THE ZOOPLANKTON

IV. THE OCCURRENCE AND SEASONAL DISTRIBUTION OF THE TUNICATA, MOLLUSCA AND COELENTERATA (SIPHONOPHORA)

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WITH THIRTY TEXT-FIGURES.

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TUNICATA.

MOLLUSCA—*continued.*

COELENTERATA.

TUNICATA

THE pelagic Tunicates (Tables I, II and III, pp. 232–234) formed an important part of the larger plankton, but among the great number of small animals retained by the silk nets they were less important. On the average the tunicates formed one-half of the total number of animals caught in the stramin net, while in the coarse and fine silk nets, oblique hauls, these proportions were only 5·7% and 2·7% respectively. We give below the percentages of the total animals formed by the tunicates for the different nets on the average for each month in the barrier reef lagoon.

Number of Tunicates as Percentage of Total Animals Caught in each Month.

	Oblique hauls.		
	Stramin.	Coarse silk.	Fine silk.
1928 :			
July	2·7	0·5	0·2
August	7·1	1·6	0·9
September	47·5	3·8	1·7
October	52·1	9·9	4·3
November	75·7	14·7	1·5
December	6·5 or 27·7*	2·9	2·3
1929 :			
January	43·5 or 54·1*	12·0	4·7
February	36·4	8·8	4·0
March	6·9	3·4	2·5
April	85·9	7·7	4·8
May	67·1	6·4	3·9
June	3·4	3·8	3·0
July	3·1	5·2	2·5
Average for year (based on average catch for each month)	52·1*	5·7	2·7

It is quite evident that in the stramin net catches the tunicates played an important part, reaching as much as 85·9% of the average catch for the month of April. In the coarse silk net by contrast the greatest percentage is only 14·7% in November.

* Excluding Echinoderm larvae, which are not retained in the stramin net under normal circumstances, but here occurred owing to excessive swarms.

We give below the percentage for each month of Doliolids, Salps and Appendicularians for the stramin and coarse silk nets.

Percentage Composition of Average Monthly Catches of Tunicates.

	Oblique hauls.					
	Stramin.			Coarse silk.		
	Doliolids.	Salps.	Appendicularians.	Doliolids.	Salps.	Appendicularians.
1928 :						
July	6·2	2·3	91·5	..	0·7	99·3
August	10·9	8·5	80·5	6·4	0·2	93·4
September	1·1	84·8	14·1	0·2	27·8	72·0
October	1·3	86·1	12·6	1·3	64·9	33·7
November	0·2	92·4	7·4	..	42·4	57·6
December	8·6	77·4	14·0	10·0	13·9	76·1
1929 :						
January	0·5	67·5	32·0	2·3	8·7	89·0
February	2·6	9·5	88·9	1·4	0·3	98·5
March	12·9	2·0	85·1	1·9	..	98·1
April	0·2	98·8	1·0	3·3	51·1	45·6
May	0·3	99·5	0·2	2·9	46·8	50·3
June	31·4	1·7	7·2	3·9	0·2	95·8
July	9·3	0·4	90·3	0·3	..	99·7
Average for year (based on average catch for each month)	1·1	91·0	7·9	2·3	26·3	71·4

These figures show that on the average for the year the Thaliacea far outnumbered the Appendicularians in the stramin catches, but that there were violent fluctuations in the composition of the Tunicata, which we shall see later were due to swarming of certain species, notably *Salpa democratica* and *Megalocercus huxleyi*. In the coarse silk net, however, the Appendicularians preponderated, except in months when swarms of Salps were met with ; these Appendicularians were nearly all of a small size not retained in great numbers by the stramin net. In both nets the Doliolids were on the whole of very small significance.

The identification of the pelagic tunicates has been done by Miss A. B. Hastings, and the list of species observed is given in her report on the Tunicata in Volume IV of these Reports* (1931, p. 105). The total collections comprised 3 species of Doliolids, 6 species of salps, and 8 species of Appendicularians, but the only species which played an important part in the composition of the plankton at the weekly station were *Salpa democratica*, *Oikopleura rufescens* and perhaps *Oikopleura longicauda*.

From the proportional occurrence of the species in the samples examined by Miss Hastings and from notes made by us while examining the complete catches, it has been

* To that list must now be added *Doliolum gegenbauri*, *Fritillaria pellucida* and *Fritillaria borealis truncata* (see pp. 208 and 225).

possible to apportion the numbers of tunicates in each catch amongst the various species present. The resulting figures are given in Tables I, II and III (pp. 232–234). While it must be realized that these figures cannot be regarded as strictly accurate, it is most probable that they represent a fair picture of the occurrence of the tunicates in our collection, since we have exercised considerable judgment in producing them, and when in doubt have always had larger samples examined by Miss Hastings. We are very grateful to her for the help she has given in this respect.

THALIACEA.

Family Doliolidae, Bronn.

Three species of Doliolids were recorded, namely *Doliolum denticulatum*, Q. and G., *Doliolum tritonis*, Herdman, and *Doliolum gegenbauri*, Ulianin. Of these *D. gegenbauri** is recorded for the first time from the Pacific Ocean, and *D. tritonis* for the first time from this region of the Pacific. All species occurred at the weekly station in the barrier reef lagoon, but *D. denticulatum* was easily the most abundant.

Genus *Doliolum*, Q. and G.

Doliolum denticulatum, Q. and G.

Individuals of the phorozooid and gonozooid generations of *D. denticulatum* were present throughout the year in the barrier reef lagoon. In Text-fig. 1 are given the curves for the average catches for each month for all three nets for all Doliolids. (On account of the great preponderance of *D. denticulatum* these curves practically represent the results for this species.) They show a large increase in December, which is sustained, especially by the coarse silk net, oblique hauls, until June, with decreases in February and March. (The numbers caught in the coarse silk net, vertical hauls, were rather too small to give significant results, but they also showed an increase between November and April.) A closer analysis shows that this increase is due to the presence of very small individuals in the catches. At a number of stations some Doliolids occurred of so small a size that it was necessary to count them in the 1/200 samples. These small individuals occurred at the following stations, the numbers in brackets being the number recorded at each station: Coarse silk, oblique, Stations 7 (400), 15 (200), 34 (1400), 35 (200), 36 (200), 37 (400), 39 (600), 42 (200), 47 (200), 52 (200), 53 (600), 56 (600), 60 (200), and stramin, oblique, Station 32 (600). They occurred mostly during the months from December to June. In Text-fig. 2 are given the curves for the monthly average abundance of Doliolids in the coarse silk and stramin nets, oblique hauls, excluding these very small forms; it shows that the large and medium-sized individuals were much more evenly distributed throughout the year. There was also perhaps a tendency for them to be more consistently abundant in April, May and June. On the whole gonozooids were rather more abundant than phorozooids.

* Since writing this, *D. gegenbauri* has been recorded by Garstang (1933) from the South Pacific in the collections of the British Antarctic (" Terra Nova ") Expedition, 1910.

As regards the occurrence of blastozooids,* there was quite definitely a tendency for their presence in the catches to coincide with the period at which the small Doliolids were so abundant. It is presumed that many belonged to *D. denticulatum*, but the larger ones were too old for identification. Probably many small nurse-forms were also present at times among the small unsorted individuals.

This species was usually present in collections from outside the Barrier (Table III), and appears to have been rather abundant in February and March in the regions of Cook's Passage and Papuan Pass.

Doliolum tritonis, Herdman.†

Tables I and II show that the phorozooids and gonozooids of *D. tritonis* occurred very rarely in the collections from the weekly station in the barrier reef lagoon. It seems to have become suddenly abundant in December and early January. Up to that time one specimen had been recorded from the stramin net from Station 24 (6.xi.28), and one from the coarse silk net at Station 22 (23.x.28). The only other catch was at Station 52 (6.iv.29) in the coarse silk net. At stations other than the weekly one *D. tritonis* was not common, being recorded only from one coarse silk net and three stramin net catches (Table III).

Doliolum gegenbauri, Ulianin.†

D. gegenbauri was recorded on only two occasions, both at the weekly station in the lagoon, Station 34 (19.xii.28) and Station 47 (4.iii.29), in the coarse silk net. It is possible that it may have occurred on other occasions among the very small individuals that were not sorted, but the species appears like *D. tritonis* to be of small importance compared with *D. denticulatum*.

On the Occurrence of Doliolids.

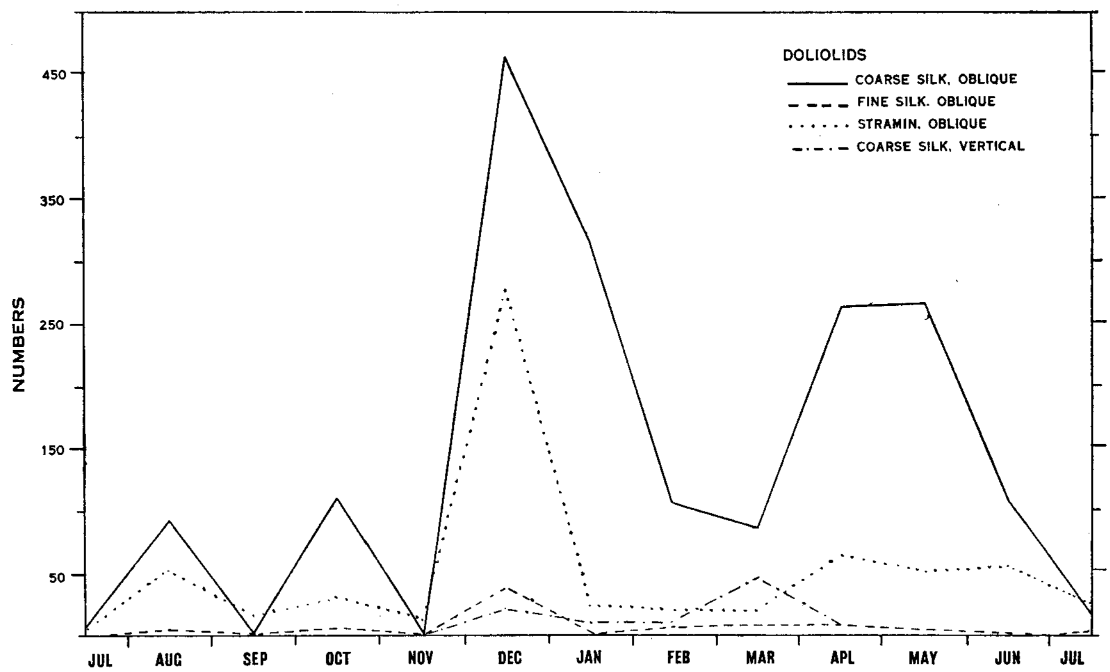
On the Siboga Expedition (Ihle, 1910) four species of Doliolids were recorded: *Anchinia rubra*, Vogt, *Doliolum tritonis*, Herdman, *D. nationalis*, Borgert, and *D. denticulatum*, Q. and G. Of these, *D. denticulatum* was by far the most frequent species in the collections, and *D. tritonis* was second. *D. denticulatum* is given by Neumann (1906) as the most frequent of all *Doliolum* species. In the Pacific *D. tritonis* has been recorded by Ritter (1905) as the most abundant species off San Diego. On the whole the Pacific does not appear to be so rich in *Doliolum* species as other oceans, although the appearance of *D. gegenbauri* in these collections leads one to suppose that further collections may show the presence of more species.

Little appears to be known of the seasonal occurrence of Doliolids.

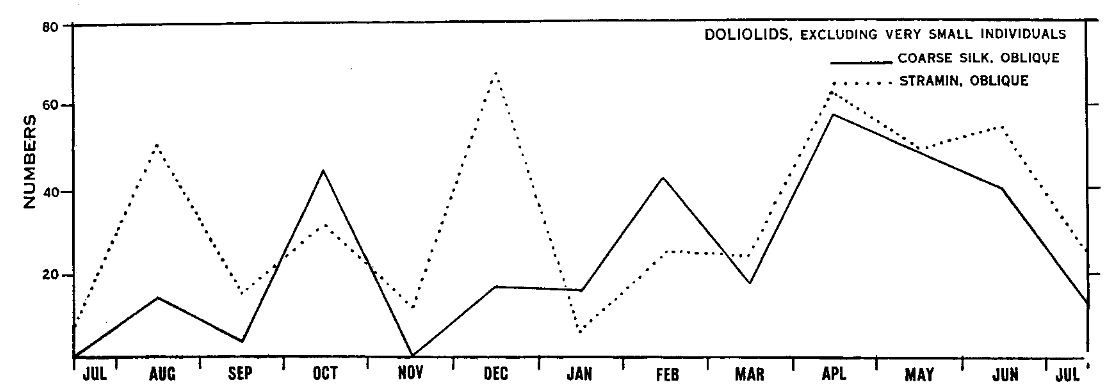
Vertical Distribution.—Doliolids only occurred at two of the vertical distribution stations in sufficient numbers to give significant results. At both these stations, which were taken in the lagoon in daylight in October and June, the Doliolids avoided the surface layers. They were evidently affected by the transparency of the water, their depths of

* Blastozooids occurred as follows: Coarse silk oblique, Station 35, 2; Station 37, 1; Station 41, 1; Station 47, 1; Station 53, 1; Station 58, 1; Station 60, 1. Stramin, oblique, Station 30, 1; Station 32, 5; Station 34, 1; Station 35, 8; Station 37, 3; Station 47, 4; Station 59, 1; Station 60, 1.

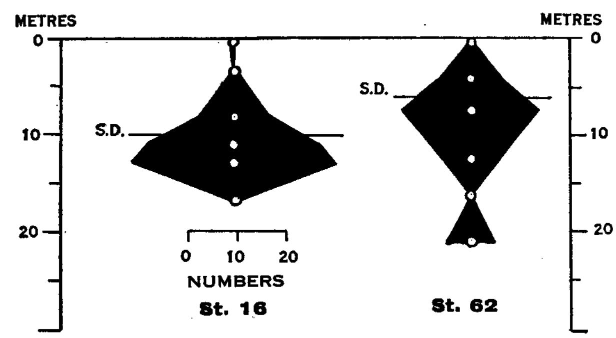
† These species have recently been removed by Garstang (1933) to the genus *Dolioletta*.



TEXT-FIG. 1.—Curves showing the average catch of Doliolids for each month at the position 3 miles east of Low Isles in the barrier reef lagoon. These consist mostly of the phorozooids and gonozooids of *D. denticulatum.* (Coarse and fine silk, and stramin nets, oblique hauls; and coarse silk net vertical hauls.)



TEXT-FIG. 2.—Curves showing the average catch of Doliolids for each month at the position 3 miles east of Low Isles in the barrier reef lagoon, when the very small individuals have been excluded. (Coarse silk and stramin nets, oblique hauls.)



TEXT-FIG. 3.—The vertical distribution of Doliolids, mostly *D. denticulatum*, in the daylight in the barrier reef lagoon. Station 16 (3.x.28), 10.13 a.m. to 12.27 p.m.; Station 62 (15.vi.29), 11.20 a.m. to 1.45 p.m. The circles and white dots indicate the average depths at which the hauls were made. Coarse silk townet. S.D., Secchi disc reading.

maximum abundance being at about 12 metres when the Secchi disc reading was 10 m., and at about 7·5 metres when the reading was 6 m. It is unlikely that their depth distribution will have affected the results given above on their seasonal distribution as shown by the oblique hauls, except perhaps on days when the water was unusually clear. On both occasions their numbers diminished greatly in the deepest layers sampled at the vertical distribution stations (see Text-fig. 3). *Doliolum denticulatum* alone occurred at Station 16. The actual numbers in the catches were as follows :

Station **16**.		Station **62**.		Station **65**.		Station **68**.	
S.	1	*S.*	..	*S.*	2	*S.*	..
3·1 m.	..	4·0 m.	13	3·7 m.	1	3·5 m.	..
8·0 ,,	14	7·5 ,,	27	8·0 ,,	1	7·5 ,,	2
11·1 ,,	34	12·5 ,,	11	12·5 ,,	..	12·0 ,,	2
12·5 ,,	41	16·0 ,,	..	15·5 ,,	..	16·5 ,,	7
16·5 ,,	1	21·0 ,,	10	20·7 ,,	..	20·7 ,,	6

Although the numbers are very low there is an indication that the Doliolids came to the surface in the dark at Station 65.

Family Salpidae, Forbes.

Six species of Salps were recorded : *Cyclosalpa pinnata* (Forskål), *Salpa democratica*, Forskål, *Salpa zonaria* (Pallas), *Salpa cylindrica*, Cuvier, *Salpa confoederata*, Forskål, and *Salpa rostrata*, Traustedt.

S. rostrata is here recorded for the first time from the Pacific. *S. democratica* was easily the most abundant species. All occurred at the weekly station three miles east of Low Isles, except *S. zonaria*, which was only taken outside Trinity Opening.

Genus *Cyclosalpa* (de Blainville).

Cyclosalpa pinnata (Forskål).

C. pinnata was only taken once at the weekly station in the lagoon, namely at Station 2 (30.vii.28), when one aggregate individual was taken in the stramin net.

Four other specimens were caught, a solitary individual at Station 19 (20.x.28) outside Trinity Opening, and 3 aggregate individuals at Station 50 (18.iii.29) outside Papuan Pass in the stramin net from 170 metres.

Genus *Salpa*, Forskål.

Salpa democratica, Forskål.

S. democratica, " the commonest Salp in warm waters " (Apstein, 1906, p. 270), was easily the most abundant and most frequent salp in our collections. Calculation of the average monthly abundance at the weekly station in the Barrier Reef lagoon shows that there were two periods of the year at which these Salps were especially frequent, namely during the months September to January, and in April and May. During the remaining months of the year, June to August and February and March, they were almost completely absent.

A more detailed analysis (Text-figs. 4 and 5) shows also that during the months of greatest abundance it was only on a few days that really large catches were made. At these periods the Salps could often be seen in the sea in enormous numbers, and many were washed up on the beach at Low Isles. Text-figs. 4 and 5 show also that on the whole the curves for the stramin and coarse silk net oblique hauls agree fairly closely. On 2nd October, however, a very large catch was made by the coarse silk net, while very few were caught in the stramin net. On 2nd November the two nets caught approximately the same numbers, while on 6th November and on all subsequent occasions the stramin net caught more than twice as many as the coarse silk net.

