

HYDROMEDUSAE IN THE SURFACE WATER AROUND THE "TEXEL" LIGHTVESSEL

by

S.M. VAN DER BAAN

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I. SUMMARY

The Hydromedusae collected in six years (1961-1966) of macroplankton research at the "Texel" lightship, are discussed, with seasonal occurrence and dates of peaks, if possible, given.

Of the Anthomedusae the following species were of regular occurrence: *Sarsia tubulosa*, *Steenstrupia nutans*, *Turritopsis nutricula*, *Bougainvillia britannica*, and *Leuckartiara octona*; further species comprise: *Sarsia gemmifera*, *Hybocodon prolifer*, *Podocoryne borealis*, *Rathkea octopunctata* and *Bougainvillia principis*.

In the Leptomedusae the extreme abundance of *Phialidium hemisphaericum*, except for a short period in spring, proved a great handicap, since it was impossible to sort out and identify every single one of the thousands of medusae. Therefore quite a number of specimens of other species may have gone undetected in the routine research. The following species were found. *Laodicea undulata*, *Melicertum octocostatum*, *Mitrocomella brownei*, *Cosmetira pilosella*, *Phialidium hemisphaericum*, *Obelia* spp. *Lovenella clausa*, *Eucheilota maculata*, *Phialella quadrata*, *Eirene viridula*, *Helgicirrha schulzei*, *Aequorea vitrina* (discussed in some detail with sizes etc. given) *Eutima gracilis* and *gegenbauri*, *Tima bairdi* (also with sizes given). Various hydroids of the *Obelia* *Laomedea* group were also collected.

Of the Limnomedusae only *Gossea corynetes* was found.

Of the Trachymedusae a remarkable influx of *Aglantha digitale* in 1962 is discussed.

II. INTRODUCTION

From 1961 (mid. January) to the end of 1966 macroplankton was collected around the "Texel" lightship by means of a net of Saran gauze (mesh 2 mm) as described in CREUTZBERG (1961). The original net was intended for the catch of elvers. Since it was emptied at every slack tide, each catch represented one ebb or flood. At first the main aim of the research was to study the occurrence of ephyrae and post-ephyrae of Scyphomedusae, but soon the total macroplankton was studied or put at the disposal of other marine biologists.

The hydromedusae were sent to the Rijksmuseum v. Natuurlijke Historie, Leiden, on behalf of J.C.A.M. SARABER, who identified and described them for a graduation subject. He did not count them, so that his report, a copy of which is kept in the NIOZ files, does not give any information on peak periods, he finished his subject in July 1961. As we failed to find somebody else interested in our hydromedusae we included them in our research from about April 1962 onwards. The material of 1961 and the early months of 1962 is therefore incomplete, though the identifications by Saraber have been included in the observations.

After nearly two years the fishing schedule was reduced to 12 samples a week, if possible on consecutive days, and for 1966 - the last year of the research - to 6 samples a week, again consecutive ones, weather permitting.

The main drawback in the identification of hydromedusae proved to be the overwhelming abundance of *Phialidium hemisphaericum* (and probably similar species) in late summer and autumn, preventing any exactitude in counting and identification of all the species present. Moreover this species was

sometimes heavily infested by nematodes, which might have left only an almost empty umbrella (see discussion of *Ph. hemisphaericum*). Under these circumstances only a rough sketch of peak occurrence etc. can be given.

Since each haul represented the catch during either a flood - or an ebb - period, the separation between flood - and ebb - occurrence is a clear one. Less easy is that between light and dark hours, since the times of the hauls shifted with the tide and might include daylight, twilight and night. Also, given a random distribution, the chance of being caught during the hours of total or partial darkness is greatest for a "cold" species which has its main period of occurrence around midwinter, while a midsummer species stands a greater chance of being caught during daylight hours.

III. LIST OF COLLECTED SPECIES

Order Anthomedusae:

- | | |
|------------------------|---------------------------------|
| fam. Corynidae: | <i>Sarisa tubulosa</i> |
| | <i>Sarsia gemmifera</i> |
| fam. Tubulariidae: | <i>Hybocodon prolifer</i> |
| | <i>Steenstrupia nutans</i> |
| fam. Clavidae: | <i>Turritopsis nutricula</i> |
| fam. Hydractiniidae: | <i>Podocoryne borealis</i> |
| fam. Rathkeidae: | <i>Rathkea octopunctata</i> |
| fam. Bougainvilliidae: | <i>Bougainvillia britannica</i> |
| | <i>Bougainvillia principis</i> |
| fam. Pandeidae: | <i>Leuckartiara octona</i> |

order Leptomedusae

- | | |
|-----------------------|---|
| fam. Laodiceidae: | <i>Laodicea undulata</i> |
| fam. Melicertidae: | <i>Melicertum octocostatum</i> |
| Fam. Mitrocomidae: | <i>Mitrocomella brownei</i> |
| | <i>Cosmetira pilosella</i> |
| Fam. Campanulariidae: | <i>Phialidium hemisphaericum</i> |
| | <i>Obelia</i> spp |
| | and the hydroids: <i>Campanularia</i> |
| | spp and <i>C. johnstoni</i> : <i>Obelia geniculata</i> (L) = <i>Laomedea geniculata</i> (L) |

	<i>Laomedea bicuspidata</i>
	" <i>dichotoma</i> (L.)
	" <i>pelagica</i>
	" <i>gelatinosa</i>
	" <i>geniculata</i> (L.)
	" <i>longissima</i>
Order fam. Lovenellidae:	<i>Lovenella clausa</i>
	<i>Eucheilota maculata</i>
fam. Phialellidae:	<i>Phialella quadrata</i>
fam. Eirenidae:	<i>Eirene viridula</i>
	<i>Helgicirrha schulzei</i>
fam. Aequoreidae:	<i>Aequorea vitrina</i>
fam. Eutimidae:	<i>Eutima gracilis</i>
	<i>Octorchis gegenbauri</i> = <i>Eutima</i>
	<i>gegenbauri</i>
	<i>Tima bairdi</i>
Order Limnomedusae	
fam. Olindiidae:	<i>Gossea corynetes</i>
Order Trachymedusae	
fam. Rhopalonematidae:	<i>Aglantha digitale</i> var. <i>rosea</i>

IV. SEASONAL OCCURRENCE AND DISCUSSION OF THE SPECIES

See Tab. I.

