 1 55 E.	29	..	..	16 4	..	b
932	IV	10 . XI	51 48 N. 2 40 E.	51	..	35.14	..	13 2	b
1909									
1010	V	1-2 . V	Near Deal		..	..	..	..	..
5105	III	19 . —	51 47 5 N. 2 42 E.	19	..	..	11 2	..	b
5106	III	— —	51 47 N. 2 46 5 E.	12	..	..	11 3	..	b
5111	III	— —	51 46 N. 2 49 E.	11	..	..	12	..	b
5202	III	17 . VIII	51 44 N. 2 42 E.	14	..	..	18 8	..	b
5228	III	21 . X	51 04 N. 2 06 E.	15	..	..	14 8	..	b
1910									
5250	III	12 . IV	51 46 N. 2 40 E.	10	..	..	7 6	..	b
5251	III	18 . —	51 47 N. 2 52 5 E.	12	..	..	8 6	..	b
5252	III	— —	51 49 N. 2 58 E.	7	..	..	8 9	..	b
1140	IV	30 . —	51 48 N. 2 09 E.	..	..	..	..	..	..
5274	III	18 . V	51 29 N. 2 55 E.	34	..	..	12 2	..	b
1180	II	18 . VIII	50 58 5 N. 1 28 E.	60	..	34.67	..	16 2	b
1911									
1241	IV	1 . V	51 32 5 N. 2 41 E.	53	..	33.31	..	7 6	b
1275	IV	23 . VIII	51 48 N. 2 09 E.	59	..	34.58	..	18 1	b
1912									
1381	IV	25 . VIII	51 33 N. 2 40 E.	25.5	..	33.39	..	15 8	b
1383	IV	— —	51 47 N. 2 40 E.	42	..	33.44	..	15 3	b
1390	V	26 . —	Near Deal.		..	..	..	..	..

(1) s = surface. b = bottom.

continued.

Table I,

NUMBER OF SAMPLE	SECTION	DATE	POSITION	Depth m.	Salinity ‰		Temperature °C		Depth of haul (1).
					surface.	bottom.	surface.	bottom.	
1912									
1518	II	27. VIII	51°04' N. 4°20'5 E.	29	..	34.64	..	15°75	b
1531	IV	13. XI	51 48 N. 2 10 E.	51	..	34.70	..	11 8	b
1913									
5550	III	25. IV	51 18 N. 3 03 E.	9	..	..	8°5	..	b
1590	IV	28. —	51 22 5 N. 2 26 5 E.	31	..	34.43	..	9 0	b
1615	II	30. —	50 59 N. 1 27 5 E.	51.5	..	36.08	..	9 5	b
1628	IV	2. V	51 30 N. 2 41 E.	..	..	..	..	..	..
5555	III	5. —	51 18 N. 3 03 E.	6	..	..	11	..	b
5557	III	8. —	51 14 N. 2 54 E.	3	..	..	10 7	..	b
5553	III	27. —	51 47 5 N. 2 58 5 E.	4.5	..	..	6 6	..	b
1637	IV	25. VIII	51 32 N. 2 40 5 E.	18	..	33.31	..	16 8	b
1650	V	26. —	Near Deal.	..	34.61	..	16 6	..	s
1653	II	27. —	51 03 5 N. 1 18 E.	24	..	34.63	..	16 6	b
1656	II	— —	50 59 N. 1 27 E.	..	..	..	..	..	..
1659	II	— —	50 55 N. 1 32 E.	49	..	34.60	..	16 8	b
1660	I	— —	Near Newhaven.	..	34.92	..	17 2	..	s
1662	I	— —	50 34 N. 0 07 W.	..	35.01	..	16 1	..	b
1914									
1730	I	5. II	50 39 N. 1 33 E.	22	..	..	4 5	..	s
5632	III	10. VI	51 09 5 N. 2 43 E.	6	..	..	14	..	b
3636	III	13. —	Near Ostende.	..	..	..	..	..	..