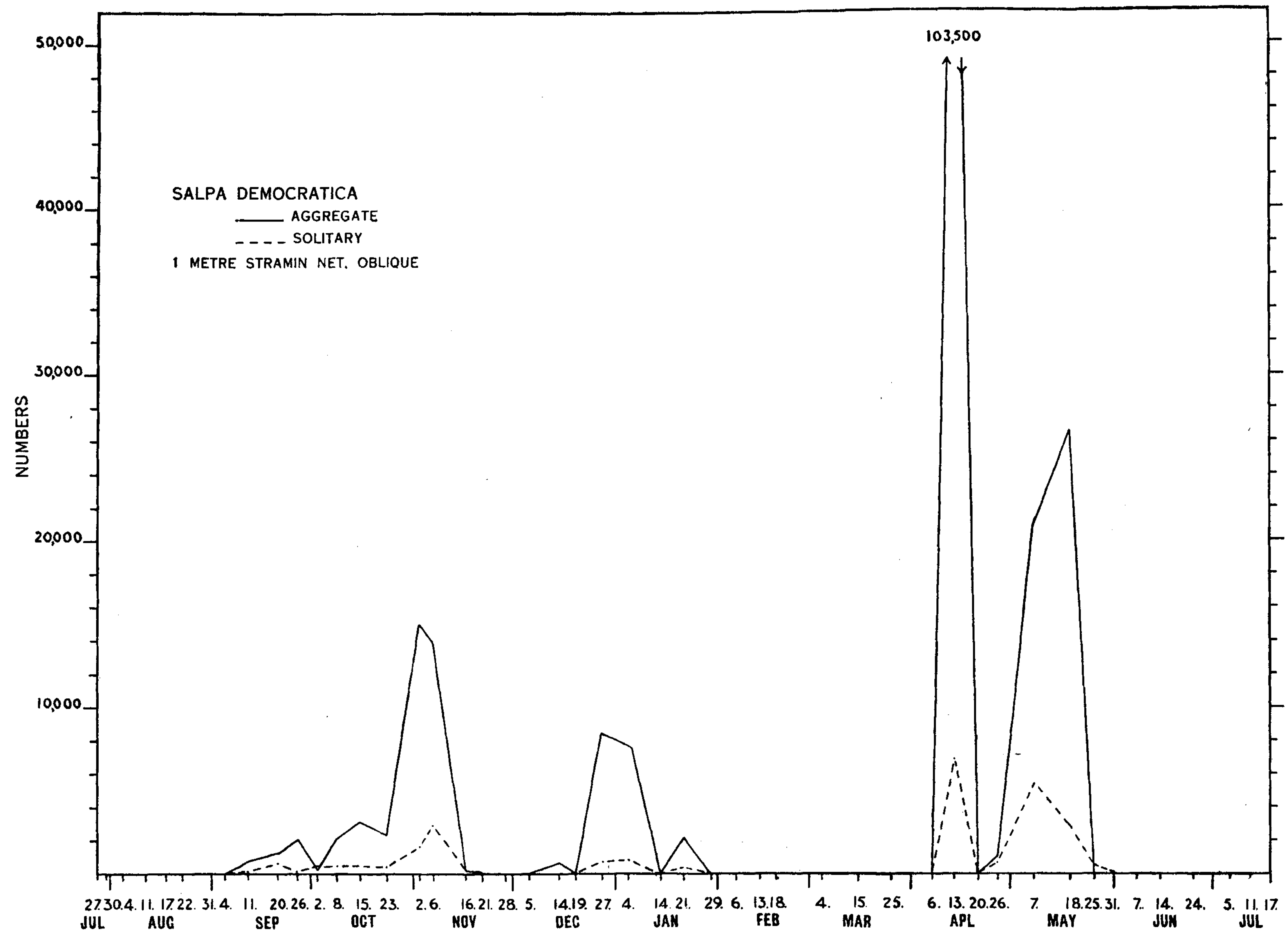
The most sudden increase was in April, 1929, when, after the occurrence of 12 and 22 Salps on 6th April (Station 52), the numbers taken on 13th April (Station 53) were 17,000 in the coarse silk net and 110,400 in the stramin net, the largest catch for the year. By 20th April (Station 54) there were only 17 and 50 Salps in the two nets respectively.

Before attempting to explain this seasonal distribution of *S. democratica*, it will be perhaps worth while to summarize briefly our knowledge of the life-history of this interesting animal.

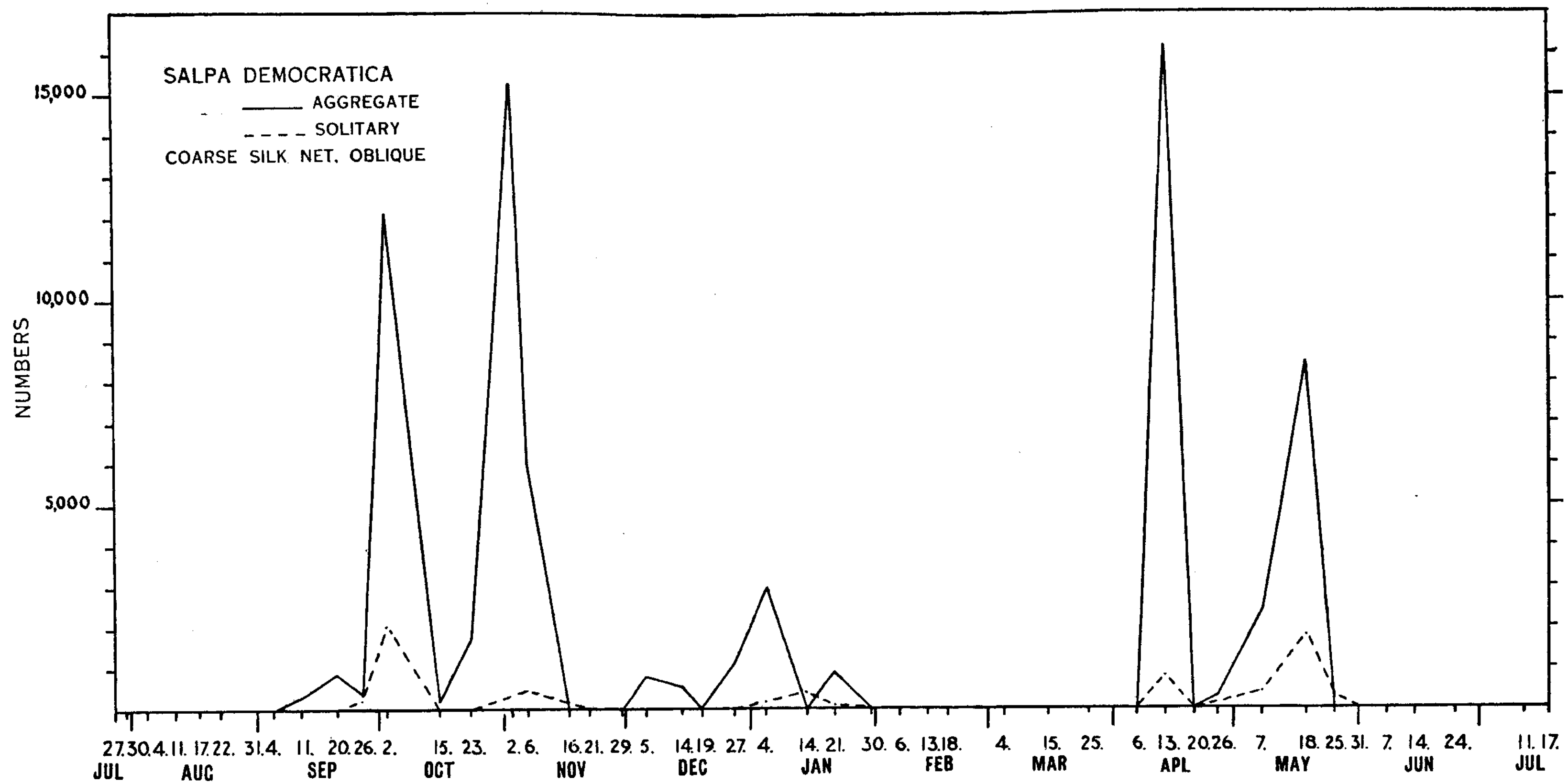
In common with other Salps, *S. democratica* goes through two generations in its complete life-cycle. The *solitary* individual produces offspring by budding from the stolon, and the buds when mature constitute the *aggregate* or *sexual* generation. Each individual of the aggregate generation produces sexually *one* of the solitary generation, although at first they carry three eggs, two of which disintegrate. Michael (1918, p. 244) says : " In *Salpa democratica* the stolon undergoes more or less regular periods of active segmentation and rest, so that the aggregate salpae are developed in sets or blocks, all individuals in a single block being of approximately the same size and in the same stage of development. Leuckart (1854, p. 67) found forty in one block and sixty-five in another ; while Seeliger (1886, p. 593) counted sixty-one in a single block. As there are from three to four blocks present when the distal end of the chain is ready to emerge from the mantle cavity to the exterior, the stolon carries in the neighbourhood of two hundred salpae at one time. No evidence is at hand that the stolon ever exhausts its capacity for producing them, and segmentation probably continues until terminated by the death of the solitary salpa."

Nothing is known as to the length of life or period required to attain maturity in the different forms.

In Text-fig. 6 we have made a complete summary of the seasonal abundance of total Salps in the stramin and coarse silk nets, inserting also the data as to temperature, salinity, and the phases of the moon. It is remarkable that in the earlier increases the peaks tend to be at about the period of full moon, while in the later increases the two peaks occur at or after new moon. Certain shore animals showed a similar periodicity in their breeding. On 23rd November, 1928, when proceeding to take a station outside Trinity Opening we passed through a great swarm of Salps just off the south-western corner of Batt Reef. No indication of this swarm was shown at the weekly station in the lagoon three miles east of Low Isles, either on 21st November (Station 27) or on 28th November (Station 30). We have indicated the position of this swarm with an asterisk in Text-fig. 6, and it is curious that this also occurs very near the full-moon period. It does not seem likely, however, that these increases really indicate a lunar periodicity in reproduction. While, from the method of reproduction of *S. democratica*, it is conceivable that considerable



TEXT-FIG. 4.—Curves showing the catches of aggregate and solitary forms of *Salpa democratica* in the 1-metre stramin net oblique hauls at the position 3 miles east of Low Isles in the barrier reef lagoon.



TEXT-FIG. 5.—Curves showing the catches of aggregate and solitary forms of *Salpa democratica* in the coarse silk net oblique hauls at the position 3 miles east of Low Isles in the barrier reef lagoon.

numbers could be produced in a very short time, it seems extremely improbable that numbers so produced could so quickly die down to practically nothing.

It seems much more probable that, rather than indicating successive outbursts of reproduction in the waters round Low Isles, the sudden peaks of the curve are due to swarms drifting up the Barrier Reef lagoon. The occurrence of swarms of Salps, some of which cover very large areas, is well known, and various accounts of such swarms are collected together by Apstein (1894, pp. 53–64). If these are indeed swarms drifting past, it would be interesting to know how they have arisen, and why they appeared to be completely absent at certain times of the year.

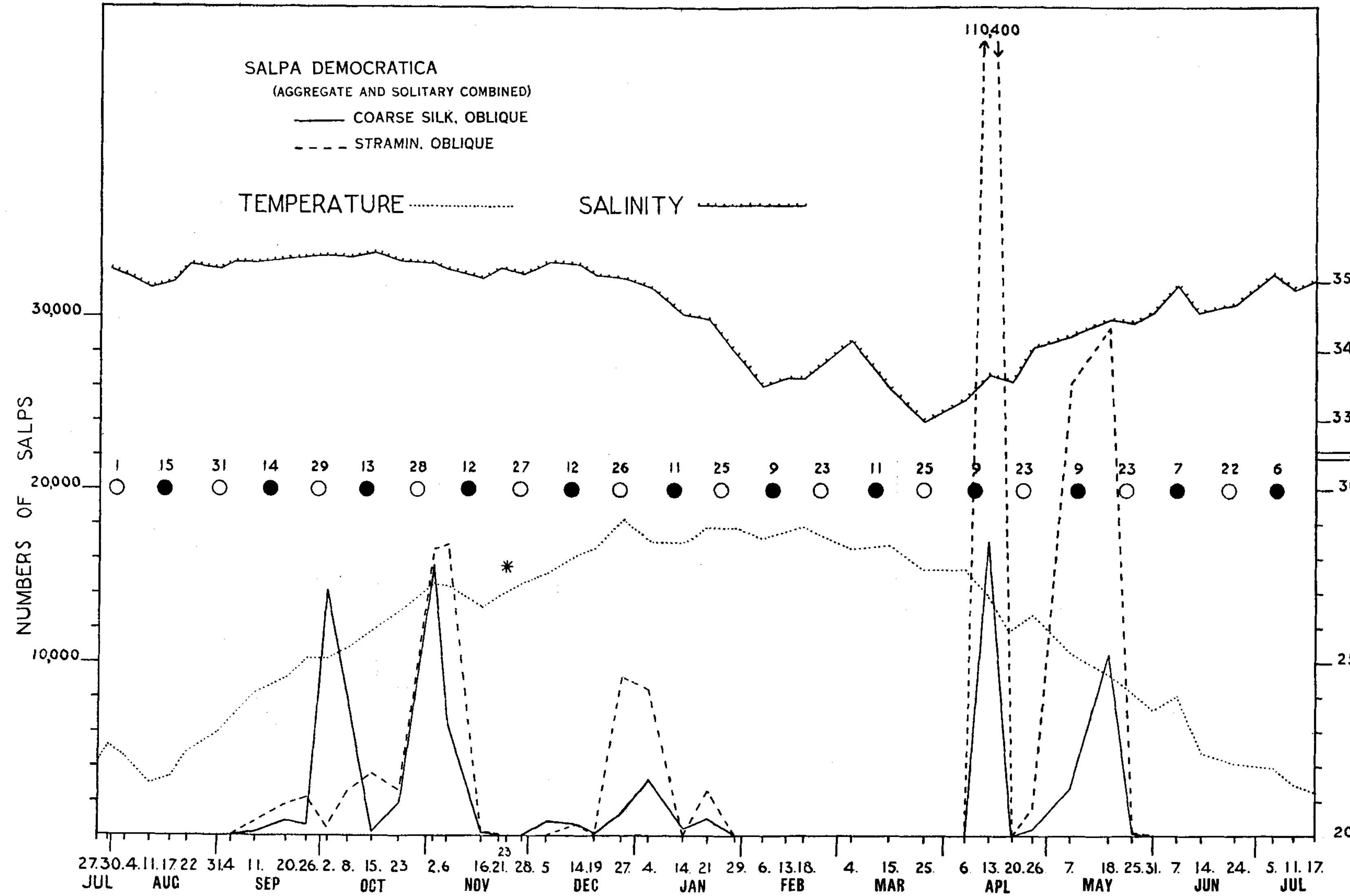
A comparison of their times of appearance with the hydrographic conditions (Text-fig. 6) shows that the two chief periods of abundance occurred when the temperature was rising from about 24° C. to 28° C. in September, October and November, and when it was falling from about 28° C. to 24° C. in April and May. There was also a smaller increase in December and January, when the temperatures lay between 27° C. and 28° C., and this was followed by a period of complete absence with the temperatures between 28° C. and 29° C., until April, when the temperatures were once more falling. Few Salps were taken with the temperature below 24° C. The period of almost complete absence in February and March coincided with the period of falling salinity, the lowest salinity of 33°/oo being reached in March, but the April increase took place before the salinity had risen much above 33·5°/oo. While it is doubtful whether the salinity has any effect within the limits reached, it seems possible that the seasonal abundance of *S. democratica* may have been connected with the temperature of the water, especially as both the periods of greatest abundance occurred at about 24° C. to 28° C. This would indicate a definite periodicity in the reproduction of the Salps.

A definite seasonal distribution of *S. democratica* has been shown by Michael (1918, p. 250) in the waters off San Diego: "Both generations of this species occur on the surface mainly during the months of June and July, solitary forms being restricted entirely to these months. No collections, however, were made during the months of January, May, October or December." During this period of maximum abundance the average temperatures were 17·9° C. in June and 18·9° C. in July, the average salinities of 33·61°/oo and 33·64°/oo respectively. August was apparently the warmest month in the year, with an average temperature of 19·9° C.

The seasonal distribution of *S. democratica* in the Mediterranean at Naples has been given by Schmidtlein (1881, p. 164). This species is recorded as being present in January, February, March and May, and most abundant in July and then August. From figures given by Lo Bianco (1909, p. 533), the average temperatures in July and August are about 25·5° and 26°–27° C. respectively. In March the temperature may drop as low as 13° C.

Changes in seasonal abundance of Salps have also been recorded in such regions as the northern coasts of Scotland, where they are possibly not so much due to periodic reproduction as to passive carriage in the Atlantic Drift waters.

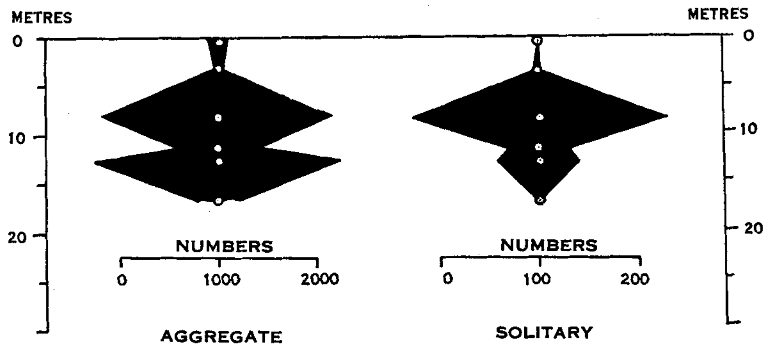
Presuming then that a seasonal distribution of *S. democratica* is shown by our Barrier Reef collections, are we to assume that the swarms producing the sudden increases off Low Isles are due to isolated centres of reproduction, or have they been brought about by other conditions? Apstein (1906, pp. 285 *et seq.*) discusses the possible methods of swarm production in Salps, and stresses what he calls the "self-purification of the currents" (Selbstreinigung des Strömes) as one of the causes in the open ocean. This effect occurs



TEXT-FIG. 6.—Curves showing the catches of *Salpa democratica* (aggregate and solitary forms combined) in the 1-metre stramin and coarse silk nets, oblique hauls, at the position 3 miles east of Low Isles in the barrier reef lagoon. Curves are also given for the temperature and salinity, and the dates of full and new moons are shown.

on the edges of currents running through still regions, in counter currents, and where currents impinge upon one another or upon land. Such regions are comparable with those mentioned by Ruud (1932, p. 63). In contradistinction to these swarms there are those that appear seasonally at a certain place at the same time each year, such as those carried by the Atlantic Drift.

In examining the occurrence of the swarms in the barrier reef lagoon one cannot help being struck with the marked periodicity, which coincides more or less with the moon's phases. One wonders whether there may not be some tidal effects further to the south, or even in Trinity Opening, that allows swarms to be brought into the lagoon from the open ocean, or even whether they might not be carried over the tops of the outer barrier reefs at the spring tides. Examination of the hydrographic data shows, however, no indication that there is the slightest periodic change in the waters of the lagoon. We must therefore conclude that the swarms are indigenous to the lagoon, and it seems most probable that they are due to small centres of reproduction arising during the optimum



Text-fig. 7.—The vertical distribution of aggregate and solitary forms of *Salpa democratica* in the daylight in the barrier reef lagoon. Station 16 (3.x.28), 10.13 a.m. to 12.27 p.m. The circles and white dots indicate the average depths at which the hauls were made. Coarse silk townet. Secchi disc reading, 10 metres.

breeding temperatures, the swarms thus produced drifting slowly northwards. Their coincidence with the moon's phases would then appear to be unexplainable until further observations have been made.

A periodicity in the occurrence of swarms of Salps has also been noticed by Seymour Sewell (1926) in the Indian Ocean. This he attempts to correlate with changes brought about by the periodic alteration from north-east to south-west in the direction of the winds during the monsoons, which set up seiches in the Andaman Sea and Bay of Bengal.

Vertical Distribution.—*Salpa democratica* only occurred at one of the stations made to study the vertical distribution of plankton in the barrier reef lagoon. Both the aggregate and solitary forms definitely avoided the surface layers in daylight. They reached their maximum abundance at about 10 metres and decreased rapidly in numbers below 15 metres. An indication of unevenness in horizontal distribution is given by the lower numbers taken at 11·1 m., this haul being taken after the remainder of the series had been completed. There is an indication from Text-fig. 7 that the solitary forms tend, if anything, to mass together at a slightly higher level than do the aggregate forms; see p. 217 (Michael, 1918). The actual numbers of individuals taken were as follows :

	Station 16.	
	Aggregate.	Solitary.
S.	201	1
3·1 m.	60	5
8·0 ,,	2342	258
11·1 ,,	840	60
12·5 ,,	2485	83
16·5 ,,	420	2

On the Proportion of Solitary to Aggregate Individuals in the Swarms of S. democratica.