Anthomedusae

Sarsia tubulosa (M. Sars)

This species has been collected from winter to early summer. In 1961 it occurred between 11 April and 16 June, but the exact numbers are not known. In 1962 two specimens were seen in January, on the 26th and 28th resp. In the next months the hydromedusae were not counted, but *Sarsia tubulosa* was present after mid-March. Starting April 1962 all hydromedusae were identified and, whenever possible, counted separately. The species is present in increasing numbers, the highest being 57 in one haul (daylight flood) on 26 April. Between 22 April and 7 May it is present in every haul, then it decreases quickly and the last one is caught on 15 May. During the peak period flood numbers exceed ebb numbers. On 2 December another speci-

men is caught, probably the forerunner of the 1963 season. In 1963 it occurs fairly regularly between 23 and 30 January, the highest catch being 11 specimens in an ebb haul at night. In February the sea's temperature dropped below zero, fishing was stopped on 16 February and resumed on 13 March. The next specimen was caught on 25 April and then only occasionally and in low numbers between 7 May and 12 June. Though the numbers are too low to permit any definite conclusion, the predominance of flood catches over ebb catches seems to be lost. In 1964 the species is present in low numbers from 20 February onwards and more regularly, though still in low numbers, between 14 and 17 April, which represents the "peak" of this year's occurrence. After that only single specimens are caught, at intervals of several days, till it disappears in June with a catch of 5 specimens on the 2nd and the last specimen on the 18th. There is a very slight but not significant dominance of flood numbers. In 1965 *Sarsia tubulosa* makes its come-back. The first specimens are caught on 25 February, on 3 March there are already 59 in one haul (early morning flood). Till 30 March it is caught regularly but in low numbers, next there are some peak periods of a few days, alternating with low numbers and after mid-April there are catches of some 100-200 and even 346 specimens per haul (daylight flood on 30 April). In May the catch changes abruptly to very low numbers (last catch on 13 May), then none at all till 21 June (2 specimens) and the last one is caught on 1 July. There is a clear dominance of flood catches. In 1966 the species is again scarce. The first one is caught on 8 March, the next one on 6 April and numbers remain low, the catch of 10 specimens in a night-flood on 9 May representing this year's "peak". The end comes abruptly on 31 May.

I have given these data in some detail because *Sarsia tubulosa* is an easily recognizable species, mentioned by various authors, a.o. KÜNNE (1937), RUSSELL (1939), as characteristic for coastal water. Its tendency to be more numerous in flood hauls than in ebb hauls could be in accordance with its coastal origin (see VAN DER BAAN 1975 on the interpretation of *Crangon* catches and DIETRICH, 1953). The low numbers for 1963 and 1964 might have been due to the extremely cold spring of 1963, with ice-formation along the coast and the Wadden Sea almost completely frozen over. This must have done a great deal of damage to the hydroids, if not by actual freezing then by the ice-floes moving up and down with the tidal currents. The comparative increase in ebb numbers for these two years might point to a temporary breakdown of the coastal hydroids. On the other hand the year 1965, in which *Sarsia tubulosa* was very numerous, was a very favourable year for various species and in 1966 the species was again low in numbers, though the winter had been mild.

VERVOORT (1946a) describes the hydroid from Den Helder and states that it is much less common than the medusa. More recent publications prove however, that both the hydroid and medusa are common to abundant in the Wadden Sea and also in other places along the coast (LUCAS, 1950; MULDER, 1956; DEN HARTOG, 1961; VADER, 1963). TULP (1961) found the hydroid to be locally abundant in the *Fucus* zone at the line of low tide, where it is protected against desiccation, but also on the poles of jetties etc. and on mussels and cockles. He found the medusae in the Wadden Sea in May and June (TULP, 1955). TULP (1963) and VADER (1963) mentioned it as a host to *Hyperia galba*.

Sarsia tubulosa is recorded from April/May to June or July for Valencia (DELAP & DELAP, 1906); from February to June with a maximum from March to May for the Kieler Förde by KÄNDLER (1961); from December to July for the Elbe estuary by KÜHL (1962), from January to July for the outer Elbe (KÜHL & MANN, 1967); from March to May for the German Bight (KÜNNE, 1952). At the other side of the North Sea HAMOND (1957, 1963) records it as a spring and summer species for the Norfolk coast. In Scandinavia ALLWEIN (1968) records it from about mid-April to mid-May for the Øresund, and RUNNSTRØM (1931), for the Herdla and Hjeltefjord, calls it a summer species. Our data seem to fit well into the seasonal distribution.

Sarsia gemmifera Forbes

This species was found on two occasions, 2 June 1966 in a flood-haul in the morning one doubtful (damaged) specimen, and on 7 June 1966 two specimens in a flood-haul in the evening. It is recorded as a summer-species (DELAP & DELAP, 1906; KRAMP, 1927; KÜNNE, 1952; ALLWEIN, 1968). RUSSELL (1953) describes it as "not abundantly recorded" and his data suggest a distribution in oceanic water.