(1) s = surface. b = bottom.

continued.

TABLE II. — Distribution of the most important species in the various sections of the area investigated.

KRAMP, P. L. — HYDROMEDUSAE

SPECIES	Number of finds in each section.						Number of specimens found in each section.						Indigenous in :				
													The Channel.	Sections.			
	I	II	III	IV	V	Tot.	I	II	III	IV	V	Tot.		III	IV	V	
<i>Sarsia tubulosa</i> . . . . .	.	1	.	8	4	40	.	1	.	57	10	68	(X)	(?)	X	X	X
<i>Purena gemmifera</i>	1	2	3	11	.	17	1	3	3	188	.	195	X	.	X	X	X
<i>Ectopleura dumortieri</i> . . . . .	.	.	.	6	.	6	.	.	.	16	.	16	X	.	X	X	X
<i>Hybocodon prolifer</i>	2	5	1	3	1	12	69	41	4	22	30	166	X	.	X	X	X
<i>Turritopsis nutricula</i>	2	9	7	11	3	32	19	40	12	14	8	93	X	X	.	X	.
<i>Amphinema dinema</i> . . . . .	.	1	.	5	1	7	.	1	.	10	1	12	X	.	.	.	.
<i>Leuckartiara octona</i> . . . . .	.	3	14	2	3	22	.	26	250	7	5	288	X	X	X	X	X
<i>Laodicea undulata</i>	2	4	3	10	.	19	3	22	4	76	.	105	X	.	X	?	X
<i>Obelia</i> spp. . . . . .	.	3	2	1	.	6	.	8	21	2	.	31	X	X	?	X	X
<i>Phialidium hemisphaericum</i> . .	5	8	6	28	13	60	50	175	26	c. 700	c. 650	c. 1600	X	(X)	X	X	X
<i>Eucheilota maculata</i> . . . . .	.	1	5	.	1	7	.	1	36	.	1	38	.	X	.	?	X
<i>Eirene viridula</i> . . . . .	.	1	2	1	.	4	12	3	1	.	16	X	.	X	.	.	X
<i>Eutonina indicans</i> . . . . .	.	13	1	.	14	.	120	1	.	121	.	129	X	.	.	?	X
<i>Gossea corynetes</i>	1	4	8	5	2	20	49	7	58	11	4	129	X	.	.	.	.

(X) = rare

LITERATURE QUOTED

1862. AGASSIZ, L., *Contributions to the Natural History of the United States.* (2 monogr., vol. IV.)
1857. ALDER, J., *A Catalogue of the Zoophytes of Northumberland and Durham.* (Transact. Tyneside Nat. Field Club, vol. III.)
1905. BROCH, H., *Zur Medusenfauna von Norwegen.* (Bergens Museums Aarbog, 1905.)
1896. BROWNE, E. T., *On British Hydroids and Medusæ.* (Proceed. Zool. Soc. London, 1896.)
1903. — *Report on some Medusæ from Norway and Spitzbergen.* (Bergens Museums Aarbog, 1903.)
1848. FORBES, E., *A Monograph of the British Naked-eyed Medusæ* (London).
1879. HAECKEL, E., *Das System der Medusen.*
1911. HARTLAUB, CL., *Craspedote Medusen*, 1. Teil, 2. Lief. (Nordisches Plankton, Bd XII.)
1919. KRAMP, P. L., *Medusæ*, Part 1. *Leptomedusæ.* (The Danish Ingolf Exped., vol. V, Part. 8.)
1924. — *Medusæ.* (Rep. Danish Oceanograph. Exped. 1908-1910 to the Mediterranean, etc., vol. II, H. 1.)
1927. — *The Hydromedusæ of the Danish waters.* (Mém. de l'Acad. des Sciences et des Lettres de Danemark. Sect. scient., 8^e sér., t. XII, n° 1.)
1910. MAYER, A. G., *Medusæ of the World.*
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