Although the time taken to reach maturity is not known, attempts to calculate on any time basis the proportion of solitary to aggregate individuals likely to occur in nature soon show that when the varying circumstances of death-rate, time of individual breeding, length of life, etc., are taken into consideration no prediction can be made, except that on the whole one would expect the aggregate individuals to be usually the more numerous. Tables I and II show that the aggregate individuals were generally the more numerous in the Barrier Reef Expedition collections, but the actual proportions between the two types of individual vary rather widely, and are of the same order as in the catches of the same species given by Michael for San Diego (1918, pp. 246–248). It is, however, of interest to note that at the end of each of the two maximum periods of abundance in November and in May in the waters around Low Isles the solitary individuals preponderate. It is thus open to speculation whether this is an indication that the limiting factor in breeding operates on the individual that produces the eggs rather than on that in which the egg matures.

Owing to the even distribution of temperature from top to bottom in the waters of the barrier reef lagoon, it is unlikely that any differences in proportion between the two types of individuals could have been produced by differential behaviour, such as was observed by Michael (1918) off San Diego, where the solitary individuals tend to collect in the warmer surface waters.

Salpa zonaria (Pallas).

Only one specimen of *S. zonaria* was taken; this was in the bottom stramin net at Station 29 (24.xi.28) outside Trinity Opening, in about 200 metres of water, and was of the solitary form.

Salpa cylindrica, Cuvier.

S. cylindrica was not an abundant species in the collections, but occurred fairly frequently. Some specimens were taken in one or other of the nets in all months except July, October and June. The large catches at Station 35 (27.xii.28), Station 41 (13.ii.29), Station 52 (6.iv.29) and Station 55 (26.iv.29) in the stramin net (Table I) were due to the capture of chains of aggregate individuals; at Stations 41 and 52 there was only one solitary individual each, and at Station 55 there were 10, while at Station 35 solitary and free aggregate individuals were both present.

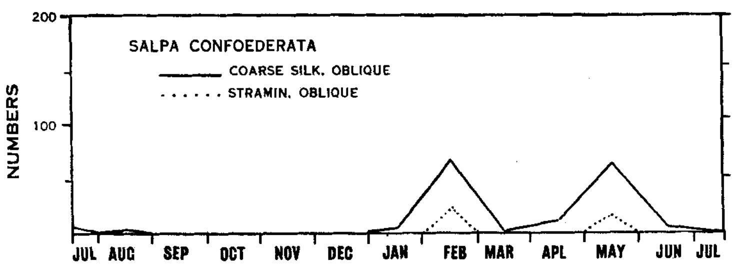
The solitary individuals of this species were apparently taken in greatest numbers just outside Papuan Pass at Station 50 on 18.iii.29.

On the whole *S. cylindrica* was most abundant between December and May at the weekly station.

Salpa confoederata, Forskål.

S. confoederata was, like *S. cylindrica*, not very abundant in our collections. It was entirely absent during the months from September to December inclusive, and in March, at the weekly station in the barrier reef lagoon. It appeared most abundantly at this station between January and June, and especially in February and May (Text-fig. 8). The largest catches consisted of 166 aggregate and 14 solitary individuals at Station 40 (6.ii.29) and 160 aggregate at Station 59 (31.v.29), both in the stramin net. The solitary individuals do not appear to have been so scarce as indicated by Metcalf (1918, p. 139), who suggests that they normally live deep in the water. Fourteen specimens of the aggregate form were caught at dredging Station XIV (7.iii.29, ½ mile S.E. of Lizard Island) in a hand net.

There was an indication that both this species and *S. cylindrica* appeared most abundantly at times when *S. democratica* was scarce.



TEXT-FIG. 8.—Curves showing the average catch of *Salpa confoederata* for each month at the position 3 miles east of Low Isles in the barrier reef lagoon. (Coarse silk and stramin nets, oblique hauls.)

Salpa rostrata, Traustedt.

Specimens of *S. rostrata* occurred in the collections of one net or another in November, December, January, April, May, June and July, but it was never abundant. The largest numbers were taken in December and in May. At the weekly station in the barrier reef lagoon every specimen identified was a solitary individual. One aggregate form, however, was taken at Station 19 (20.x.28) outside Trinity Opening. The absence of aggregate forms inside the Barrier Reef is rather remarkable. Ihle (1910, p. 29) records that the solitary form was taken at 10 stations on the Siboga Expedition, while the aggregate form was only caught at 3 stations.

REMARKS ON THE OCCURRENCE OF SALPS.

The geographical distribution of the Salps taken on the Great Barrier Reef Expedition is, according to Apstein (1906) and Seymour Sewell (1927):

C. pinnata: All three oceans; a purely tropical species which does not thrive in water below 20° C. In the Atlantic it is carried northward in the Gulf Stream.

S. democratica: Very common in the warm waters of all three oceans, and is carried north in the Atlantic Drift and south in the Brazil Current.

S. zonaria : In all three oceans ; carried north in the Atlantic Drift.

S. cylindrica : Frequent in the tropical regions of all oceans.

S. confoederata: Found in the warmest parts of all three oceans. Metcalf (1918, p. 168) says that this is the most abundant species from collections in the region of the Philippine Islands.

S. rostrata : In tropical region of Atlantic Ocean and in the Indian Ocean. As a result of the Great Barrier Reef Expedition this species is now recorded in the Pacific. Its occurrence might, however, be expected, as it has been recorded by Ihle (1910, p. 29) from the region among the East Indies surveyed by the Siboga ; Metcalf (1918, p. 166) records its absence from the Philippine region, but (1919, p. 4) expresses the opinion that it might be expected to occur.

These are all warm water species. Sewell (1926) divides the Indian Salps into two groups :

(A) Species whose solitary zooids normally inhabit deep waters, but occasionally come near the surface.

(B) Species whose solitary zooids normally inhabit the upper layers, but usually in Indian waters at some little depth below the surface.

Of the species taken on the Great Barrier Reef Expedition, *S. zonaria* and *S. confoederata* are included in (A) and the remainder in (B). The only individual of *S. zonaria* in our collections was taken in the bottom stramin net in water of about 200 metres.

If the Barrier Reef collections be compared with those of the Siboga Expedition the paucity of species is at once apparent. Ihle (1910) records 15 species of Salps from the Siboga catches, 3 *Cyclosalpa* spp., and 12 *Salpa* spp. In the region surveyed by the Siboga *S. democratica* (= *S. mucronata*) was also by far the most frequent Salp.

It seems possible that the paucity of species in our collections may indicate that the species caught are those better able to live in the conditions existing in shallow coastal waters, such as are found within the Barrier Reef. The same may also hold true for the small number of species of Appendicularians. On the other hand, it may be that in some years other species will be found to be present which, owing to their sparse distribution, happened not to be brought near the coast in the year we collected.

The absence of *S. fusiformis* Cuvier in our collections is perhaps surprising. It is recorded by the Challenger Expedition from north of New Guinea (Herdman, 1888, p. 75), and by Metcalf (1918) from the Philippine region. Ihle (1910) records it as fairly frequent from the region explored by the Siboga. It seems to be generally distributed in the Pacific Ocean, and Ritter (1905, p. 67) says that it is the most abundant species of *Salpa* of the western shores of North America, and probably of the whole Pacific, at any rate north of the equator.

In the region of San Diego Ritter (1905) only records 8 species of Salps.

APPENDICULARIA.

Eight species of Appendicularia were recorded: *Oikopleura rufescens*, Fol, *O. longicauda* (Vogt), *O. fusiformis*, Fol, *Megalocercus huxleyi* (Ritter and Byxbee), *Stegosoma magnum* (Langerhans), *Fritillaria haplostoma*, Fol, *F. pellucida*, Busch, and *F. borealis truncata* f. *intermedia*, Lohmann. In the stramin net catches *O. rufescens*, the most abundant species of all the Appendicularians, is the only *Oikopleura* sp. recorded. This is no doubt due to the large mesh of the stramin material, *O. rufescens* and the two large species *Megalocercus huxleyi* and *Stegosoma magnum* being the only Appendicularians which reach a large enough size to be retained. All species occurred at the weekly station in the barrier reef lagoon.

Family Oikopleuridae.

Genus *Oikopleura*, Mert.

Oikopleura rufescens, Fol.

O. rufescens was by far the most common and abundant species occurring in the Barrier Reef collections. This species was recorded for certain in 23 of the 46 coarse tow-net catches at the weekly station in the barrier reef lagoon, and it was probably present at all stations at which *Oikopleura* spp. were taken. In Table II are given the total figures for all *Oikopleura* spp. at each station, and the presence of the different species from the identifications of small samples is marked +. At Stations 27, 37, 39 and 41, in which *Oikopleura* spp. were especially abundant, the total number of each species is given in the proportions found in larger samples examined by Miss Hastings. These samples gave the following numbers :

Station **27** (21.xi.28). Coarse silk oblique :
- 145 *O. rufescens* (6 with horizontal rectum).
- 106 *O. longicauda*.
- 40 *Oikopleura* sp. (unfit for specific determination—both types, but more like *O. rufescens*).

Station **37** (14.i.29). Coarse silk oblique.
- 235 *O. rufescens* (23 with horizontal rectum).
- 37 *O. longicauda*.
- 66 *Oikopleura* sp. (unfit for specific determination—mainly *O. rufescens* type, but a few like *O. longicauda*).

Station **39** (30.i.29). Coarse silk oblique.
- 158 *O. rufescens* (19 with horizontal rectum).
- 6 *O. longicauda*.
- 87 *Oikopleura* sp. (unfit for specific determination—very nearly all of *O. rufescens* type).

Station **41** (13.ii.29). Coarse silk oblique.
- 204 *O. rufescens* (21 with horizontal rectum).
- 91 *O. longicauda*.
- 1 *O. fusiformis*.
- 56 *Oikopleura* sp. (unfit for specific determination—both kinds).

Measurements of a number of specimens were made by Miss Hastings, and we give below lengths, in millimetres, of trunk and tail, for the four largest individuals of those measured :

Station.	Date.	Trunk.	Tail.
2	30.vii.28	1·7	7·4
8	24.viii.28	1·7	6·8
22	23.x.28	1·9	5·2
55	26.iv.29	1·9	7·3

Details of the seasonal distribution are given on p. 225, where all the appendicularians are treated together.

Oikopleura longicauda (Vogt).

Next to *O. rufescens*, *O. longicauda* was the most abundant species in the coarse silk net catches at the weekly station. It was definitely recorded in 10 catches out of the 46 in which *Oikopleura* spp. occurred in the coarse silk tow-net oblique collections from this station. An examination of its numbers in the samples given above for Stations 27, 37, 39 and 41 seems to indicate that, while being much less numerous than *O. rufescens*, it was probably sufficiently abundant to have occurred in all the catches in which *Oikopleura* spp. were taken. It was not recorded as being found in the catches of the stramin net at any station, being, possibly, small enough to pass through the meshes.

Measurements of length of the larger individuals in mm. were as follows :

Station.	Date.	Trunk.	Tail.
3	4.viii.28	0·99	4·2
26	19.xi.28	0·7	3·4
27	21.xi.28	0·8	3·7
37	14.i.29	0·7	3·3
41	13.ii.29	0·6	2·8

Oikopleura fusiformis, Fol.

This species was definitely recorded at only two stations in the coarse net oblique catches, Station 14 (26.ix.28) and 41 (13.ii.29), and at Station 21 (22.x.28) in the stramin. The analysis of Station 41 given above shows that when present the numbers of *O. fusiformis* must have been very low, only one specimen being found out of 296 definitely identified specimens. It may be concluded therefore that throughout the year this species was easily the rarest of the three *Oikopleura* spp. occurring in our catches. That this was not due to small size is shown by the following measurements, which are comparable with those for *O. longicauda* :

Station.	Date.	Trunk.	Tail.
14	26.ix.28	0·75	3·8
21	22.x.28	1·1	3·7

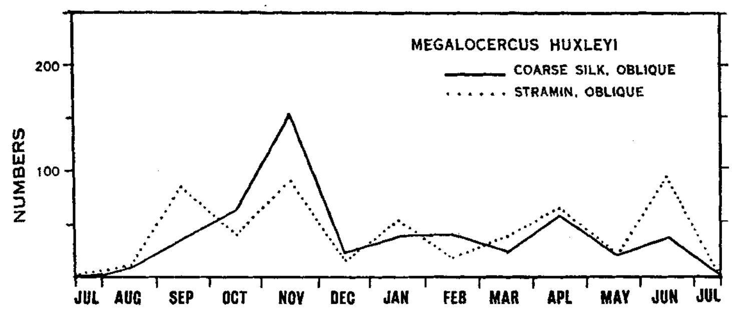
Genus *Megalocercus*, Chun.

Megalocercus huxleyi (Ritter and Byxbee).

Of the remaining Appendicularians *M. huxleyi* was the most commonly occurring, and on account of its large size was a striking object in the catches. In actual abundance it fell very far below *O. rufescens*, the largest catch for *M. huxleyi* being 380 specimens at

Station 24 (6.xi.28), and for *O. rufescens* 17,843 individuals at Station 37 (14.i.29), both in coarse silk net oblique hauls.

Tables I and II show that *M. huxleyi* occurred throughout the year at the weekly station, but was very rare in July. Text-fig. 9 gives the curves for the monthly averages of the catches of the oblique hauls with coarse silk and stramin nets. The curves show no really marked seasonal differences in distribution, but are on the whole very irregular. A closer examination of the figures for each catch for both nets shows that its numbers increased and decreased in a very irregular manner even during the period of a month. On the whole the sudden rises and falls agree very closely in the two nets, as shown in Text-fig. 10. There was, however, one station at which a very large catch in the coarse silk net was recorded when the stramin net catch was small, namely Station 30A (29.xi.28) [taken on the next day to stramin Station 30 (28.xi.28)]. The fact that these two stations were made on different days only stresses the spasmodic appearance of *M. huxleyi* and its evident tendency to swarm formation. While too much reliance should not, perhaps, be



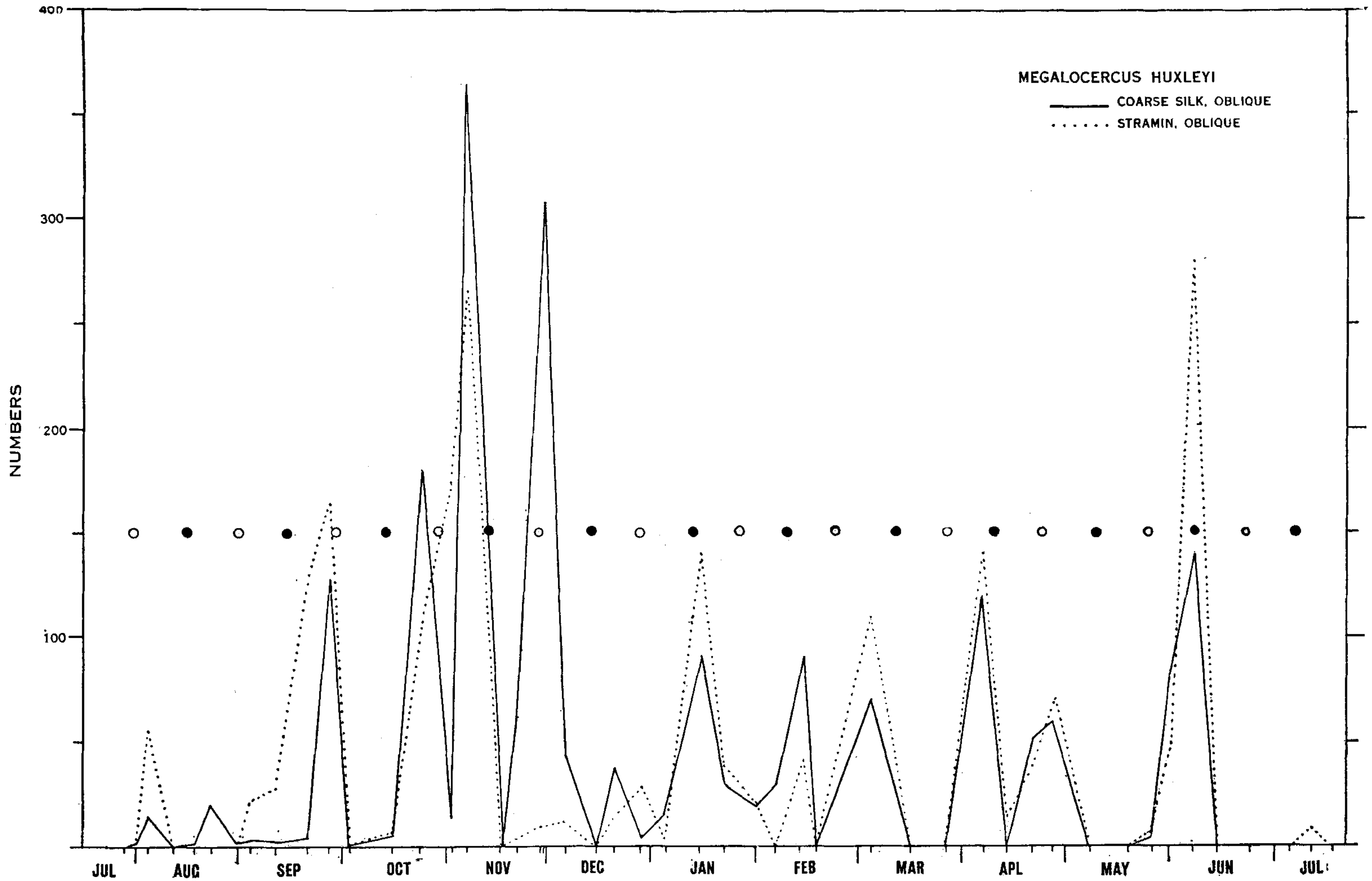
TEXT-FIG. 9.—Curves showing the average catch of *Megalocercus huxleyi* for each month at the position 3 miles east of Low Isles in the barrier reef lagoon. (Coarse silk and stramin nets, oblique hauls.)

placed on the actual figures given in Tables I and II, owing to the method of sampling, we think that the agreements shown by the two nets, coupled with our own personal observations of the living catches (*M. huxleyi* being a striking animal when alive), confirm the general trend of the figures, and that the curves in Text-fig. 10 give a fairly true picture of the occurrence of *M. huxleyi* at the weekly station.

No obvious correlation could be found between the increase and decreases of this species and the weather conditions, hydrographical data, phases of the moon or transparency of the water; it must be concluded that the results shown are due to isolated swarms drifting up the barrier reef lagoon past Low Isles.

There was probably a tendency for the coarse silk net catches to hold a higher proportion of young individuals than the stramin net, as is indicated by the following figures given us by Miss Hastings. Here the "young" are regarded as those in which the gonads are not yet developed, or are only presented as rudiments, while in the "old" the gonads were instantly discernible:

			Young.	Old.
Station **39**	(30.i.29)	Coarse silk oblique	9	1 (gonads small).
		Stramin oblique	1	11 (2 disintegrating).
Station **41**	(13.ii.29)	Coarse silk oblique	18	29
		Stramin oblique	7	34 (4 disintegrating).