Hybocodon prolifer L. Agassiz

On 11 March 1961 two specimens of this species were caught in an ebb in the night. The next record is 4 June 1964. Between 4 and 22 June 1964 6 specimens are recorded: 4 in three ebb hauls, 2 in a flood haul. In 1966 25 specimens are caught, 1 on 15 April (ebb), 6 on 17 May (ebb), and on 12 May 9, 4 and 5 specimens in consecutively a flood -, an ebb and a flood haul.

Hybocodon prolifer is considered to be a northern boreal

species (a.o. KRAMP, 1927, RUSSELL, 1953) occurring from mid-winter (KRAMP, 1927). RUNNSTRØM (1931) calls it a typical spring species for the Herdla and Hjeltefjord. KÜHL (1962) considers it a straggler (Irrgast) for the Elbe estuary, but KÜNNE (1952) records it from the German Bight in March, May and July, which is in accordance with our data. AURICH (1958) mentions the relation with temperature: at $1-3^{\circ}\text{C}$ the asexual reproduction starts with a peak in May and June, the sexual reproduction starts at $14-16^{\circ}\text{C}$. These data refer to the southern North Sea. VERVOORT (1946a) states that only the medusa but not the hydroid has been recorded from Dutch waters. For the lightship catches the temperatures vary between 5.8°C (15 April 1966) and 13.7°C (17 May 1966). For 1961 and 1964 the pertaining salinities vary between 33.0 and $34.6\text{ }^{\circ}/\text{oo}$, for 1966 they were definitely "coastal": $31.5\text{ }^{\circ}/\text{oo}$ on 15 April, $28.5\text{ }^{\circ}/\text{oo}$ on 17 May and $31.6\text{ }^{\circ}/\text{oo}$ on 18 May.

Steenstrupia nutans (M. Sars)

In 1961 these species was found on 27 May and 9 July, in both cases in evening ebb-hauls; the numbers are not known, but they are probably low. In 1962 it was not found, in 1963 there are 3 records from September, suggesting that the cold spring of 1963 has retarded its development. The dates are 5 12 and 17 September, with 1.1 and 3 specimens resp. all ebb hauls and all partly completely in the dark hours. In 1964 there are 3 ebb and 2 flood catches, all except one at night or partly at night and all in June: 4.5, 21.22 (2 hauls) June. The biggest catch is 11 specimens (ebb, late evening on 22 June), and in one haul the very young-medusae are sticking together in "clusters" (Fig. 1). In 1965, of the seven catches between 15 June and 5 July, six concern only clusters of specimens. The last

haul on 5 July had only one separate specimen. Four were ebb hauls and three flood hauls and all but one took place during total or partial darkness. In 1966 all specimens were normal. They occurred from 17 May to 7 July, with a definite peak from 7 to 9 June (117, 70-21 and 11 specimens in the respective hauls). There were eight hauls in all, six ebb and two flood, of which six were night hauls, one haul during daylight and one late in the evening. Therefore the data suggest that at the "Texel" lightship *Steenstrupia nutans* is to be found mainly in ebb currents in the night, as a summer species.

It is not clear why, especially in 1965, the young medusae were caught sticking together in clusters. Prof. Vervoort, who examined the catches, could find no explanation. The tentacles seem to have got entangled, probably at liberation of a lot of young medusa all at the same time, from a great number of hydroids growing close together near the lightship (VERVOORT, in a letter of 14 July 1965). They only were retained in the net because they were entangled, young medusae of that size would have escaped through the meshes.

Except for the abnormal year of 1963 the period of occurrence agrees with the records for Plymouth (RUSSELL, 1938) and is slightly earlier than the data given for the German Bight (KRAMP, 1927; KÜNNE, 1952), VERVOORT (1946a) assumed the hydroid to be indigenous, though he had no verifiable records for the Netherlands.

Turritopsis nutricula Mc. Crady

The species was present in every winter of the research, but only in low numbers. In 1961 it was found in November on the 6th, 7th and 20th with 2, 1 and 1 spec. resp. It may have been present in December, but at that time not all the hydro-

medusae were identified. In 1962 it is caught in single specimens on 3, 4 and 22 December, with a specimen on 17 January 1963 belonging to the same period. At the end of 1963 it was more numerous than in any other year of the research. Separate catches were recorded on 9, 15 and 16 November, but from 27 November to 5 December it is present in practically every haul, with one to 8 specimens per haul. On 9, 10, 17 and 23 December single specimens are caught and the last catch is a specimen on 18 January 1964. There are no records for the end of 1964, but on 19, 20 and 21 January 1965 there are again catches of single or two specimens. The 1965 and 1966 period starts with single specimens on 16 and 20 December 1965, 3 specimens on 4 January 1966 and single specimens on 14 and 17 January. It was not found in the last months of 1966.

Single specimens tended to occur in ebb hauls, but during the peak of 1963 *Turritopsis nutricula* was present in every haul, so that for the six years of the research the total sum is 12 successful flood hauls against 18 ebb hauls. The relation between light and dark period is 5 daylight hauls against 25 hauls completely or for the greater part in the dark hours but, as has been said in the Introduction, the chance of being caught in the dark hours is relatively greater for a midwinter species than for a summer species.

Several authors consider *Turritopsis nutricula* to be an indicator of Channel water (KRAMP, 1930, WULFF, BÜCKMANN & KÜNNE, 1934, RUSSELL, 1938, 1953; FRASER, 1965, EDWARDS, 1968). At the "Texel" lightship a water sample for the determination of salinity was taken every day at 8 A.M., therefore the salinity data do not always refer to the actual haul in which *Turritopsis* was found. With the exception of three samples (32.2 ‰ on 18 Jan. 1964, 32.4 ‰ on 20 Jan. 1965 and

28.4 ‰ on 4 Jan. 1966), which may be due to this divergence, they all fell between 33 and 35.6 ‰, usually over 34 ‰. This is in accordance with the supposed inflow of Channel water, which actually reaches as far as the lightship.