TEXT-FIG. 10.—Curves showing the actual catches of *Megalocercus huxleyi* at the position 3 miles east of Low Isles in the barrier reef lagoon. The dates of full and new moons are also shown. (Coarse silk and stramin nets, oblique hauls.)

Some measurements in mm. of the lengths of larger individuals of *M. huxleyi* were as follows :

Station.	Date.	Trunk.	Tail.
3	4.viii.28	3·7	12·6
10	4.ix.28	4·7	13·3
22	23.x.28	3·8	12·7
32	5.xii.28	4·0	11·7
50	18.iii.29	3·9	13·8
60	7.vi.29	4·4	13·4

M. huxleyi occurred abundantly in the oblique hauls at Station 8 (24.viii.28) and Station 26 (19.xi.28) in Trinity Opening, but curiously enough hardly occurred in the collections from outside the barrier, being taken only at Station 45 (28.ii.29) and Station 50 (18.iii.29), and then only in ones and twos. This may possibly have been because the hauls were deep vertical hauls, and did not fish for long in the upper water layers.

Genus *Stegosoma*, Chun.

Stegosoma magnum (Langerhans).

Tables I and II show that *S. magnum* was taken occasionally during most of the months of the year, but was apparently absent in May, June and July. In the stramin net catches at the weekly station in the barrier reef lagoon the largest number was 10, and the coarse silk net shows similar results. It is quite evident, then, that this species was much rarer than *M. huxleyi* in the barrier reef lagoon.

In Trinity Opening, however, *S. magnum* was quite abundant in two oblique catches, at Station 8 (24.viii.28) in the stramin net, and at Station 26 (19.xi.28) in the coarse silk net. The estimated numbers for these two catches were 160 and 169 respectively. As these are based on the actual identification of 56 and 25 individuals from the samples, they should be reliable.

Measurements of lengths of trunk and tail in mm. were as follows :

Station.	Date.	Trunk.	Tail.
3	4.viii.28	3·8	10·8
13	20.ix.28	(disintegrated)	9·3
22	23.x.28	2·3	8·7
26	19.xi.28	3·0	8·7
27	21.xi.28	2·9	5·2
37	14.i.29	3·1	7·7

(The anterior part of the head of *S. magnum* is usually rather shrivelled, and the measurements given are probably on the short side except those for Stations 3 and 26, which were made from specimens in excellent condition.)

Family Fritillaridae.

Genus *Fritillaria*, Q. and G.

Fritillaria haplostoma, Fol.

F. haplostoma was represented by only two individuals picked out from the fine silk net catch at Station 37 (14.i.29) in the barrier reef lagoon. It is possible that there may have been other specimens in the fine net collections, but owing to the shortage of time it was not possible to examine these catches as thoroughly as those of the stramin and coarse silk nets. From the size of its trunk (length in mm.) given below, however, it should have been retained in the coarse silk net catches if present.

Station.	Date.	Trunk (mm.).	Tail (mm.).
37	14.i.29	1·5	2·2

Fritillaria pellucida, Busch.

Only three specimens were identified, all from the fine silk net at Station 42 (18.ii.29), in the barrier reef lagoon.

Fritillaria borealis truncata f. *intermedia*, Lohmann.

One specimen only was identified, also from the fine silk net catch at Station 42 (18.ii.29), in the barrier reef lagoon, agreeing with Lohmann's definition (1931).

There were five other specimens of the *F. borealis* type from the same catch, but not in good enough condition for a more exact determination.

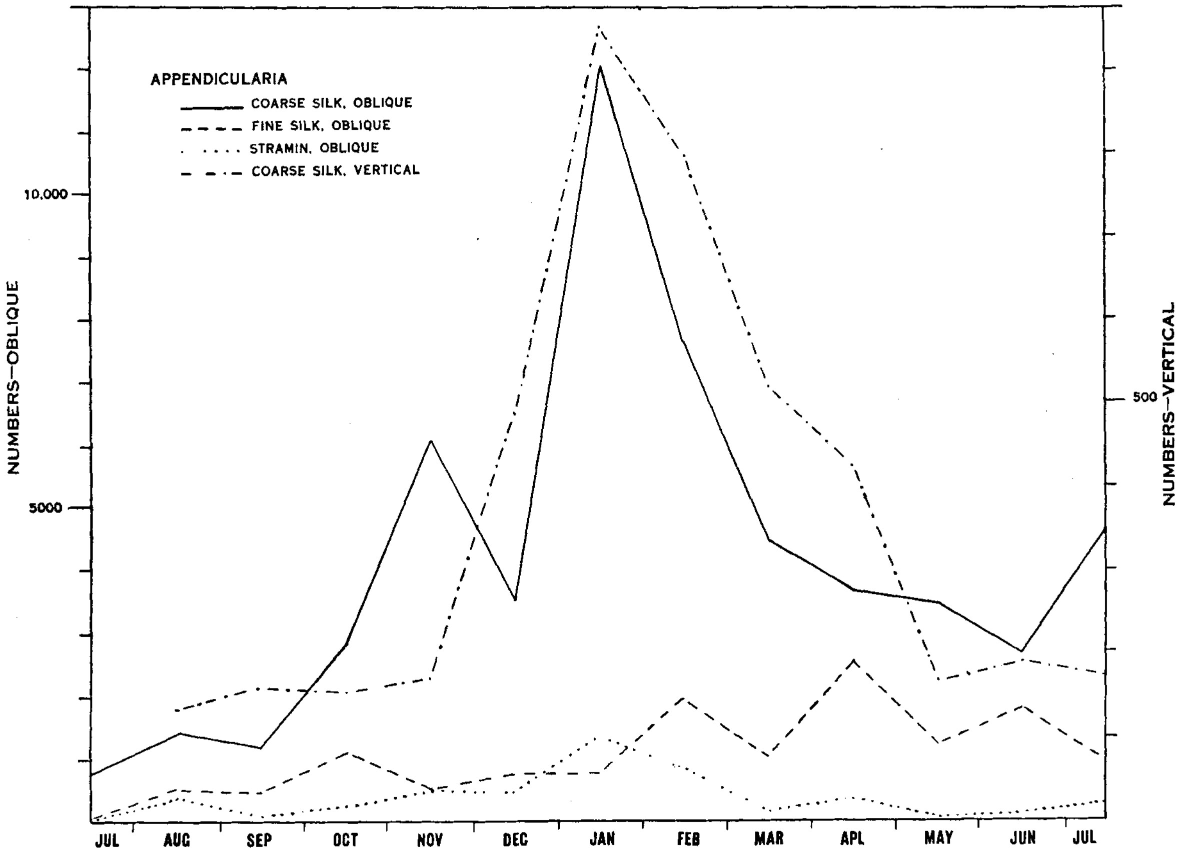
On the Occurrence and Seasonal Distribution of Appendicularians.

Since a complete numerical analysis has not been made of the different species of Appendicularians in the collections, it is advisable that in discussing their occurrence and seasonal distribution the group should be treated as a whole. Actually, owing to the comparatively small numbers of *M. huxleyi*, *S. magnum*, *O. fusiformis*, *F. haplostoma*, *F. pellucida* and *F. borealis*, the general results of the seasonal observations may be regarded as referring to *O. rufescens* and *O. longicauda* together, and especially to the former, which was undoubtedly the most abundant species.

Text-fig. 11 shows the curves for the average monthly occurrence of Appendicularians at the weekly station in the barrier reef lagoon. It indicates that in the coarse silk net oblique catches there was a gradual increase in numbers after September, when the monthly average was 1190, reaching a high maximum of 12,062 in January, with a slight drop in December. The numbers fell off rapidly in February and March to 4443, and from then onwards to July they were fairly steady, though rather higher than in the previous July, August and September. A careful examination of the results in Table II shows that, although there are considerable differences in the abundance from week to week, the monthly average curve may, on the whole, be regarded as giving a fairly true picture of the seasonal occurrence of appendicularians in the coarse silk tow-net catches.

The curve for the coarse silk net is followed closely by that for the stramin net, but in the latter the monthly averages are on the whole very much lower, being in September 200, and in January, 1318. It is probable that the majority of the smaller *Oikopleura* spp. individuals would pass through the meshes of the stramin net.

From a comparison of the two nets it appears possible that the monthly average for the coarse silk net oblique hauls in November may be unduly high owing to the very large catch made at Station 30A (29.xi.28). This collection was made on the day after the stramin net catch [Station 30 (28.xi.28)], in which appendicularians were rather low in



TEXT-FIG. 11.—Curves showing the average catch of all Appendicularia for each month at the position 3 miles east of Low Isles in the barrier reef lagoon. Owing to the preponderance of *Oikopleura rufescens* this curve probably holds good for this species. (Coarse and fine silk and stramin nets, oblique hauls; and coarse silk net, vertical hauls.)

number, and probably indicates the arrival of a swarm. The general trend of the seasonal distribution is confirmed by the vertical hauls with the coarse silk net (Text-fig. 11).

The curve for the fine silk net, shown in Text-fig. 11, does not agree with those for the other two. Owing to the possibilities of clogging of the very fine silk during such long hauls, the results are of rather doubtful significance. It is probable, however, that the same species are represented in the catches, since an examination of a sample from fine net Station 55 (26.iv.29) by Miss Hastings gave 21 *O. rufescens* and 6 *O. longicauda.*

Ignoring the results of the fine silk net, the period of maximum abundance was January and February; this coincided with the period of highest temperatures, 28°–29° C., and of decreasing salinity.

As regards the geographical distribution of the species occurring in the Barrier Reef Expedition collections Lohmann (1931) gives the following:

O. rufescens: A true tropical form which is scarcer in the open ocean than in the coastal region; more frequent in the Indian Ocean than in the Atlantic.

O. longicauda: The characteristic species for the warm water region of all three oceans; abundant both in coastal waters and in the open ocean; sensitive to lowering of temperature, but can withstand low salinities.

O. fusiformis: Occurs generally in the warm water region of all three oceans, and is abundant both in coastal and ocean waters.

M. huxleyi: Occurs in Indian and Pacific Oceans, but has not been found in the Atlantic; in the Indian Ocean it occurs both in coastal and ocean waters. All its occurrences lie within a region where the surface water is more than 20° C.

S. magnum: A warm water form distributed in all three oceans, in coastal as well as ocean waters; occurs mostly in small numbers.

F. haplostoma: Distributed in the warm-water region of all three oceans, and is one of the most abundant *Fritillaria* species. Penetrates far into the coastal water, and appears, *viâ* the warm deep water, as a tropical visitor in Antarctic water.

F. pellucida: Occurs in the warm waters of all three oceans. It extends to 42° N. in the Atlantic, and as far south as 72° S. in the Weddell Sea.

F. borealis is cosmopolitan; it occurs in all three oceans and reaches from pole to pole. *F. borealis truncata* f. *intermedia* does not extend further south than about 40° S. (where it is abruptly replaced by *F. borealis acuta*). It is found throughout the Indian and Atlantic Oceans, in the Mediterranean Sea, and as far north as Davis Strait.

The paucity of *Fritillaria* spp. in the Barrier Reef collections, compared with those of the Siboga Expedition (Ihle, 1908), is at once evident. The Siboga Expedition records 7 species, *F. pellucida, F. haplostoma, F. formica, F. megachile, F. tenella, F. bicornis* and *F. borealis truncata* f. *ritteri*; of these only *F. pellucida* and *F. haplostoma* were found in the Barrier Reef collections, with the addition of *F. borealis truncata* f. *intermedia*. Each species was caught on one occasion only, in very small numbers, and all in the fine silk net. This scarcity may perhaps be explained to a certain extent by the fact that the collections made by the fine silk net have not been thoroughly examined, and by the possibility that in the coarse silk net catches the delicate *Fritillaria* spp. have been damaged beyond recognition by the bulk of the plankton. If, however, they had been abundant in the region, surely some would have been seen in the coarse silk net catches, and one cannot help feeling that their rarity is significant. Examination of the Siboga Expedition records shows the *Fritillaria* species were by no means common. *F. pellucida*, which was the most frequent species taken, appeared only at 17 stations out of the 69 at which Appendicularians were caught; *F. formica* and *F. borealis* f. *ritteri* were only taken at 8 stations; *F. tenella* at 5 stations, *F. bicornis* at 3, and *F. haplosoma* and *F. megachile* only at 1 station each. It is evident therefore that even *F. haplostoma*, which according to Lohmann is one of the most frequent of Fritillarians, was not abundant in the region surveyed by the Siboga Expedition.

Among the *Oikopleura* species Ihle (1908) records only 4 species from the Siboga Expedition, *O. longicauda, O. rufescens, O. fusiformis* and *O. cophocerca*, of which the first three occurred in the Barrier Reef collections. While, however, *O. rufescens* was easily the most abundant species in the Barrier Reef region surveyed, *O. longicauda* was the most frequent species taken by the Siboga Expedition, *O. rufescens* coming next in importance. This is perhaps in agreement with Lohmann's statement (1931) that *O. rufescens* is scarcer in the open ocean than in coastal waters, the Barrier Reef collections being purely coastal and shallow water, as opposed to many of the Siboga stations which were taken in deep water among the islands of the Dutch East Indies.

Of the true warm-water species of *Oikopleura*, *O. cophocerca*, *O. albicans*, *O. parva*, *O. intermedia*, *O. gracilis* and *O. cornuto-gastra* were absent from our collections. According to Lohmann, *O. intermedia*, though coastal and oceanic, has never been recorded from the Pacific, *O. gracilis* occurs only in the tropical region of the Indian Ocean, and *O. cornuto-gastra* has so far only been recorded from the Japanese coast. *O. cophocerca* and *O. albicans* thrive best in the open ocean far from the coast. *O. parva* is also a deep-water form that would hardly be expected to occur in our collections.

The absence of that cosmopolitan species *O. dioica* is, however, of especial interest, as the Siboga Expedition also failed to take it. It has been recorded elsewhere in the Pacific; on the western side by Aida (1907), off the Japanese coast, and by Lohmann (1931, p. 96) from the Bismarck Archipelago.

The two remaining species in our collections, *M. huxleyi* and *S. magnum*, appear to agree with the findings of other expeditions, the former being the more common. Ihle (1908, p. 106) says that in the region explored by the Siboga Expedition *M. huxleyi* was not rare, occurring in 44 stations out of the 69 at which Appendicularians were caught, but *S. magnum* was not frequent and never occurred in large numbers.

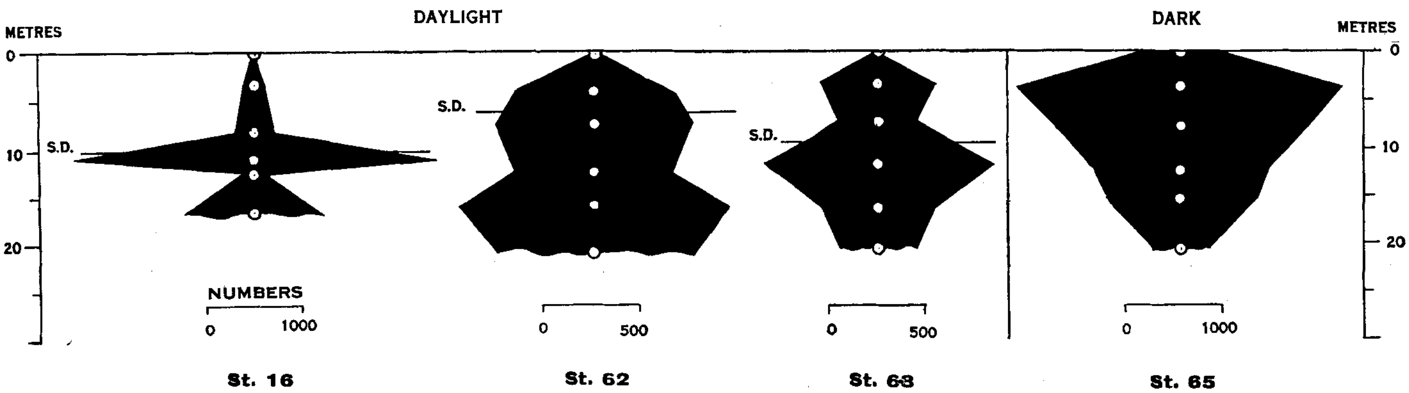
The only localities in the Pacific where seasonal observations have been made of Appendicularia are the Bismarck Archipelago (Lohmann, 1931, p. 96), San Diego off the Californian Coast (Essenberg, 1922), and the Japanese coast (Aida, 1907).

The Bismarck Archipelago collections were made by Dahl at Ralum down to depths of 500 metres during seven months in 1896–97. The collections were unfortunately not counted, and Lohmann (1931, p. 96) is only able to give the compositions of samples from the different catches in each month. The surface water ranged from 28–30° C. the whole time. The most abundant *Oikopleura* species was *O. longicauda*, which was followed by *O. fusiformis* and *O. rufescens* (Lohmann says *O. dioica*, but his Liste 30 shows *O. rufescens* to be more abundant). Among the Fritillaria species *F. borealis truncata* f. *ritteri* predominated, followed by *F. pellucida*, and somewhat further behind by *F. formica* and *F. haplostoma*. *S. magnum* was apparently more abundant than *M. huxleyi*. No conclusions as to seasonal abundance could be drawn, but examination of the numbers in the samples given in Liste 30 shows that most specimens and species occur in January, February and March.

For the Californian coast at San Diego we have more substantial data supplied by Essenberg (1922) as a result of daily collections from the pier head over a period of three years. Essenberg gives (1922, pp. 57 and 58) two curves showing the numbers of *Oikopleura* spp. and of *Fritillaria* spp. respectively, plotted against the temperature of the sea. "The greatest numbers of species and individuals occur in the cooler months from October to March and April. After that the animals decrease in numbers gradually, until in the summer months the *Fritillaria* almost completely disappear from the surface waters, and only the cosmopolitan species of *Oikopleura* such as *O. dioica* and *O. longicauda*, with rare exceptions of other species, occur in limited numbers in that season." "The optimum temperature lies between 14° and 16° C. At this temperature the maximum representation is reached. In a temperature above 16° a decrease of Appendicularians is noticed, and at 20°–22° they are almost completely absent from the surface waters."

In that region *O. dioica* is the most common species (Essenberg, 1926, p. 486), followed by *O. longicauda* and *O. fusiformis*. *O. cophocerca* and *O. rufescens*, among other species, have only been found occasionally. The Californian coast, being bathed by the cool south-going current, evidently has a more temperate appendicularian population than the western Pacific, and it seems possible that even in summer, with a temperature of 21° C., the water is only approaching the lower limit of the optimum temperature range of the warm-water species, or at any rate does not reach it for long enough to allow any species to establish itself abundantly.

Aida (1907) records *O. longicauda*, *O. dioica* and *O. fusiformis* as the commonest species off the coast of Japan, which agrees with the observations at San Diego. *O. rufescens* and *S. magnum* occur among the oceanic plankton organisms that approach the



TEXT-FIG. 12.—The vertical distribution of Appendicularians in the daylight and in the dark in the barrier reef lagoon. Station 16 (3.x.28), 10.13 a.m. to 12.27 p.m.; Station 62 (15.vi.29), 11.20 a.m. to 1.45 p.m.; Station 68 (18.vii.29), 10.30 a.m. to 12.55 p.m.; Station 65 (10.vii.29), 9.00 p.m. to 11.25 p.m. The circles and white dots indicate the average depths at which the hauls were made. Coarse silk townet. S.D., Secchi disc reading.

Japanese coast in mid-summer and early autumn. Aida (1907, p. 25) says, "It is in the summer, when that wind (south) prevails and the black current sweeps nearer the land than in other seasons, that the Copelata are most richly represented along the Pacific Coast of Japan".

The Barrier Reef collections are so far the only records giving a full picture of a year's course in a region in the Pacific where warm tropical water conditions exist all the year round. In other seas we have the results of Lohmann at Messina in the Mediterranean, in the Weddell Sea, and off Kaiser Wilhelm II Land (1931), of Fish (1925), for the Woods Hole region in the Atlantic, and of Nikitin for the Black Sea, but none of these relate to regions strictly comparable with the Barrier Reef.

VERTICAL DISTRIBUTION.—The vertical distribution of appendicularians at the four stations taken in the barrier reef lagoon is shown in Text-fig. 12. While tending to avoid the actual surface layers, quantities of appendicularians occurred well above the bottom, so that the seasonal distribution shown by the oblique hauls should be reliable. At Station 16 there is an indication of considerable unevenness in horizontal distribution in that very large numbers were taken in the haul at 11·1 m., which was made after the rest of the series had been completed. The actual numbers caught at each station can be found in Table VIII, in Vol. II, No. 6.

At Station 65, which was taken in the dark, the appendicularians had evidently moved very much nearer the surface than they were in the daylight collections at the other three stations.

On the Occurrence of Appendicularian Houses.

Throughout the year the occurrence of the houses of appendicularians in the plankton was very noticeable, and they were often so abundant as to make counting of the smaller animals extremely difficult. As is to be expected, the abundance of the houses shows rather a similar course to that of the appendicularians themselves. They were definitely most abundant from November to February, the highest monthly average being 11,950 houses in the coarse net in January.

The presence of these slimy houses is evidently a very characteristic feature of some tropical waters, and their identification at first troubled the writers until the meshes of the grid could be made out. It is interesting to read in this connexion a description, evidently referring to these houses, given in the "Challenger" Reports (Summary of Results, p. 774), at Station 199 in the Celebes Sea: "There were also small masses of transparent jelly-like matter of various shapes, mostly spherical or cylindrical, containing inside small Diatoms like *Navicula*, Coccospheres, Rhabdospheres, and small Polycystinæ, and frequently attached to the outside the above-mentioned forms of Oscillatoriacea and other foreign bodies, including some Infusoria. These jelly or colloid masses rendered the townet quite sticky, as though covered with a coating of thin glue; they were generally about the size of peas . . ."

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TABLE I.—*Tunicata Occurring in Oblique Hauls of the 1-metre Stramin Net at the Stations in the Barrier Reef Lagoon 3 miles East of Low Isles.*

Station number.	Date.	*Salpa democratica.* Solitary	*Salpa democratica.* Aggregate	*Salpa confœderata.* Solitary	*Salpa confœderata.* Aggregate	*Salpa cylindrica.*	*Salpa rostrata.*	*Cyclosalpa pinnata* (aggregate).	*Doliolum tritonis.*	*Doliolum denticulatum.*	*Doliolum* spp.	*Megalocercus huxleyi.*	*Stegosoma magnum.*	*Oikopleura rufescens.*	*Oikopleura* spp.
1	27.vii.28	..	..	..	..	..	..	..	..	1	..	..	..	10	..
2	30.vii.28	1	..	..	4	..	..	1	..	14	..	1	..	184	45
3	4.viii.28	..	..	..	1	1†	..	..	..	10	..	56	7	1518	2236
5	11.viii.28	..	..	..	..	..	..	..	..	9	..	..	..	..	..
6	17.viii.28	..	..	..	..	..	..	..	..	106	..	1	..	103	24
7	22.viii.28	89	53	..	..	..	..	..	..	112	..	..	1	..	11
9	31.viii.28	63	..	..	..	..	..	..	..	26	..	..	..	..	..
10	4.ix.28	9	25	..	..	..	..	..	..	8	..	22	..	..	101
12	11.ix.28	99	704	..	..	..	..	..	..	26	..	27	2	90	..
13	20.ix.28	572	1174	..	..	3	..	..	..	17	..	130	8	..	..
14	26.ix.28	131	2080	..	..	..	..	..	..	11	..	163	4	250	..
15	2.x.28	364	120	..	..	..	..	..	..	81	..	2	..	..	..
18	15.x.28	498	3092	..	..	..	..	..	..	12	..	7	..	261	..
22	23.x.28	233	2310	..	..	..	..	..	..	2	..	107	2	576	..
23	2.xi.28	1611	14,924	..	..	..	..	..	..	12	..	172	..	..	..
24	6.xi.28	2920	13,920	..	..	..	..	..	..	20	..	265	..	..	804
25	16.xi.28	120	90	..	..	..	..	..	..	..	..	..	..	..	..
27	21.xi.28	10	..	..	..	..	1	..	..	..	..	4	9	1015	120
30	28.xi.28	..	..	..	..	..	..	..	..	23	4	10	3	280	..
32	5.xii.28	11	10	..	..	..	..	..	128	746	16	12	4	84	..
33	14.xii.28	..	600	..	..	..	..	..	..	..	..	..	..	..	610
34	19.xii.28	..	50	..	..	10†	4	..	..	10	10	14	2	910	..
35	27.xii.28	745	8171	..	..	178†	58	..	122	13	49	28	7	113	..
36	4.i.29	810	7610	..	..	..	..	..	56	14	..	3	..	607	..
37	14.i.29	58	..	..	..	..	1	..	..	..	3	140	..	2260	..
38	21.i.29	360	2230	..	..	..	2	..	..	..	..	40	..	820	..
39	30.i.29	10	20	..	8	..	..	..	..	10	..	20	..	1380	..
40	6.ii.29	10	10	14	166	..	..	..	..	2	..	..	..	192	128
41	13.ii.29	..	..	11	12	155*	..	..	..	1	..	41	..	1700	29
42	18.ii.29	3	10	..	..	2	..	..	..	..	71	..	..	..	440
47	4.iii.29	..	..	..	..	1	..	..	..	38	29	110	10	380	..
48	15.iii.29	..	..	..	..	..	..	..	..	9	..	..	..	..	..
51	25.iii.29	11	..	..	..	..	..	..	..	..	..	..	..	..	1
52	6.iv.29	1	21	..	..	195*	..	..	..	60	..	140	10	265	15
53	13.iv.29	6900	103,500	8	11	..	..	..	..	160	..	15	..	..	..
54	20.iv.29	40	10	..	..	..	..	..	..	27	..	38	..	170	..
55	26.iv.29	500	1050	..	20	100*	..	..	..	3	..	70	..	580	..
56	7.v.29	5400	20,800	1	50	1†	..	..	..	120	..	..	..	..	..
57	18.v.29	2800	26,600	7	40	3†	3	..	..	60	..	..	..	..	..
58	25.v.29	110	20	1	..	..	90	..	..	7	..	6	..	60	..
59	31.v.29	2	..	..	160	..	10	..	..	7	6	50	..	..	..
60	7.vi.29	..	2	..	2	..	..	..	..	147	13	280	..	70	..
61	14.vi.29	..	..	..	5	..	..	..	..	2	..	..	..	..	..
63	24.vi.29	..	..	..	1	..	..	..	..	2	..	..	..	..	..
64	5.vii.29	..	..	..	..	..	1	..	..	60	..	..	..	..	700
66	11.vii.29	..	..	..	1	..	..	..	..	1	..	10	..	..	..
67	17.vii.29	..	..	..	..	..	..	..	..	15	..	..	..	..	20

* Some of the aggregate individuals were still united as chains, though free from the parent. The component individuals of these chains have been counted, and the number given comprises them as well as the completely free aggregate individuals. St. 41 also contains 1 solitary ; St. 52, 1 solitary ; and St. 55, 10 solitary.

† St. 3, solitary ; St. 34, aggregate and solitary ; St. 35, 7 solitary ; St. 56, 1 solitary ; St. 57, 3 solitary.

TABLE II.—*Tunicata Occurring in Oblique Hauls of the Coarse Silk Tow-net at the Stations in the Barrier Reef Lagoon 3 miles East of Low Isles.*

Station number.	Date.	*Salpa democratica.*		*Salpa confœderata.*		*Salpa cylindrica.*		*Salpa rostrata.*	*Doliolum gegenbauri.*	*Doliolum tritonis.*	*Doliolum denticulatum.*	*Doliolum* spp.	*Megalocercus huxleyi.*	*Stegosoma magnum.*	*Oikopleura fusiformis.*	*Oikopleura longicauda.*	*Oikopleura rufescens.*	*Oikopleura* spp.
		Solitary	Aggregate	Solitary	Aggregate	Solitary	Aggregate											
1	27.vii.28	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	+	440
2	30.vii.28	..	..	..	..	..	..	..	..	..	..	10	1	..	..	..	+	1142
3	4.viii.28	3	..	..	..	1	5	..	..	..	2	..	15	2	..	+	+	2652
5	11.viii.28	..	..	..	..	..	..	..	..	..	3	..	..	..	..	..	+	1810
6	17.viii.28	..	..	..	..	..	..	..	..	..	45	..	1	..	..	..	+	989
7	22.viii.28	3	..	..	..	..	..	..	..	..	415	..	20	3	..	+	+	1420
9	31.viii.28	3	..	..	..	..	..	..	..	..	8	..	1	..	..	..	..	..
10	4.ix.28	..	10	..	..	..	..	..	..	..	1	..	3	..	..	..	+	1430
12	11.ix.28	13	270	..	..	..	..	..	..	..	10	..	2	..	..	..	..	429
13	20.ix.28	29	892	..	..	..	..	..	..	..	3	..	4	4	..	..	+	840
14	26.ix.28	241	378	..	..	..	..	..	..	..	2	..	127	6	+	+	+	1920
15	2.x.28	2103	12,151	..	..	..	..	..	..	..	329	..	1	..	..	..	+	2200
18	15.x.28	38	220	..	..	..	..	..	..	..	2	..	6	..	..	..	+	5057
22	23.x.28	60	1750	..	..	..	..	..	..	1	2	..	180	120	..	..	+	923
23	2.xi.28	340	15,311	..	..	2	9	..	..	..	..	..	14	..	..	..	..	10
24	6.xi.28	480	5960	..	..	12	..	..	..	..	2	..	380	..	..	..	..	611
25	16.xi.28	152	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
27	21.xi.28	..	..	..	..	..	..	..	..	..	..	..	62	123	..	6530	8939	2466
30A	29.xi.28	..	..	..	..	..	..	..	..	..	..	..	307	..	..	+	+	10,810
32	5.xii.28	10	800	..	..	..	..	1	..	7	44	..	44	..	..	..	+	3210
33	14.xii.28	10	612	..	..	..	..	..	..	..	..	..	..	..	..	..	+	1200
34	19.xii.28	..	..	..	..	..	2	10	130	10	13	1400	37	..	..	+	+	4110
35	27.xii.28	1	1110	..	..	3	3	..	..	50	..	204	4	8	..	..	..	5440
36	4.i.29	183	3037	..	..	1	..	2	..	..	231	..	15	..	..	..	?	2420
37	14.i.29	410	..	..	..	..	..	..	..	..	..	412	90	10	..	2810	17,843	5447
38	21.i.29	78	890	..	..	..	..	..	..	..	..	..	30	..	..	..	+	5970
39	30.i.29	..	20	..	..	..	..	..	..	..	621	..	20	..	..	316	8330	4934
40	6.ii.29	..	..	..	60	..	..	..	..	..	10	..	30	..	..	..	..	3570
41	13.ii.29	..	..	..	2	..	..	..	..	..	3	10	90	..	41	3710	8318	2641
42	18.ii.29	..	20	..	..	..	..	..	..	..	..	235	..	..	..	..	..	4550
47	4.iii.29	..	..	..	..	..	..	..	+	..	173	60	70	..	..	+	+	11,130
48	15.iii.29	..	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..	400
51	25.iii.29	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	1800
52	6.iv.29	2	10	..	..	..	..	..	..	65	196	..	120	..	..	..	+	7880
53	13.iv.29	800	16,200	1	..	1	..	1	..	..	593	130	..	..	..	..	..	400
54	20.iv.29	17	..	..	..	..	..	..	..	..	30	..	50	..	..	..	+	3014
55	26.iv.29	80	330	..	..	..	..	10	..	..	31	..	60	..	..	..	+	3140
56	7.v.29	400	2400	1	..	1	..	1	..	..	724	..	..	..	..	..	+	2200
57	18.v.29	1800	8600	3	41	..	..	..	..	..	70	..	..	..	..	..	..	600
58	25.v.29	210	..	1	..	1	..	80	..	..	..	1	5	..	..	..	..	6060
59	31.v.29	31	..	..	..	..	..	10	..	..	..	..	80	..	..	..	+	4820
60	7.vi.29	12	1	..	..	..	..	1	..	..	302	17	140	..	..	..	+	2280
61	14.vi.29	..	1	..	..	..	..	..	..	..	1	..	..	..	..	..	..	2000
63	24.vi.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3410
66	11.vii.29	..	..	..	..	..	..	..	..	..	3	..	..	..	..	..	..	3600
67	17.vii.29	..	..	..	..	..	..	..	..	..	23	..	..	..	..	..	+	5431

+ Implies that the species was noted as present but not counted in the sample.

TABLE III.—*Tunicata from Stations other than that 3 miles East of Low Isles.*

Station number.	Date.	Position.	*Salpa democratica.* Solitary	*Salpa democratica.* Aggregate	*Salpa confœderata.* Solitary	*Salpa confœderata.* Aggregate	*Salpa cylindrica.* Solitary	*Salpa cylindrica.* Aggregate	*Salpa rostrata.*	*Salpa zonaria.*	*Cyclosalpa pinnata.*	*Doliolum tritonis.*	*Doliolum denticulatum.*	*Doliolum* spp.	*Megalocercus huxleyi.*	*Stegosoma magnum.*	*Oikopleura fusiformis.*	*Oikopleura longicauda.*	*Oikopleura rufescens.*	*Oikopleura* spp.
									COARSE SILK NET.											
8	24.viii.28	I.T.O.	2	1	..	..	1	..	..	..	..	..	..	..	72	4	..	..	+	155
11	6.ix.28	I.T.O.	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	400
19	20 .x.28	O.T.O.	28	5	..	..	..	..	1	..	..	44	46	..	..	..	..	..	..	5
20	20.x.28	O.T.O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	300
21	22.x.28	3 m. E. night	285	1765	..	..	..	..	..	..	..	..	24	..	+	+	..	..	..	2850
26	19.xi.28	I.T.O.	1	..	..	..	..	..	..	..	..	..	1	..	..	169	..	130	1636	254
28	23.xi.28	O.T.O.	10	..	..	..	..	..	..	..	..	..	10	5	..	..	..	..	..	102
43	26.ii.29	C.B.	..	..	..	1	1	..	..	..	..	..	..	10	..	..	..	..	..	600
44	27.ii.29	Li.I.	1	..	..	..	..	..	..	..	..	..	30	..	23	..	..	..	..	1590
45	28.ii.29	O.C.P.	..	..	..	..	..	..	..	..	..	..	221	44	2	..	..	..	..	400
46	28.ii.29	I.C.P.	..	..	1	..	..	..	..	..	..	..	..	10	23	..	..	..	..	1030
49	17.iii.29	I.P.P.	11	61	..	..	2	..	..	..	..	..	80	60	50	..	..	+	+	3420
50	18.iii.29	O.P.P.	..	325	..	..	8	..	..	..	..	..	3	8	..	..	..	..	..	405
									STRAMIN NET.											
8	24.viii.28	I.T.O.	4	124	..	..	..	..	..	..	..	..	..	..	230	160	..	..	45	..
11	6.ix.28	I.T.O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	20.x.28	O.T.O.	12	27	..	..	..	..	..	..	1	12	20	..	3	3	..	..	..	..
21	22.x.28	3 m. E. night	627	3081	..	..	..	..	..	..	..	..	..	..	240	..	+	..	+	82
26	19.xi.28	I.T.O.	1	..	..	..	..	..	..	..	..	..	2	..	..	30	..	..	2100	160
28	23.xi.28	O.T.O.	33	..	..	..	..	..	..	..	..	..	5	8	..	..	..	..	..	30
29	24.xi.28	O.T.O. B.S.N.	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..
31	2.xii.28	3 m. E. B.S.N.	10	10	..	..	..	..	..	..	..	..	..	..	3	..	..	..	100	..
43	26.ii.29	C.B.	..	..	2	..	..	3	..	..	..	..	..	10	1	..	..	..	..	41
44	27.ii.29	L.I.	2	..	..	..	..	..	..	..	..	4	10	10	2	1	..	..	200	..
45	28.ii.29	O.C.P.	2	3	..	..	..	..	..	..	..	..	10	8	1	..	..	..	..	..
46	28.ii.29	I.C.P.	9	..	..	..	1	1	..	..	..	8	8	15	95	..	..	..	110	..
49	17.iii.29	I.P.P.	110	441	..	..	5	10	..	..	..	..	90	80	140	30	..	..	180	..
50 (i)	18.iii.29	O.P.P.	2	110	..	..	78	62	..	..	..	..	54	28	1	..	..	..	..	..
50 (ii)	18.iii.29	O.P.P.	13	131	4	4	78	..	..	..	3	..	4	26	1	..	..	..	..	..

I.T.O., in Trinity Opening; O.T.O., outside Trinity Opening; C.B., off Cape Bedford; Li.I., off Lizard Island; O.C.P., outside Cook's Passage; I.C.P., inside Cook's Passage; I.P.P., inside Papuan Pass; O.P.P., outside Papuan Pass; B.S.N., bottom stramin net. St. 50 (i) = 400 m. St. 50 (ii) = 170 m. (For positions see Chart II, Vol. II, No. 1.)

\+ Implies that the species was noted as present but not counted in the sample.

MOLLUSCA

Molluscs did not form a very important part of the plankton population at any time of the year, the average catches for the whole year being, for the stramin net 2·2% of the total catch, for the coarse silk net oblique hauls 3·0%, and for the fine silk net 3·8%. The highest values reached in any one month for these nets were respectively 6·7%, 4·9% and 8·9% (this excludes fine silk Station 25 (16.xi.28), when a catch of 114,500 lamellibranch larvae was recorded. This was evidently a swarm, perhaps of newly spatted larvae, and its presence was not indicated by the coarse silk net, which was fishing at the same time).

We give below the average catch for each month expressed as a percentage of the total animals caught for each net :

Number of Molluscs as Percentage of Total Animals Caught in each Month.

	Oblique hauls.		
	Stramin.	Coarse silk.	Fine silk.
1928 :			
July	1·1	2·4	..
August	1·0	4·2	0·2
September	1·2	3·9	3·5
October	2·7	4·9	8·9
November	1·3	3·6	3·0 (or 44·4)*
December	1·3	2·2	3·6
1929 :			
January	5·4	2·1	7·6
February	6·5	2·5	4·0
March	6·7	3·4	5·7
April	0·9	3·4	4·6
May	1·3	2·3	3·7
June	2·3	3·4	3·8
July	0·4	2·5	0·7
Average for year (based on average catch for each month)	2·2	3·0	3·8

The mollusca were represented by planktonic pteropods and heteropods, and the temporary larval stages of gastropods and lamellibranchs. In addition there were one or two isolated specimens of young cephalopods caught.

* Including Station 25 (16.xi.28).