Podocoryne borealis (Mayer)

There are only three records for this species, 1 specimen on 7 November 1961, 1 on 9 and 1 on 10 October 1963. RUSSELL (1953) says that it is never numerous in the plankton, but that in British waters it has been recorded for every month of the year, except February, October and November. EDWARDS (1972) found it to be common in the Clyde Sea area where the medusa is found from February to November. Our specimens may just have been stragglers.

Rathkea octopunctata (M. Sars)

There is only one record of this species: one specimen in an ebb haul in the night of 3 to 4 April 1961. It is possible that is usually too small - full-grown species being 1-4 mm (RUSSELL, 1953)- to be taken by the net.

Bougainvillia britannica Forbes

For this species there are records for 1961, '64, '65 and '66, with the restriction that the last specimen for 1964 and the only specimen found in 1965 could not be identified further than the genus. The data are for 1961: 18, 23 and 24 May, 9 and 12 July; for 1964, 3, 4 and 22 June; for 1965: 11 March and for 1966, 17 and 25 May. For 1961 the exact numbers are not always known, for the other years it always concerns single specimens, except on 17 May 1966 when 10 specimens were caught in one haul. Together there are 4 flood hauls and 7 ebb hauls.

It seems curious that the species should have been absent in 1962 and '63 and rare in the next two years. In 1966 the fishing schedule was restricted to 6 samples per week (see Introduction), so that the peak, indicated by 10 specimens on 17 May have been more extensive KÜHL (1962) and KÜHL & MANN (1967) consider the species as rare, non-indigenous and a straggler for the outer Elbe-estuary, but KÜNNE (1952) found it in the German Bight, in May - July and September, especially in spring, and also in the Wadden Sea near Sylt, VERVOORT (1946a) doubts the occurrence of the hydroid around our coast.

Bougainvillia principis (Steenstrup)

There are only three records of this species; 12 and 19 May and 8 June 1961. KRAMP (1927) calls it a northern species, with SW Ireland and Heligoland as its southernmost line of distribution, RUSSELL (1938) says that it is "commoner on the northern and outer-western coast of the British Isles than in the English Channel area". I think we may consider our specimens to be "stragglers".

Leuckartiara octona (Fleming)

This is a very common species, with maximum catches of over a thousand specimens in one haul, with a definite dominance of flood catches, except for the end of the year. For 1961 the exact numbers and dates are not known and the data are not reliable, which is why they are not recorded in the diagram. In 1962 the first reliable identification is a specimen in 8 July. It is numerous in early November, when the net was full - and probably clogged by - hydroids, mainly *Laomedea pelagica* (see later), and again in early December, with a peak of about 200 specimens in an ebb haul on 6 December. It de-

creased in January 1963 when the extreme cold set in, and, after fishing is resumed on 13 March, there is one specimen caught at the 16th. It is back again in September, at first rather irregular, but practically continuous after 9 October with peaks of 201 specimens in a flood haul on 18 October, 659, 819 and even 2386 specimens in haul in early November, all in flood hauls. The numbers decrease after mid-November and the last specimen of this season is caught on 3 March 1964. In August the first specimens of the '64/'65 season turn up, after 21 September it occurs regularly, on 25 October there are already 214 specimens in one flood haul, then follow regular catches of over a hundred specimens, alternating with lower catches, on 11 November there are 456 in a flood haul. On 22 November the two flood hauls of this date contain 1819 and 1818 specimens respectively and, though after mid December there are no more catches of over a hundred specimens, it is still caught regularly till 12 January 1965. After mid December the maximum catches are in the ebb hauls. On 11 March 1965 the last specimen of this season is caught. The 1965/66 season begins on 19 August 1965. Catches of over a hundred - usually some 200 specimens - occur after mid October - with a maximum on 9 November (1226 in a flood haul). The numbers decrease after mid-November, but the species occurs in practically every haul till the end of the year. In January 1966 it peters out, the last specimen for January is on the 16th, there is another one on 6 April one on 3 May, and two on 18 May (in two catches) In 1966 the late summer and autumn catches are much lower than in previous years, which cannot be ascribed to the restricted fishing program. In late summer there was an invasion of *Pelagia noctiluca* from the Channel regions (VAN DER BAAN, 1967a & b), which may have kept the usual coastal supply of *Leuckartiara*

octona away from the lightships. There is a slight peak in early November (max. number 79 in a flood haul) and another one in early December, with catches of 95 and 91 specimens on 5 and 7 December. After mid December there are only occasional catches.

Near the "Texel" lightship *Leuckartiara octona* is an autumn to midwinter species, with a dominance of flood numbers, except at the end of its period. RUSSELL (1953) says that it occurs chiefly in the plankton from April to October, however, our peak period is obviously around November. KRAMP (1930) named August as the final month for liberation of medusae from the hydroid - with exceptions - but for the Northumberland coast these data are September to February (ROBSON, 1914). The medusa seems to be long-lived (RUSSELL, 1953). The hydroid is known from various parts of the Dutch coast (VERVOORT, 1946a; TULP, 1955). A dominance of flood catches points to a coastal origin (VAN DER BAAN, 1975). The transition to ebb maxima at the end of the seasonal period may be caused by medusae having drifted to the open sea.

See Table II
Leptomedusae

Laodicea undulata (Forbes & Goodsir)

There is only one record of this species, namely on 9 May 1966 in a flood haul in the evening: 2 damaged specimens, which could not be identified with absolute certainty.

Melicertum octocostatum (M. Sars)

This species is mentioned by Saraber in an ebb catch on 2 June 1961. It was found again on 4/5 June 1964 in a midnight flood. In 1965 on 30 September there were 4 in an ebb catch.

RUSSELL (1953) records *Melicerium octocostatum* as being a mainly northern species.

Mitrocomella brownei (Kramp)

The only record is a flood haul in the night of 23 to 24 May 1961. It may have occurred in some of the abundant *Phialidium* catches (see below) where it may easily have escaped detection. However, according to RUSSELL (1938, 1953) it is not a common species. HAMOND (1963) records a catch on 17 September and thinks that it may be a summer species of 13°C or above. The temperature of our catch was 11.5°C.

Cosmetira pilosella Forbes

For 1961 there are three records, one on 18 April (3 specimens) and on 17 and 19 May of which the exact numbers are not given. It is absent in 1962 and '63, perhaps due to cold winters, and it is late in 1964, when it is recorded on 25, 26 and 28 October, always in single specimens. In 1965 one specimen was found on 5 March and another one in 1966 on 9 May 1966.

The species is said to be characteristic of mixed coastal and oceanic waters, according to various authors, e.g. KÜNNE (1937), RUSSELL (1939) FRASER (1965) considers it an indicator for northern North Sea water, EDWARDS (1968) says that it enters the North Sea both from the NW and from the Channel, and that it is numerous in the southern North Sea.

Phialidium hemisphaericum (L.) and similar species

Especially in autumn this species used to be present in such overwhelming numbers that it was impossible to identify every separate specimen. Many similar species may have been present but escaped detection. Peak numbers vary between

"several thousands" and "one or two buckets-full" thrown overboard at the lightships. During these peak period the highest numbers are found in the ebb hauls.

Even with the restriction that some similar species may have been overlooked, it is clear that *Phialidium hemisphaericum* is very abundant around the "Texel" lightships from about June to mid January, then decreases to total absence for 2-3 months in spring and then quickly reaches maximum numbers again.

Especially in late autumn and winter parasitic nematods occurred in the medusae. Dr. A. Coomans of the Zoological Institute, University of Ghent, Belgium, kindly identified them as the larval stages of *Contracaecum aduncum* (letter of 11 Dec. 1964). RUSSELL (1953) also mentions nematods in *Phialidium islandicum*.

The seasonal occurrence of *Phialidium hemisphaericum* is in agreement with the general picture suggested by the data in literature, KÜHL (1962) found it in the Elbe estuary all the year round except in January, February and March, KÄNDLER (1961) in the Kieler Förde from August to spring, with a peak in October and November. According to ALLWEIN (1968) it is never very numerous in the Øresund, there is a peak in December and January, but afterwards only a few species. For the Norfolk coast HAMOND (1957, 1963) says: *Obelia* spp and *Phialidium hemisphaericum* the whole year round, but very scarce from November to March, with between June and October in the Thames estuary, while RUSSELL (1938) says that in Plymouth it is abundant from March to October, decreases in winter and may be absent in January and February.

The statement in the Atlas of Marine Environment that it is one of the indicator species for northern North Sea water

(FRASER, 1965) may be true for *Phialidium islandicum*, but not for *Phialidium hemisphaericum*.

The hydroid is found all along the Dutch coast (VERVOORT, 1946a, b; LUCAS, 1950; MULDER, 1956).

Obelia sp

Only one specimen of this species is recorded, from an ebb-haul in the night of 25/26 November 1962, at a salinity of 35.2 ‰. It is not easy to explain why it is not mentioned more often. It may have escaped notice in the great masses of *Leptomedusae*, but, is so, why was this one singled out? It seems more likely that it may be scarce in surface waters.

The hydroids of the *Obelia* species are certainly very common. Every autumn they were caught in the plankton net, sometimes in masses. Not every specimen was identified, but some of the least damaged were sent to Prof VERVOORT of the Rijksmuseum van Natuurlijke Historie, Leiden, for identification. They are listed in order of abundance.

The most abundant species was *Obelia* or *Laomedea pelagica* (van Breemen) which in 1961/62 was found between 29 August 20 January and again between 2 October and 29 December 1962. In 1963, after the extremely cold spring, it is only mentioned on 16 and 18 October, in 1964 only on 21 October, in 1965 it is found between 26 August and 14 December and perhaps later (not identified) and in 1966, with a much restricted fishing program, on 8 and 9 November.

Laomedea dichotoma (L.) was found on 5 October 1963, 27 October 1964, 12 October to 14 December 1965, 18 May, 13 August and 5 October 1966.

Laomedea gelatinosa (Pallas) was found from 11 October to 8 November 1965 and on 25 October 1966.

Laomedea geniculata (L.) was found on 1 July 1964 and on 18 and 25 March 1965.

Laomedea longissima (Pallas) was found on 1 July and 21 October 1964.

Laomedea bicuspidata (Clark) A piece of a hydroid, belonging to this species, was found on 8 September 1965.

Other hydroids are, *Campanularia* spp found between 10 and 16 October 1961 and again (*C. Johnstoni* Alder) in 1965 on 12 October and 4 November.

specimens from the *Tubularia* species, which were abundant in 1961, but afterwards disappeared completely, perhaps due to a new anti-fouling treatment of the lightship, have never been counted as they were sure to come directly from the vessel itself.

All the hydroids named above have been recorded for the Netherlands coast and coastal waters (VERVOORT, 1946a & b; LUCAS, 1950; MULDER, 1956; TULP, 1961, 1964).

Lovenella clausa Hincks

The only record of this species is that of 31 May/ 1 June 1961, when it was found in an ebb haul, according to the report by SARABER. In an routine research it may have escaped notice in the masses of *Phialidium*, though literature data suggest that it is not a very common species (RUSSELL, 1953; KÜHL, 1962).