Below is given the percentage composition of the average monthly catches of mollusca in the oblique hauls with the stramin and coarse silk nets :

Percentage Composition of Average Monthly Catches of Mollusca.

	Oblique hauls.							
	Stramin.				Coarse silk.			
	Pteropods.	Heteropods.	Gastropods.	Lamellibranchs.	Pteropods.	Heteropods.	Gastropods.	Lamellibranchs.
1928 :								
July	91·1	8·9	..	..	1·5	0·7	42·9	54·9
August	59·5	27·5	13·0	..	0·8	0·8	49·6	48·8
September	76·0	24·0	..	..	1·6	2·6	61·9	33·9
October	71·8	28·2	..	..	19·4	..	54·9	25·7
November	51·3	35·9	12·8	..	51·8	0·4	39·0	8·7
December	30·5	6·7	62·8	..	57·5	..	32·7	9·8
1929 :								
January	96·9	2·8	0·3	..	64·3	0·4	15·3	20·0
February	83·2	15·6	1·2	..	29·8	0·4	29·8	40·0
March	90·0	7·4	2·6	..	26·7	..	22·3	51·0
April	75·2	17·8	7·0	..	30·5	0·4	38·0	31·1
May	57·4	33·3	9·3	..	24·2	1·1	31·1	43·6
June	57·3	38·5	4·2	..	18·2	1·3	29·3	51·2
July	41·7	58·3	..	..	0·8	..	11·5	87·7
Average for year (based on average catch for each month)	66·4	15·1	18·5	..	24·7	0·5	36·0	38·8

On the average for the year, 66·4% of all mollusca in the stramin net catches were pteropods. Of the remainder, 15·1% were heteropods and 18·5% gastropod larvae ; the high percentage of gastropod larvae is, however, due to one large catch at Station 35 in December. The large size of the stramin mesh allowed no lamellibranch larvae to be retained. In the coarse silk net the larval molluscs played a much greater part, comprising on the average 74·8% of the total molluscs, 36·0% being gastropods and 38·8% lamellibranchs. Of the remainder in the coarse silk net 24·7% were pteropods, while only 0·5% were heteropods. An examination of the figures for each month shows also that in the coarse silk net it was only from October, 1928, to June, 1929, that the pteropods were of importance, in the remaining three months the molluscs being almost entirely larval gastropods and lamellibranchs.

GASTROPODA.

PTEROPODA.

The Pteropods have been identified by the late Miss Anne L. Massy, of the Fisheries Department, Dublin. Fifteen species were recorded, of which 13 were Thecosomatous and 2 Gymnosomatous. They were *Peraclis* sp., *Cavolinia longirostris* (Les.), *C. tridentata*

(Forsk.), *C. inflexa* (Les.), *C. uncinata* (Rang.), *C. quadridentata* (Les.), *Diacria trispinosa* (Les.), *Cleodora pyramidata* (L.), *Creseis* (*Hyalocylix*) *striata* (Rang.), *Creseis* (*Styliola*) *subula* (Q. and G.), *Creseis virgula*, Rang., *C. acicula*, Rang., *Gleba* sp. ? *Pneumoderma mediterraneum*, Van Beneden, and *Paraclione pelseneeri*, Tesch.

Creseis virgula, *C. acicula* and *Cavolinia longirostris* were the only common species at the weekly station in the barrier reef lagoon, and at other stations within the barrier. The only other pteropods occurring at all within the barrier were one specimen of *Cavolinia tridentata* recorded at Station 15 (2.x.28), and single specimens of *Paraclione pelseneeri* taken in the stramin and coarse silk nets, oblique hauls, at Station 6 (17.viii.28). One *Pneumoderma mediterraneum* was recorded from the anchorage of Low Isles on April 2nd, 1929.

The collections from outside the barrier were much richer in species, 13 different species being taken as shown in Tables IV, V and VI.

A separate report has not been published by Miss Massy, but in the following accounts of the species the passages in inverted commas have been taken verbatim from her manuscript.

EUTHECOSOMATA.

Family Limacinidae.

Genus *Peraclis*, Forbes.

Only one limacinid pteropod has been found in all the plankton catches taken during the Great Barrier Reef Expedition. This occurred at Station 20 (20.x.28) outside Trinity Opening, and belonged to the deep-water genus *Peraclis*. The specimen was sent to Prof. Tesch for identification, but was not in a fit state of preservation for him to say definitely which species it was; he thought, however, that possibly it was *P. reticulata*, d'Orbigny.

Limacinids might conceivably have been overlooked among the numerous gastropod larvae in the plankton. All the gastropod larvae picked out from the collections have, however, been re-examined by Prof. Pelseneer and one of us (F. S. R.), but not a single pteropod could be found among them except the *Peraclis* mentioned above.

Family Cavoliniidae.

Genus *Cavolinia*, Gioeni, 1873, Abildgaard 1791.

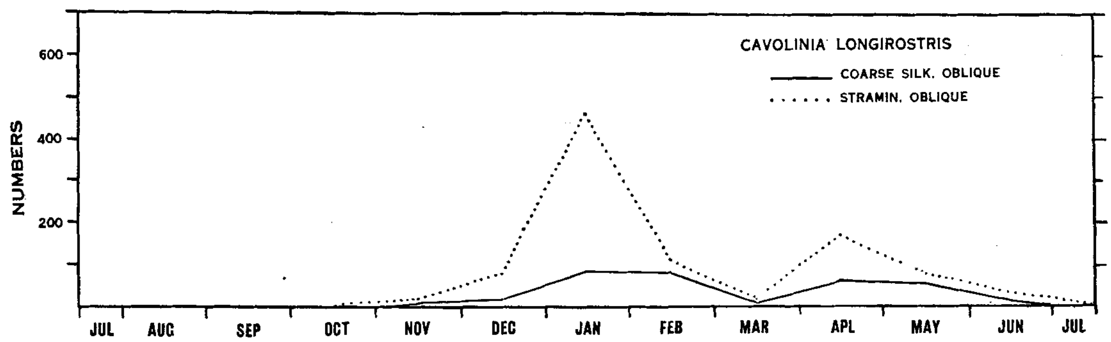
Cavolinia longirostris (Lesueur), 1821.

Cavolinia longirostris was by far the commonest species of this genus and, next to *Creseis acicula* and *Creseis virgula*, the most abundant pteropod within the barrier. At the weekly station in the barrier reef lagoon single specimens only were taken from July to October, but an increase in abundance started in November which reached a maximum in January, when the largest catch of 1216 individuals was made in the stramin net at Station 38 (21.i.29). The numbers fell again very low in March, but rose to a fresh peak in April, when the largest catch was 435 in the stramin net at Station 53 (13.iv.29). Thereafter the numbers fell once more to a minimum in July. Text-fig. 13 shows graphically the average monthly catches for this species in the stramin and in the coarse silk nets, oblique hauls. The coarse silk net catches reflect those of the stramin net, but owing to the larger amount of water filtered by the stramin net the catches for that net are the greater. This indicates that the majority of the *C. longirostris* taken were of a large size and would not pass through the meshes of the stramin.

At Station 27 (21.xi.28) the specimens were "mostly young." The presence of two "larvae" is recorded from Station 50 (18.iii.29) outside Papuan Pass.

"In almost all the specimens the shells were beautifully preserved, so that it was a pleasure to sort them." Immediately after sorting from the formalin-preserved collections the pteropods were placed in 70% alcohol.

This species occurred both inside and outside the barrier.



TEXT-FIG. 13.—Curves showing the average catch of *Cavolinia longirostris* for each month at the position 3 miles east of Low Isles in the barrier reef lagoon. (Coarse silk and stramin nets, oblique hauls.)

DISTRIBUTION.—"In Atlantic up to about 47° N. latitude. Indian and Chinese Seas very abundant." Tesch (1906) records this species as very abundantly distributed in the whole region surveyed by the Siboga Expedition and "certainly the most common species of *Cavolinia* in the East Indian Archipelago".

Cavolinia tridentata (Forsk.), 1775.

C. tridentata was never recorded from the plankton, but only at Dredge Station XV (8.iii.29, ½ mile outside Cook's Passage, 210 fathoms), when one whole specimen and one empty shell were taken.

"Distributed in all warm seas." Tesch (1904) reports it as "not so abundant as nearly all the other species of *Cavolinia*" in the Siboga collections.

Cavolinia inflexa (Les.), 1812.

C. inflexa was only taken at two stations outside Trinity Opening, namely Station 19 (20.x.28), stramin net, one specimen; metre silk net, "? three young", and Station 28 (23.xi.28), stramin net, one; coarse net, four. It was never recorded from any locality within the barrier.

"Distributed in all warm seas. Wanders occasionally with a warm current as far as about 50° N. off the south west of Ireland." From the Siboga collections Tesch records it as not nearly so abundant as *C. longirostris*.

Cavolinia uncinata (Rang.), 1836.

C. uncinata was never recorded from the plankton, but only from Dredge Station XV (8.iii.29), when one shell was taken.

" Distributed in all warm seas." This species was very common in the Siboga collections (Tesch 1904), but the specimens were chiefly empty shells.

Cavolinia quadridentata (Les.), 1821.

Like *C. inflexa*, *C. quadridentata* was only recorded from outside Trinity Opening at Station 19 (20.x.28), 6 specimens in stramin net, and at Station 29 (24.xi.28), when one " shell " was taken in a depth of about 205 metres in the bottom stramin net.

" Distributed in all warm seas." Recorded by Tesch (1904) as a very common form in the whole area of Siboga Expedition.

Genus *Diacria*, Gray, 1842.

Diacria trispinosa (Les.), 1821.

D. trispinosa was never recorded from the plankton, but only from Dredge Station XV (8.iii.29), when one shell was taken in the dredge.

" Distributed in all warm seas. Wanders occasionally with a warm current as far as about 50° N. off the South-west of Ireland." Of this species Tesch (1904) remarks that on the Siboga Expedition not a single living animal was obtained, but only empty shells. He comments upon this, as several authors say that the species is very abundant in warm seas.

Genus *Cleodora*, Péron and Les., 1810.

Cleodora pyramidata (L.), 1767.

C. pyramidata was only recorded from outside Trinity Opening ; at Station 28 (23.xi.28) stramin net, five ; coarse net, one, and at Station 29 (24.xi.28) when " ? three shells " were taken in the bottom stramin net at about 205 m. Also from Dredge Station XV (8.iii.29) Miss Massy records " ? two broken shells ".

" Widely distributed in warm and temperate seas." Under the name of *Clio pyramidata* Tesch records this species as found at many stations on the Siboga Expedition, and by far the most common form among the species of Clio.

Genus *Creseis*.

Subgenus *Hyalocylix*, Fol, 1875.

Creseis (*Hyalocylix*) *striata* (Rang), 1828.

H. striata was recorded only at six stations. During the months of October, November and December it occurred in small numbers both outside Trinity Opening and at the weekly station in the barrier reef lagoon from the stramin net.

" Widely distributed in all warm seas." In the Siboga material Tesch (1904) records this species as very abundant at some stations, and occurring throughout the whole region explored.

Subgenus *Styliola*, Les., 1825.

Creseis (Styliola) subula (Q. and G.), 1827.

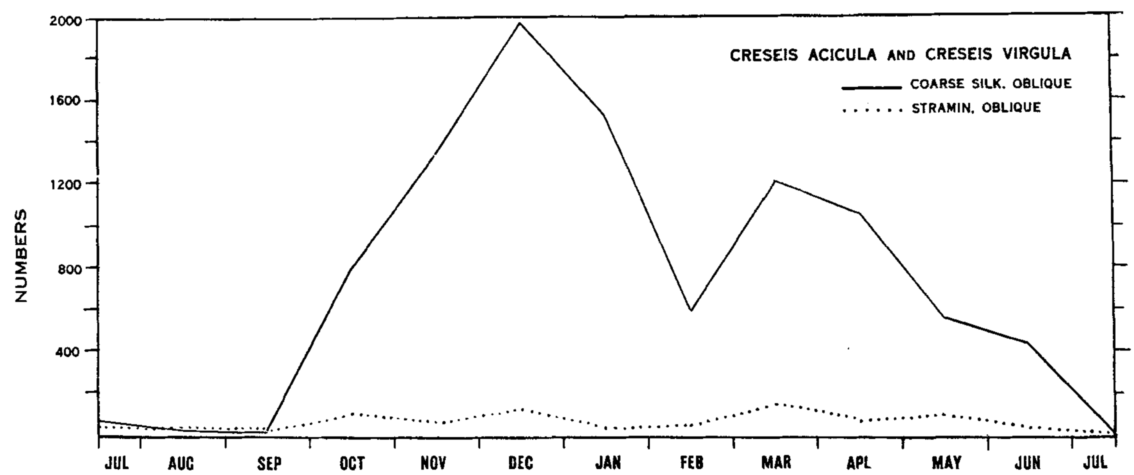
This species was only recorded from Station 19 (20.x.28), Station 28 (23.xi.28), and Station 29 (24.xi.28). At Station 29 " two and two shells " were recorded from the bottom stramin net in about 205 metres.

" This is a warm-water species, but it appears to avoid the immediate neighbourhood of the equator." Tesch (1904) recorded that it did not appear to be very abundant from the Siboga Expedition.

Subgenus *Creseis*, Rang, 1828.

Creseis virgula, Rang, 1828, and *Creseis acicula*, Rang, 1828.

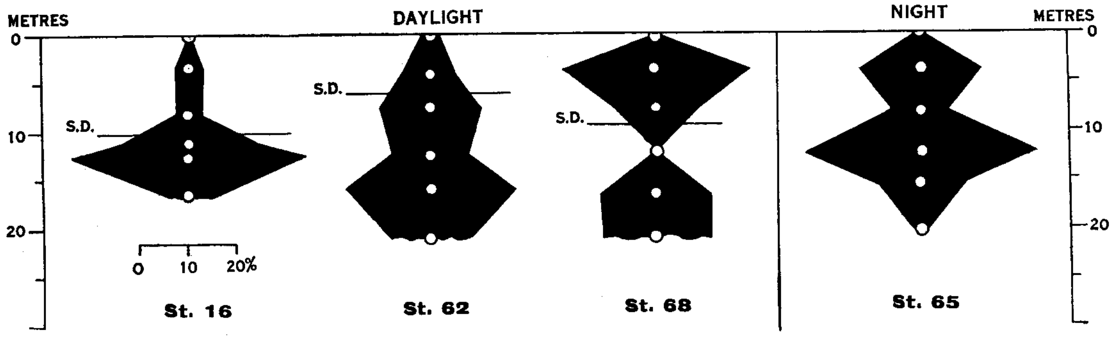
C. virgula and *C. acicula* will be discussed together since they were by far the most abundant pteropods in our catches. They were found both inside and outside the barrier. When sorting the material these two species were placed together as " *Creseis* sp." and it is not possible to apportion the numbers between them for certain. In Table IV an attempt has been made to apportion the numbers between the two species at certain



TEXT-FIG. 14.—Curves showing the average catch of *Creseis acicula* and *Creseis virgula* combined, for each month at the position 3 miles east of Low Isles in the barrier reef lagoon. (Coarse silk and stramin nets, oblique hauls.)

stations from numbers supplied by Miss Massy, and it would appear that when present *C. virgula* was the most numerous. *C. acicula*, however, seemed to be numerically most important from July to November, and again from April to July. In fact no specimens of *C. virgula* were recorded by Miss Massy from our sorted samples for July and August. Thus it appears that of the two species, both of which had a marked seasonal change in abundance, *C. acicula* had a more prolonged season. In Text-fig. 14 are given the average monthly catches for both species together, for the coarse silk and the stramin nets, oblique hauls. It appears that the period of greatest abundance was from October to June;

this may probably be taken as correct for *C. acicula*, but for *C. virgula* it should possibly be November to April. The curve for the coarse silk net shows that the two species together rose to a maximum of abundance in December when the average monthly catch was 1977 specimens ; they then fell away to a low number in February, rising to a second peak in March, when the monthly average was 1217 ; they then gradually fell once more to a minimum in July. Text-fig. 14 also indicates that, unlike *Cavolinia longirostris*, *Creseis* spp. were caught in greatest numbers by the coarse net. This is a proof that the majority of *C. acicula* and *C. virgula* taken during the months of October to June were very small, and passed through the meshes of the stramin net. It was only in July, August and September that the stramin and coarse silk net catches were about equal. For instance in July, August and September the average monthly catches were for the stramin net 48, 40 and 27 individuals respectively, and for the coarse silk net 63, 33 and 28 ; but in December, while the average for the stramin net was only 119, that for the coarse silk net was 1977. The largest catch was made in the coarse silk net at Station 33 (13.xii.28), when 4215 specimens were recorded.



TEXT-FIG. 15.—The vertical distribution of Creseids, probably mostly *Creseis acicula*, in the daylight and in the dark in the barrier reef lagoon. Station 16 (3.x.28), 10.13 a.m. to 12.27 p.m. ; Station 62 (15.vi.29), 11.20 a.m. to 1.45 p.m. ; Station 68 (18.vii.29), 10.30 a.m. to 12.55 p.m. ; Station 65 (10.vii.29), 9.00 p.m. to 11.25 p.m. The circles and white dots indicate the average depths at which the hauls were made. Coarse silk townet. S.D., Secchi disc reading. The diagrams are expressed as percentages. At Stations 65 and 68 the numbers were rather low.

These two species " occur in all warm seas ". Tesch (1904) says that in the region of the Siboga Expedition *C. virgula* and *C. acicula* were by far the most common forms, and that *C. acicula* was perhaps the more abundant. Our results indicate that *C. acicula* was probably the more constant rather than the more abundant in the Barrier Reef region.

VERTICAL DISTRIBUTION.—In Text-fig. 15 are shown the vertical distribution diagrams for Creseids at the four stations taken in the barrier reef lagoon (see Table VI). These stations were made at seasons when *Creseis acicula* was the more abundant of the two species. These pteropods, which avoid the surface layers in the daylight, show a significant rise towards the surface between Station 16 and Station 62 in relation to the transparency of the water, the Secchi disc readings being 10 m. and 6 m. at these two stations respectively. The numbers caught at Stations 65 and 68 were perhaps rather too low to give a good picture of the vertical distribution. From the diagrams it can be safely assumed that the seasonal distribution as shown by the oblique hauls has not been seriously affected by changes in the vertical distribution of these species.

At Station 16 the two species have been sorted with the following results :

	C. acicula.	*C. virgula.*
S.	..	..
3·1 m.	7	11
8·0 ,,	13	4
11·1 ,,	89	1
12·5 ,,	145	2
16·5 ,,	39	..

These figures indicate that probably *C. virgula* lives much nearer the surface in the daytime than does *C. acicula*. In Text-fig. 15 the two species have been combined, but *C. virgula* is present in such small numbers as only to cause a slight thickening of the diagram at 3·1 m.

Family Cymbulidae.

Genus *Gleba*, Forsk., 1774.

Gleba sp.

One specimen of an undetermined species of *Gleba* was taken in the vertical haul with the stramin net at Station 19 (20.x.28), outside Trinity Opening. Of this specimen Miss Massy says : " This is in poor condition and measures but 6 mm. by 4 mm. across the fins, but nevertheless it shows distinctly the characteristic indentations on the lateral margins of the fins. Each lappet has a number of close-set curved muscles crossing another set which radiate towards the centre of the fin. The latter show only a set of slightly undulating muscles which run side by side from the anterior to the posterior margin. The margins are transparent and without muscles. There is no trace of a shell."

GYMNOSOMATA.