Eucheilota maculata Hartlaub

This species is more easily distinguishable from *Phialidium*, however, since it occurred together with such huge amounts of *Phialidium hemisphaericum* that their was no time to sort out all the leptomedusae, its preserme has been noted, but

not the actual numbers, so that no peak periods can be indicated. For the end of 1961 and for 1962 these notes are rather haphazard, since we were at a loss what to do with the unmanageable amounts of Leptomedusae. In 1963 after the cold spring, there were fewer *Phialidium*s and, as it seems, also fewer *Eucheilota*, since the only record I can find is one of 6 November, but some may have been overlooked. In 1964 there were buckets full of Leptomedusae thrown overboard at the lightship. On 5 November the first *Eucheilota* are recorded, very much damaged and from then on they occur regularly including for instance some hundred specimens, together with about 1000 *Phialidium* on 12 November. This occurrence lasts to about mid-December, but the specimens are rather damaged and after 5 December the records are doubtful. In 1965 the first record dates from 12 October, the last from 23 December, the specimens are often too damaged to be quite sure. The data for the end of 1966 also speak of very much damaged specimens, but from 21 November to the end of the year remains of *Eucheilota* have been recorded.

At the "Texel" lightship *Eucheilota maculata* is certainly present in late autumn, often lasting till the end of the year. The data for the German Bight are roughly from July to November (KÜHL, 1962, 1967; KÜHL & MANN 1967, 1968, 1969, 1971).

Phialella quadrata (Forbes)

This species has been recorded by SARABER for 3, 6, 17, 18 and 23 May 1961. It seems very likely that in the other years it was always taken together with *Phialidium*, though the data in RUSSELL (1938) suggest a rather uneven distribution. HAMOND (1957) found it for the Norfolk coast, but the fauna of the western side of the North Sea differs from that

on our side. Still, a closer search may reveal it to be common on our side, at least in coastal waters.

The two species belonging to the Eirenidae may also have been overloaded in the masses of *Phialidium*.

Eirene viridula (Peron & Lesueur) was found in an ebb haul in the night of 1 to 2 June 1961, and *Helgicirrha schulzei* Hartlaub from 28 to 30 May 1961 and on November 1962.

Aequorea vitrina Gosse

In 1961 the first specimen was caught on 30 May, the next one on the following day, then in June there was one specimen on the 27th, and from 2 July to (August there were regular catches of 1 to 6 specimens, varying in diameter between 55 and 110 mm. In 1962 it turned up again on 2 January, a damaged specimen which could be either *Aequorea* or *Eutomia*, and then again on 3 February (1 specimen, 65 mm $\varnothing$) and 8 February (2 specimens, 43 and 55). It was not found in summer, but ten more specimens were caught between 4 September and 27 December, the diameters varying between 50 and 80 mm. In 1963 *Aequorea vitrina* was late, just as many other species after the exceptionally cold spring. There were 7 specimens in all, caught on 25, 29, 30 and 31 October, 1 November, 6 and 9 December, the diameters varying between 15 and 50 mm. In 1964 there were only two records, 1 specimen of 90 mm $\varnothing$ on 12 February and a damaged specimen on 18 December. In 1965 one was caught on 30 June and one on 31 December, diameter 75 mm. In 1966 eight specimens were caught, four on the 4th January (25-50 mm) and the other four between 1 and 6 July (35-90 mm). Of the 86 specimens caught in the six years of fishing, 61 came from flood hauls and 25 from ebb hauls, which points to an origin from the SW or from the coast. A specimen is represented in Fig. 2.

VERVOORT (1946a) thinks it possible that the hydroid has been found on a ship at Den Helder, but the material was young and sterile and did not permit any definite identification. The species was also collected near the shore at Flushing on 5 August 1960 G. Heerebout collected one specimen of about 10 cm diameter out of a swarm of 13 and on 18 July 1961 he found another one of 7 cm. The first one contained a specimen of *Hyperia galba*. On 4 November 1962 he saw 3 specimens in the strandline on about 2 km of beach near Flushing (G. Heerebout, in lit.).

HAMOND (1957) found that in Blakeney Harbour the species occurred "every year in June and July, up to about 150 mm in diameter and often in great abundance". He also mentions some very young specimens in July and August (HAMOND, 1963). RUSSELL (1953) also mentions winter records.

Eutima gracilis (Forbes & Goodsir)

This species was found in 1964 (4 specimens) and 1965 (60 specimens and some ragged pieces). In 1964 the dates were 25 October, 12 and 18 November, in 1965 it occurred between 7 September and 12 October. Flood hauls yielded 24 specimens and ebb hauls 43. In 1964 the temperatures varied between 12.5 and 10.3 °C, in 1965 between 16.3° (on 7 Sept.) and 14.5°C (on 12 October). The pertaining salinities fluctuated around 35‰. Its distribution, as given by RUSSELL (1953) suggests a relation with waters of high salinities.

Eutima (= *Octorchis*) *gegenbauri* (Haeckel)

According to RUSSELL (1970) *Octorchis* is now regarded as a subgenus of *Eutima*, so that the correct name is: *Eutima gegenbauri*. The species was caught in 1964 and 1965, always in September, (4, 29 and 30, resp.) and always in single specimens.

Pertaining temperatures were 16.0°, 16.1° and 15.0 °C resp., and pertaining salinities 34.7, 34.9 ‰. KRAMP (1927) says that it is common near Heligoland around the end of September. It is also mentioned for various other places along the German coast (KÜNNE, 1952; KÜHL, 1962; KÜHL & MANN, 1967).

Tima bairdi (Johnston)

Tima bairdi was found in every year of the research, except 1963, though only in numbers of 1 to 4 specimens per jaar. The data are given in Table III.