Family Pneumodermatidae.

Genus *Pneumoderma*, Cuvier, 1804.

Pneumoderma mediterraneum, Van Beneden, 1838.

One specimen only was caught in the Low Isles anchorage on 2nd April, 1929.

" This measures about 6 mm. in length. It is in poor condition and of a dirty yellow colour with white translucent dots, and some very dark pigment is sparingly distributed in narrow lines, when viewed microscopically. The specimen is somewhat contracted, only one sucker-bearing appendage being partly visible. Both appendages have 6–8 suckers of three sizes. The radula appeared to have at least 4 or 5 lateral teeth on each side. The hooks are of equal length and in golden tube-shaped sheaths. A lateral gill and quadrangular posterior gill are present. In appearance this specimen strongly resembles Tesch's figure (1904) of *Pn. pygmaeum*, which, however, only measured 3 mm., and in which the radula was not examined. In the present specimen the largest suckers seemed to be in the middle, but owing to the contracted state of the little creature, it is difficult to be certain."

" Atlantic, Mediterranean, Indian and Chinese seas." No specimens of this species were recorded by Tesch (1904) from the Siboga collections.

Genus *Paraclione*, Tesch, 1904.

Paraclione pelseneeri, Tesch, 1904.

P. pelseneeri occurred only at Station 6 (17.viii.28) at the weekly station in the barrier reef lagoon, where the stramin and the coarse silk nets each contained one specimen.

"These both measure but 3·50 mm. in length. They have a transparent skin and cream-coloured viscera, and in each the organs adhere closely to the left wall, and there is a large transparent mass of branched connective tissue. Neither specimen shows any dark chromatophores. The narrow tail-like posterior end of the body occupies more than a quarter and less than a third of the length. It is throughout quite too narrow to contain any viscera, but is ringed closely by muscle bands. Two bands of muscles cross on the fins, forming a delicate lattice work which stops short of the margin. Both specimens arrest the attention at a glance by a peculiar long white fold which proceeds on either side from the lateral posterior portion of the anterior lobes of the foot. At first I believed that these folds constituted the sides of a long posterior lobe to the foot, and that the specimen might therefore prove to be the yellow *Clione flavescens*, Gegenbaur, = *Clione aurantiaca*, Fol., which is described by Gegenbaur as having a long posterior lobe to the foot. By holding the specimens at different angles and examining them with various magnifications, however, I convinced myself that there was no posterior lobe to the foot visible and that these folds formed the base of the fin.

"They are somewhat as shown in Tesch, 1904, Pl. VII, figs. 148 and 149 of *P. pelseneeri*. The buccal bulb of one specimen was examined, and proved to have two pairs of buccal cones, and a radula (2—1—2) and hooks corresponding fairly well with Tesch's (*l. c.*) Pl. VI, figs. 151 A and B. The hooks are all of the same length, and not bent. The median tooth appears to have a central cusp, but it is difficult to be certain of this, or whether there may be more than two lateral rows owing to its minute size. There is also present a rudimentary jaw somewhat like that shown by Mme. Pruvot-Fol (1924), fig. xiv ép., for *Clionina longicaudata* Soul."

Hitherto only taken from three stations in the East Indian Archipelago by Tesch (1904), who described it from the Siboga Expedition material.

ON THE OCCURRENCE OF PTEROPODS.

While the pteropods as a group have been widely recorded by a few of the larger oceanographic expeditions, there appears to have been no detailed study of their occurrence throughout the season, or of their life-histories in any one locality in warm regions. The results of the Great Barrier Reef Expedition must therefore be regarded as the first contribution towards a seasonal study of this group in the tropics.

It is quite evident that in the coastal waters of the Barrier Reef region only three species were of importance in the year under review, namely *Creseis virgula*, *C. acicula* and *Cavolinia longirostris*. Whether the same three species would predominate every year we cannot say, but judging from the results of the Siboga Expedition (Tesch, 1904) in the East Indian Archipelago region, where these same three species were also the most common, it seems probable that their occurrence is normal. Prof. Pelseneer has told us that Creseids are forms which extend normally nearer the coasts than other genera.

It is perhaps surprising that there is a complete absence of Limacinids except for the solitary *Peraclis* taken at Station 20 (20.x.28) outside Trinity Opening. This specimen was taken in a vertical haul from 250 m., and Tesch (1910) says, " More than any other genus of the Thecosomata, *Peraclis* seems to belong to the mesoplankton." The absence of this genus, at any rate from the shallow coastal waters, is not so surprising.

As regards the pteropods as a whole Tesch found, from the results of the Percy Sladen Trust Expedition (1910), that in the Indian Ocean *Creseis virgula*, *Hyalocylix striata* and *Cavolinia longirostris* were the only species caught in the daytime at the surface. This possibly also accounts for the small number of specimens taken in coastal waters. In the waters outside the barrier more species might have been expected, but the hauls were undoubtedly too few to gather a representative collection of the rarer species. The majority of species are rather sparsely distributed, and only met with occasionally in net collections.

HETEROPODA.

The only common Heteropod recorded from the collections was *Atlanta peroni*, Lesueur, which occurred both inside and outside the barrier. It was present throughout the year at the weekly station in the barrier reef lagoon.

Two other species were found : *Firoloida kowalewskii*, Vayssière, was taken in small numbers at the weekly station and outside Trinity Opening, and *Pterotrachea* (*Euryops*) *mutabilis* Tesch was taken once at the weekly station in the barrier reef lagoon.

Family ATLANTIDAE.

Genus *Atlanta*, Lesueur, 1817.

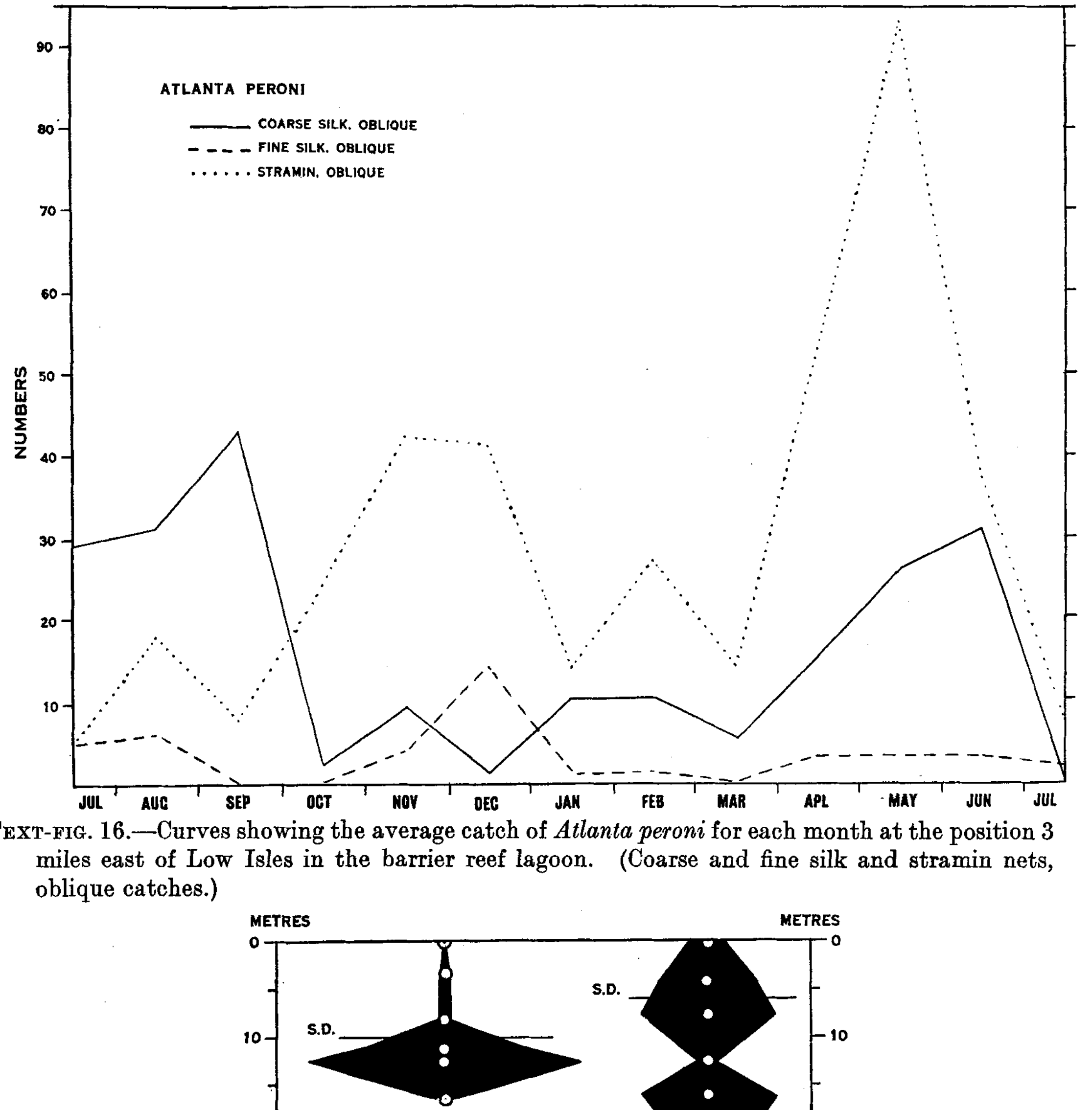
Atlanta peroni, Lesueur, 1817.

The seasonal distribution of *Atlanta peroni* at the weekly station in the barrier reef lagoon is shown in Text-fig. 16, in which the average monthly catches are given for oblique hauls with the stramin, coarse and fine silk nets. There does not appear to have been any very definite seasonal change in abundance. Compared with other plankton animals the numbers of *Atlanta peroni* were very low, and probably too low to allow much significance to be attributed to their variations. The high average catch for May in the stramin net is due to a single catch of 200 at Station 56 (7.v.29). It is noticeable that from July to January the curves for the stramin and coarse silk nets run in opposite directions; this is perhaps due to the prevalence of small individuals in July to September, and larger ones during October to January, but the exact significance is not clear.

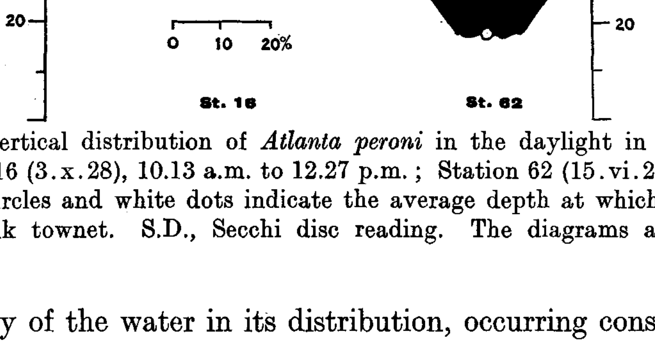
Atlanta peroni was recorded from all stations taken outside the barrier. Miss Massy examined " upwards of six hundred specimens, measuring 1·25 to 4·50 mm. in diameter. Individuals larger than 2·50 mm. were rarely met with. Mr. Eugene O'Mahony kindly allowed me to compare the largest with examples in the Dublin Museum, with which they were in perfect agreement ".

" The largest specimens were taken outside Trinity Opening at about 205 m.," in the bottom stramin net.

VERTICAL DISTRIBUTION.—*Atlanta peroni* only occurred at Stations 16 and 62 in sufficient numbers to show its vertical distribution in the barrier reef lagoon in daylight. This species evidently tended to avoid the surface layers, and showed a marked correlation



TEXT-FIG. 16.—Curves showing the average catch of *Atlanta peroni* for each month at the position 3 miles east of Low Isles in the barrier reef lagoon. (Coarse and fine silk and stramin nets, oblique catches.)



TEXT-FIG. 17.—The vertical distribution of *Atlanta peroni* in the daylight in the barrier reef lagoon. Station 16 (3.x.28), 10.13 a.m. to 12.27 p.m.; Station 62 (15.vi.29), 11.20 a.m. to 1.45 p.m. The circles and white dots indicate the average depth at which the hauls were made. Coarse silk townet. S.D., Secchi disc reading. The diagrams are expressed as percentages.

with the transparency of the water in its distribution, occurring considerably nearer the surface at Station 62 when the Secchi disc reading was 6 m. than at Station 16 when it was 10 m. (see Text-fig. 17). It is unlikely that changes in its vertical distribution will have markedly affected the seasonal distribution shown by the oblique hauls.

Family Pterotracheidae.

Genus *Pterotrachea*, Forsk., 1775.

Pterotrachea (*Euryops*) *mutabilis*, Tesch, 1906.

The only specimen of *Pterotrachea mutabilis* taken was a female, caught in the stramin net at Station 24 (6.xi.28) in the barrier reef lagoon.

" This measures 45 mm. in length, and has about nine gills. There are no tubercles in front of the eyes, which much resemble those figured by Hesse (1900). Their characteristic shape caused Tesch to found the sub-genus *Euryops*. The body is almost entirely smooth; there are, however, a few tubercles here and there, particularly on the caudal portion; but the caudal fin is without any."

Genus *Firoloida*, Les., 1817.

Firoloida kowalewskii, Vayssière, 1904.

A few specimens of *F. kowalewskii* were caught, both inside the barrier and outside Trinity Opening. They were all taken during September to November, except for a doubtful male in February.

Station 13 (20.ix.28). Coarse silk; " one female with eggs".
Station 15 (2.x.28). Fine silk; " one male ".
,, ,, Coarse silk; " one male and two females ".
Station 16 (3.x.28). Coarse silk; " three females, one with eggs ".
Station 19 (20.x.28). 1 m. coarse silk; " one female ".
Station 24 (6.xi.28). Stramin; " one female with eggs ".
Station 28 (23.xi.28). Stramin; " one male and one female with eggs ".
Station 42 (18.ii.29). Coarse silk; " ? one male ".

" The last-named (from Station 42) measures only 13 mm., and is not in good condition. The females with ova measured 21–35 mm. in length. Females without ova measured 9–17 mm. The smallest male was 12 mm. in length and the largest 25 mm. At Stat ion 28 the proboscis and one eye of a specimen which must have measured about 30 mm. also occurred. It probably belonged to the present species."

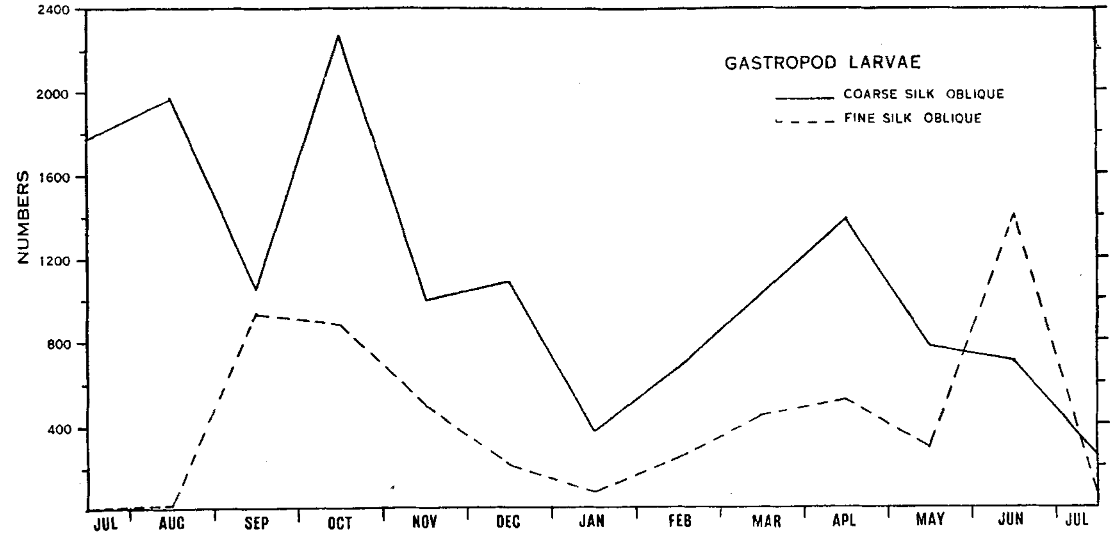
GASTROPODS.

Larval Gastropods.

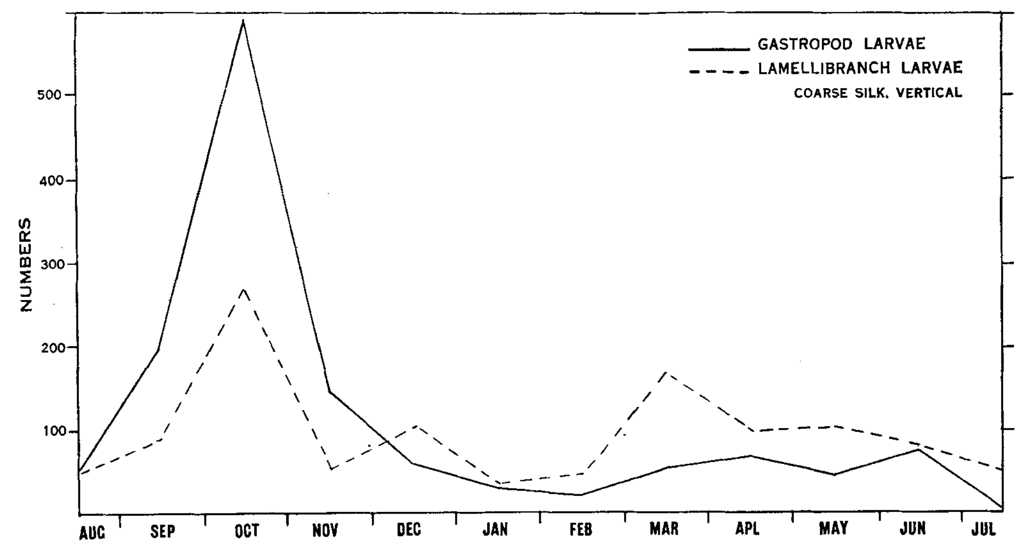
Considerable numbers of larval gastropods (other than Pteropods) occurred in the catches of the coarse and fine silk nets at the weekly station in the barrier reef lagoon. The identification of these small mollusca has not been possible, and many species are probably represented.

The material has, however, been looked through by Prof. Paul Pelseneer, and he records the occurrence of a larva of *Dolium* (" *Macgillivraya pelagica*," MacDonald) at Station 44 (27.ii.29) off Lizard Island, and larvae of *Triforis* at Station 16 (3.x.28) and Station 63 (24.vi.29). In addition a few *Echinospira* larvae were seen.

Very few gastropod larvae were taken in the stramin net, the majority being too small to be retained by the meshes of that material. In Text-figs. 18 and 19 are given the curves for the average catches per month in the coarse and fine silk oblique hauls and the coarse silk vertical hauls, at the stations three miles east of Low Isles in the barrier



TEXT-FIG. 18.—Curves showing the average catch of Gastropod larvae for each month at the position 3 miles east of Low Isles in the barrier reef lagoon. (Coarse and fine silk nets, oblique hauls.)