Tima bairdi is said to be a northern species which, if caught in the southern North Sea, is supposed to come from the Dogger Bank (KRAMP, 1927; KÜNNE, 1937; EDWARDS, 1968). FRASER (1965) calls it an indicator species for Central North Sea water. HAMOND (1957, 1963) found it cast on the Norfolk shore in March, still alive, and considers it as a winter species, which is in accordance with our data, though our latest date is 29 April. Temperatures and salinities are given in Table III. The preponderance of ebb hauls may also point to a northern origin.

See Tab. III

Limnomedusae

Gossea corynetes (Gosse)

There are five records of this species: 9 November 1961, 30 November 1963 and probably also 6 December 1963 and 4 and 26 January 1966. They always refer to single specimens, except on 4 January 1966 when four were caught in an ebb haul.

RUSSELL (1953) says that it is "essentially a medusa of late summer and autumn in British waters". According to KRAMP (1930) it enters the North Sea by way of the English Channel and it is considered to be an indicator species for Channel water

(KÜNNE, 1937); RUSSELL, 1939; FRASER, 1965; EDWARDS, 1968). In that case our specimens may be the last survivors of this immigration.

See Tab. II

Trachymedusae

Aglantha digitalis (C.F. Müller) var. *rosea* (Forbes)

As many as 1252 specimens of this species were caught between 28 February and 23 March 1962, of which 1249 were caught till 10 March and the remaining 3 some days later. This influx was not repeated in later years, though very occasionally some damaged specimens have been found which may have belonged to this species. The 1962 influx was also characterized by high numbers of *Nyctiphanes couchii* (Bell) (VAN DER BAAN & HOLTHUIS, 1969) as well as of *Themisto gracilipes* (Norman) and *Sagitta elegans* Verrill.

Aglantha digitalis is considered by many authors to be an indicator of northern water in the North Sea, e.g. KÜNNE, 1937; RUSSELL, 1939, or at least of Atlantic water (RUSSELL, 1953). SOUTHWARD (1961, 1962, 1963) thinks that it is more an indicator of cold water than of northern water. HAMOND (1963) found it from November to April at the Norfolk coast and suggests that in certain winters it has drifted there from a permanent population further north, e.g. from deep water off the Northumberland coast. In this deep water it is able to survive at any temperature below 11 °C, but it perishes in the local water. However, BEYER (1968) found that in the Oslofjord it thrives in very polluted water with a shortage of oxygen.

During 1962 peak the temperature of the surface water varied between 3.3 and 3.8 °C and the salinity between 32.5 and 34 ‰. The average number in flood catches was 10.55

specimens per hour and for ebb catches 5.94, which suggests that the main direction of supply was the SW, perhaps the Channel. This is all highly speculative, and it seems safer to say only that in some cases an unusual extension of some stock of *Ag-lantha digitale* may reach as far as the "Texel" lightship.

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Table I

Occurrence of Anthomedusae at "Texel" lightship during the years 1961-1966. Indicated are: present, no exact numbers known (-), present occasionally in low numbers (.), regularly present (x), peak period (X), occurrence not known (?).

Species	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Sarsia tubulosa</i>	1961	.		-	-	-	-	-					.
	62	xx	ice	-	xx	xxxxxx							
	63						..						
	64			xx	X	..	xx	.					
	65			..	xxxxxx	xxxxxx							
	66			.	..	..	xxxx						
<i>Sarsia gemmifera</i>	1966												
<i>Hybocodon prolifer</i>	1961												
	64						...						
	66					X							
<i>Steenstrupia nutans</i>	1961					-							
	63									...			
	64						..	...					
	65												
	66					..	X	.					
<i>Turritopsis nutricula</i>	1961											..	..
	62											..	..
	63	.	ice									..	..
	64	.										XX	...
	65	..										..	..
	66	...											
<i>Podocoryne borealis</i>	1961												
	63										..		
<i>Rathkea octopunctata</i>	1961												
<i>Bougainvillia britannica</i>	1961												
	64				?	--	..	?					
	65												
	66					X.							
<i>Bougainvillia principis</i>	1961				--	--	-						
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Table I (continued)

Occurrence of Anthomedusae at "Texel" lights during the years 1961-1966. Indicated are: present, no exact numbers known (-), present occasionally in low numbers (.), regularly present (x), peak period (X), occurrence not known (?).

Species	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Leuckartiara octona</i>	1961 (present but no reliable data)												
	62	-	?	?	?	?							
	63	xx..	1ce	.						xx	xxxxxxx	xxxxx	
	64	.							...	xxxxxxx	xxxxxxx	xxxxx	
	65	xx	.	..					.	xxxxxxx	xxxxxxx	xxxxx	
	66	..			.	..			..		X	xxxxxxx	

Table II

Occurrence of Leptomedusae, Limnomedusae and Trachymedusae at "Texel" lightship during the years 1961-1966. Indicated are: present (x), often > 100 (X), often > 1000 (Ø), dead specimens (+).

Species	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Laodicea (undulata)</i>	1966												
<i>Meliceertum octocostatum</i>	1961						?						
	64												
	65												
<i>Mitrocomella brounei</i>	1961												
<i>Cosmetira pilosella</i>	1961					++							
	64												
	65												
	66												
<i>Phialidium hemisphaericum</i> (and similar species)	1961	xxxxxxx	?	?	?	?	?	?	?	?	?	?	?
	62	ØØØxxxxxxx	xxxxxx										
	63	xxxxxx ice	+										
	64	x xxxxxxx											
	65	xxxxxxxxxxxxxxxx											
	66	xxxxxxxxxxxxxxxx											
<i>Obelia</i> sp.	1962												
<i>Lovenella clausa</i>	1961					+							
<i>Eucheilota maculata</i>	1961					+		?	x	?	?	?	x
	62												xxxxxxxxxxxxxxxx
	63												x
	64												xxxxxx.
	65												xxxxxxxxxxxxxxxx
	66												xxxxxxxxxx
<i>Phialella quadrata</i>	1961					xxx							
<i>Eirene viridula</i>	1961					+							
<i>Helgicirrha schulzei</i>	1961					+							
	62												

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Table II (continued)

Occurrence of Leptomedusae, Limnomedusae and Trachymedusae at "Texel" lightship during the years 1961-1966. Indicated are: present (X), often > 100 (X), often > 1000 (Ø), dead specimens (+).

Species	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Aequorea vitrina</i>	1961							.xxxxxx		...	.	.	...
	62	?									.	.	...
	63		..							...	.	.	...
	64										.	.	...
	65										.	.	...
	66						x					.	...
<i>Eutima gracilis</i>	1964											.	...
<i>Eutima gegenbauri</i>	65									xxx x	.	.	...
	1963									.			...
	64										.	.	...
<i>Tima bairdi</i>	65										.	.	...
	1961										.	.	...
	62		.								.	.	...
	64		..		.	.	.	.	.	.	.	.	...
	65				.	.	.	.	.	.	.	.	...
<i>Gossea cornyetes</i>	66										.	.	...
	1961										.	.	...
	63										.	.	...
<i>Aglantha digitalis (var. rosea)</i>	66										.	.	...
	1962			ØØØ x							.	.	...

Table III
Occurrence of *Tima bairdi*

Date	Time	E/F	Temp. (°C)	Sal. (‰)	Numbers	Diam. (mm)
25 March 1961	01.30-07.15	Ebb	7.2	34.81	1 *	60
19/20 Febr 1962	20.30-02.15	"	5.4	34.05	1	60
15 Febr 1964	03.30-07.50	Flood	4.4	35.99	1	50
21 Febr 1964	13.20-19.30	Ebb	3.9	34.63	1	abt. 70
8 April 1964	03.30-10.20	"	4.1	33.64	1	" 40
23 April 1964	19.00-23.05	"	6.4	34.76	1	" 65
11 March 1965	00.50-05.30	"	3.6	33.80	1	
27 April 1965	17.10-23.30	"	7.8	33.04	1	abt. ± 50
29 April 1965	06.50-12.20	"	8.2	28.69	1	" 45
29 Dec. 1966	14.30-20.30	Flood	6.6	34.25	2	35,55
30 Dec. 1966	15.30-21.00	"	7.0	34.27	1	30

*) damaged

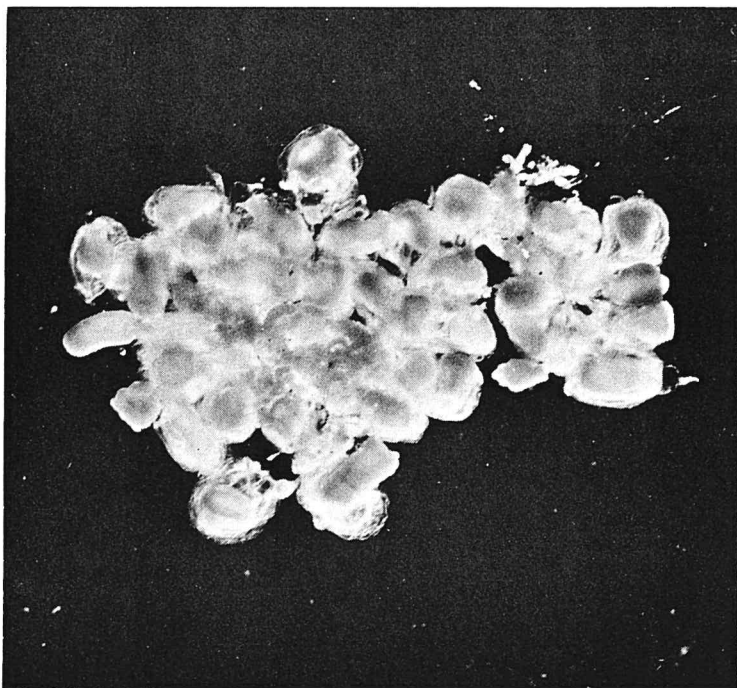
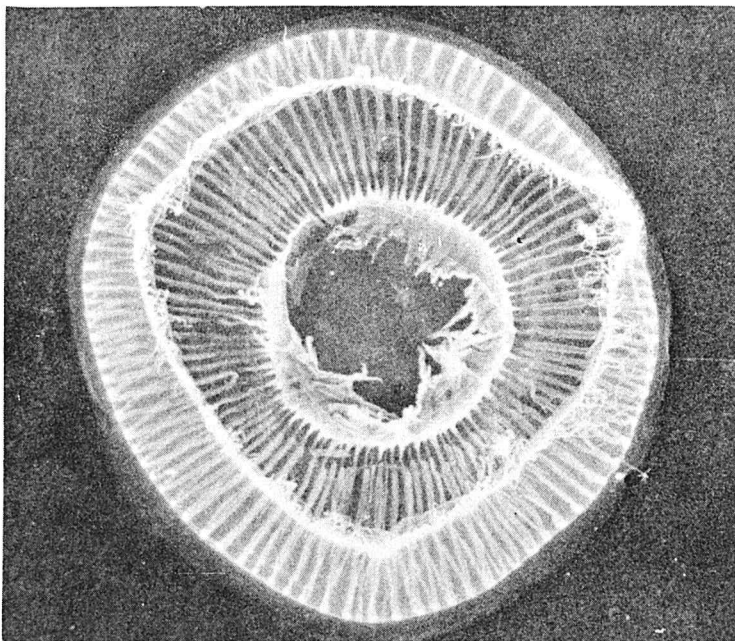


Foto boven: *Aequorea vitrina*.
Foto onder: *Steenstrupia nutans* "clusters".