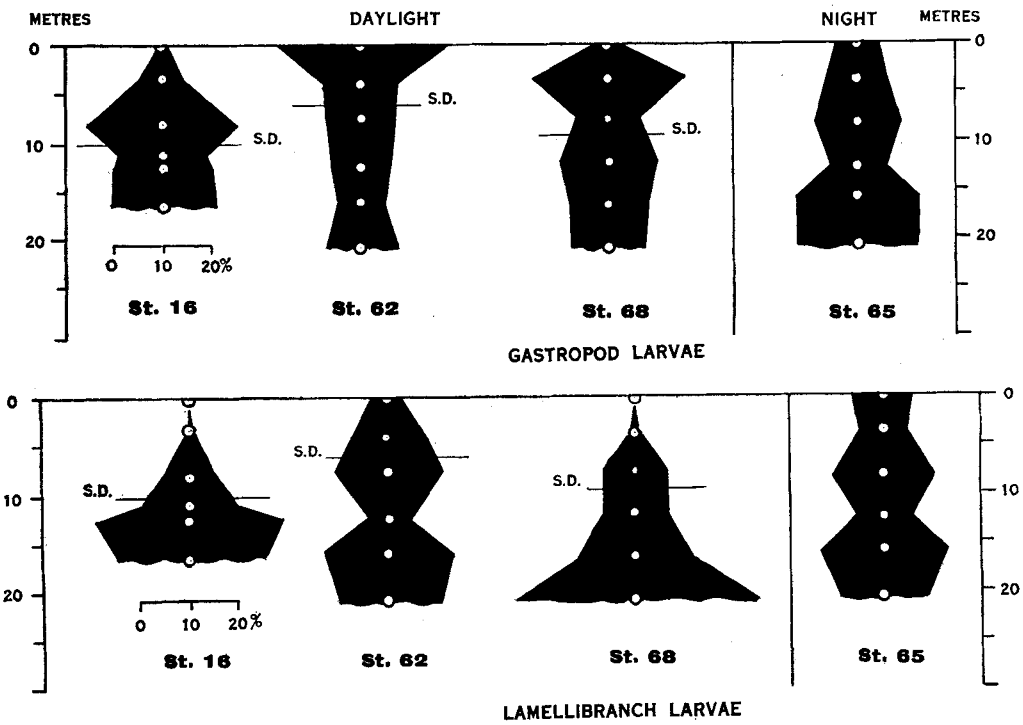


TEXT-FIG. 19.—Curves showing the average catch of Gastropod and of Lamellibranch larvae for each month in the coarse silk net vertical hauls at the position 3 miles east of Low Isles in the barrier reef lagoon.

reef lagoon. There is a definite indication that larval gastropods were slightly more abundant in October than at any other time of the year. They were least abundant in January. It was, however, to be expected that in a region with so rich a molluscan fauna there would be a supply of larval stages of different species in the plankton throughout the year.

The numbers of these larval stages in our barrier reef collections were greater than one usually sees in comparable collections from northern waters, and owing to their habit of sinking quickly to the bottom of the vessels in which the plankton was preserved, they were quite a noticeable feature of the silk net collections. We have seen above (p. 236) that on an average throughout the year they formed 35% of the molluscs present in the coarse silk oblique catches, while they only formed 8·7% of the molluscs taken in the stramin net.

The actual numbers in each catch of our collections are given in the tables at the end of Vol. II, No. 6, and owing to the fact that they have not been systematically identified, it is doubtful whether it is worth while to analyse the results further.



TEXT-FIG. 20.—The vertical distribution of Gastropod larvae (above) and Lamellibranch larvae (below) in the daylight and in the dark in the barrier reef lagoon. Station 16 (3.x.28), 10.13 a.m. to 12.27 p.m.; Station 62 (15.vi.29), 11.20 a.m. to 1.45 p.m.; Station 68 (18.vii.29), 10.30 a.m. to 12.55 p.m.; Station 65 (10.vii.29), 9.00 p.m. to 11.25 p.m. The circles and white dots indicate the average depths at which the hauls were made. Coarse silk townet. S.D., Secchi disc reading. The diagrams are expressed as percentages.

VERTICAL DISTRIBUTION.—The vertical distribution of gastropod larvae at the four stations made in the barrier reef lagoon is given in Text-fig. 20. These larvae evidently lived sufficiently high in the water in the daytime for reliable results to be obtained by the oblique hauls. There was a tendency for them to live deepest when the water was most transparent.

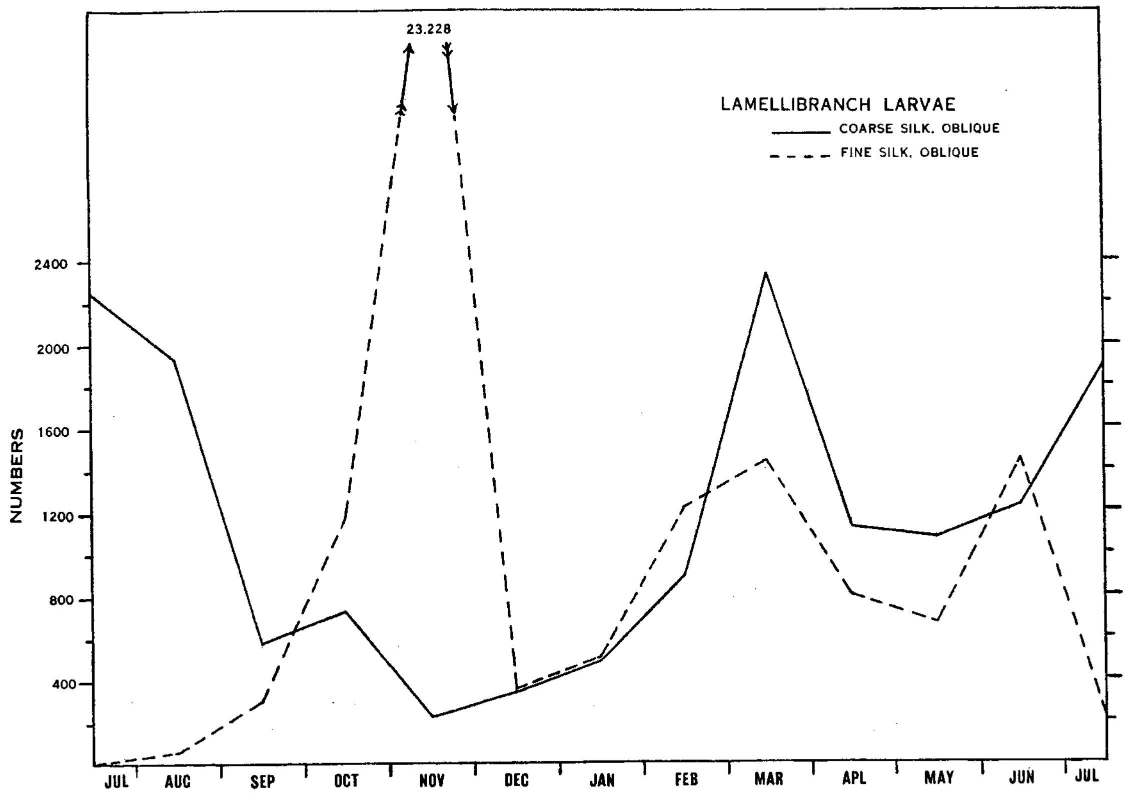
CEPHALOPODA.

The young of Cephalopoda were very scarce in the collections, and when they occurred they were found singly or in small numbers (see Tables at end of Vol. II, No. 6). They appear to have been slightly more abundant at the last few stations in the coarse silk net oblique hauls.

LAMELLIBRANCHIA.

LAMELLIBRANCH LARVAE.

The larvae of the lamellibranchs have also not been identified. They occurred in most of the catches, being on the whole about as abundant as the gastropod larvae, and forming 39% of the mollusca taken in the oblique hauls with the coarse silk net. They were, however, not taken in the catches of the stramin net, probably because as a whole they settle on the bottom at a smaller size than do some of the gastropods, and there are no large larval stages, such as the Echinospira among the gastropods.



TEXT-FIG. 21.—Curves showing the average catch of Lamellibranch larvae for each month at the position 3 miles east of Low Isles in the barrier reef lagoon. (Coarse and fine silk nets, oblique hauls.)

In Text-figs. 19 and 21 are given the curves for the average catches per month in the coarse and fine silk oblique hauls and in the coarse silk vertical hauls in the barrier reef lagoon. Examination of these figures shows that on the whole lamellibranch larvae may possibly have been slightly more abundant from March to July than at other times of the year. The somewhat irregular nature of the curve, however, prevents us from giving much significance to this, and the most that we can say is that there was no period at which these larval stages were either conspicuously abundant or markedly absent. It is likely that there will be some species breeding at all times during the year, and this is borne out by the fact that when the coarse silk net catches showed a poor occurrence in November, the fine net, which was fishing at the same time, appears to have passed through an enormous swarm of larvae. It is probable that in these warm waters the larval stages are in the plankton for only a very short period before they settle on the bottom.

The actual numbers in each catch of our collections are given in the tables at the end of Vol. II, No. 6.

VERTICAL DISTRIBUTION.—The vertical distribution of lamellibranch larvae at the four stations taken in the barrier reef lagoon is shown in Text-fig. 20. These larvae occurred in maximum abundance considerably deeper in the water than did the Gastropod larvae, and it is probable that differences in the transparency of the water may have helped to cause the irregular results shown by the oblique hauls. As the species concerned are not known, however, it is unnecessary to analyse the results further. In the dark, Station 65, they moved much nearer the surface.

The actual numbers occurring in the catches are given in Table VIII in Vol. II, No. 6.

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TABLE IV.—*Catches of Pteropods and Heteropods in the Oblique Hauls with the Coarse Silk and 1-metre Stramin Nets at the Stations in the Barrier Reef Lagoon 3 miles East of Low Isles.*

Station number.	Date.	Coarse Silk Oblique.								1 Metre Stramin Oblique.							
		Cavolinia longirostris.	*Cavolinia tridentata.*	*Cavolinia uncinata.*	*Creseis virgula.*	*Creseis acicula.*	*Paraclione pelseneeri.*	*Atlanta peroni.*	*Firoloida kowalewskii.*	*Cavolinia longirostris.*	*Hyalocylix striata.*	*Creseis virgula.*	*Creseis acicula.*	*Paraclione pelseneeri.*	*Atlanta peroni.*	*Pterotrachea mutabilis.*	*Firoloida kowalewskii.*
1	27.vii.28	..	..	..	..	82	..	1	..	..	..	..	30	..	..	..	..
2	30.vii.28	..	..	..	..	44	..	57	..	..	..	..	66	..	10	..	..
3	4.viii.28	..	..	..	..	44	..	25	..	1	..	..	29	..	4	..	..
5	11.viii.28	1	..	..	..	40	..	2	..	1	..	..	84	..	6	..	..
6	17.viii.28	..	..	..	..	52	1	28	..	1	..	..	44	1	33	..	..
7	22.viii.28	..	..	..	..	25	..	101	..	..	..	..	11	..	45	..	..
9	31.viii.28	..	..	..	..	2	..	1	..	1	..	..	34	..	4	..	..
10	4.ix.28	..	..	..	1	85	..	124	..	..	..	..	47	..	14	..	..
12	11.ix.28	..	..	..	1	2	..	1	..	..	..	2	19	..	11	..	..
13	20.ix.28	..	..	..	..	23	..	35	1	2	..	..	34	..	6	..	..
14	26.ix.28	..	..	..	..	3	..	10	..	..	..	..	9	..	2	..	..
15	2.x.28	..	1	1	11	47	..	1	3	1	..	..	47	..	4	..	..
18	15.x.28	..	..	..	..	1253	..	..	..	1	..	10	133	..	25	..	..
22	23.x.28	..	..	..	54	1034	..	5	..	1	..	131	..	..	43	..	..
23	2.xi.28	..	..	..	..	938	..	14	..	..	..	14	11	..	15	..	..
24	6.xi.28	8	..	..	..	330	..	2	..	16	..	..	67	..	73	1	2
25	16.xi.28	..	..	..	220	1860	..	..	..	..	..	..	100	..	14	..	..
27	21.xi.28	18	..	..	2331	156	..	7	..	47	..	..	41	..	90	..	..
30 **30A**	28.xi.28 } 29.xi.28 }	..	..	..	..	806	..	24	..	2	4	..	15	..	18	..	..
32	5.xii.28	4	..	..	2013	1008	..	..	..	93	3	..	17	..	2	..	..
33	14.xii.28	19	..	..	4209	6	..	3	..	8	..	29	400	..	59	..	..
34	19.xii.28	16	..	..	..	223	..	..	..	103	..	..	3	..	..	..	..
35	27.xii.28	19	..	..	225	225	..	2	..	99	9	..	27	..	102	..	..
36	4.i.29	23	..	..	1445	..	..	2	..	150	..	3	27	..	10	..	..
37	14.i.29	30	..	..	6	865	..	24	..	330	..	110	761	..	30	..	..
38	21.i.29	170	..	..	2423	477	..	14	..	1216	..	..	20	..	10	..	..
39	30.i.29	102	..	..	..	630	..	1	..	131	..	..	8	..	4	..	..
40	6.ii.29	38	..	..	..	733	..	3	..	54	..	..	40	..	20	..	..
41	13.ii.29	190	..	..	..	804	..	17	..	190	..	..	70	..	47	..	..
42	18.ii.29	10	..	..	..	205	..	11	1	69	..	..	10	..	14	..	..
47	4.iii.29	13	..	..	..	612	..	13	..	34	..	..	51	..	36	..	..
48	15.iii.29	1	..	..	420	420	..	..	..	4	..	..	13	..	..	..	..
51	25.iii.29	1	..	..	1908	292	..	2	..	1	..	..	410	..	7	..	..
52	6.iv.29	50	..	..	83	417	..	30	..	100	..	4	16	..	60	..	..
53	13.iv.29	130	..	..	..	1020	..	..	..	435	..	..	90	..	32	..	..
54	20.iv.29	20	..	..	..	1290	..	2	..	90	..	..	120	..	40	..	..
55	26.iv.29	20	..	..	932	468	..	30	..	50	..	..	10	..	80	..	..
56	7.v.29	50	..	..	..	650	..	14	..	100	..	..	30	..	200	..	..
57	18.v.29	30	..	..	..	40	..	20	..	40	..	6	56	..	50	..	..
58	25.v.29	21	..	..	+	470	..	30	..	90	..	..	180	..	80	..	..
59	31.v.29	80	..	..	..	1060	..	40	..	50	..	..	100	..	40	..	..
60	7.vi.29	11	..	..	+	470	..	60	..	40	..	4	36	..	50	..	..
61	14.vi.29	2	..	..	..	100	..	30	..	40	..	..	40	..	60	..	..
63	24.vi.29	4	..	..	..	730	..	4	..	4	..	..	4	..	..	..	..
64	5.vii.29	..	..	..	..	..	..	+	..	3	..	..	3	..	20	..	..
66	11.vii.29	3	..	..	..	..	1	..	..	3	..	..	8	..	1	..	..
67	17.vii.29	2	..	..	..	28	..	..	..	2	..	..	8	..	..	..	..

TABLE V.—*Catches of Pteropods and Heteropods at Stations other than that 3 miles East of Low Isles.*

Station number.	Date.	Position.	*Cavolinia longirostris.*	*Cavolinia inflexa.*	*Cavolinia quadridentata.*	*Cleodora pyramidata.*	*Hyalocylix striata.*	*Styliola subula.*	*Creseis virgula.*	*Creseis acicula.*	*Gleba sp.*	*Atlanta peroni.*	*Firoloida kowalewskii.*
COARSE SILK NET.													
8	24.viii.28	I.T.O.	..	..	..	..	..	..	..	9	..	8	..
11	6.ix.28	I.T.O.	..	..	..	..	..	..	1	6	..	6	..
19	20.x.28	O.T.O.	4	5	..	..	..	4	3	..	..	2	1
20	20.x.28	O.T.O.	1	..	..	..	6	..	..	..	..	1	1
21	22.x.28	3 m. E. night	2	..	..	..	..	..	662		..	29	..
26	19.xi.28	I.T.O.	1	..	..	..	..	..	334		..	27	..
28	23.xi.28	O.T.O.	..	3	..	1	..	..	2	14	..	..	..
43	26.ii.29	C.B.	5	..	..	..	..	..	..	2042	..	..	..
44	27.ii.29	Li.I.	20	..	..	..	..	..	..	450	..	1	..
45	28.ii.29	O.C.P.	1	..	..	..	..	..	..	400	..	..	..
46	28.ii.29	I.C.P.	13	..	..	..	..	..	..	1520	..	13	..
49	17.iii.29	I.P.P.	21	..	..	..	..	..	1210		..	50	..
50	18.iii.29	O.P.P.	1	..	..	..	..	..	..	202	..	..	..
1 METRE STRAMIN NET.													
8	24.viii.28	I.T.O.	..	..	..	..	..	..	..	12	..	10	..
11	6.ix.28	I.T.O.	..	..	..	..	..	..	..	19	..	4	..
19	20.x.28	O.T.O.	1	1	2	..	1	1	..	..	1	..	1
21	22.x.28	3 m. E. night	3	..	..	..	..	..	..	78	..	36	..
26	19.xi.28	I.T.O.	..	..	..	..	..	..	33		..	3	..
28	23.xi.28	O.T.O.	..	1	..	5	5	30	2	2	..	2	3
29	24.xi.28	O.T.O., B.S.N.	7	..	2	3	..	4	1	4	..	2	..
31	2.xii.28	3 m. E., B.S.N.	15	..	..	..	..	..	..	35	..	1	..
43	26.ii.29	C.B.	48	..	..	..	..	..	..	3	..	12	..
44	27.ii.29	L.I.	77	..	..	..	..	..	..	108	..	4	..
45	28.ii.29	O.C.P.	15	..	..	..	..	..	..	12	..	2	..
46	28.ii.29	I.C.P.	33	..	..	..	..	..	..	202	..	27	..
49	17.iii.29	I.P.P.	43	..	..	..	..	..	65	55	..	40	..
50 (i)	18.iii.29	O.P.P.	6	..	..	..	..	..	20	24	..	23	..
50 (ii)	18.iii.29	O.P.P.	2	..	..	..	..	..	..	7	..	2	..

I.T.O., in Trinity Opening; O.T.O., outside Trinity Opening; C.B., off Cape Bedford; Li.I., off Lizard Island; O.C.P., outside Cook's Passage; I.C.P., inside Cook's Passage; I.P.P., inside Papuan Pass; O.P.P., outside Papuan Pass; B.S.N., bottom stramin net. St. 50 (i) = 400 m. St. 50 (ii) = 170 m. (For positions see Chart II, Vol. II, No. 1.)

TABLE VI.—*The Vertical Distribution of Pteropods and Heteropods in the Barrier Reef Lagoon as Shown by Collections with the Coarse Silk Tow-net.*

	Depth in metres.	*Cavolinia longirostris.*	*Creseis* spp.	*Firoloida kowalewskii.*	*Atlanta peroni.*		Depth in metres.	*Cavolinia longirostris.*	*Creseis* spp.	Gymnosomatous pteropod.	*Atlanta peroni.*
Station **16**	S.	..	..	1	..	Station **65**	S.	..	..	2*	..
(3.x.28)	3·1	..	18	..	1	(10.vii.29)	3·7	1	21	..	1
	8·0	..	17	1	1		8·0	3	9	..	11
	11·1	..	90	1	12		12·5	1	40	..	1
	12·5	..	147	..	20		15·5	1	15	..	..
	16·5	..	39	..	2		20·7	1	1	..	..
Station **62**	S.	..	120	..	33	Station **68**	S.	..	..	..	..
(15.vi.29)	4·0	..	380	..	80	(18.vii.29)	3·5	2	57	..	..
	7·5	2	730	..	110		7·5	..	27	..	..
	12·5	7	560	..	15		12·0	..	1	..	1
	16·0	..	1200	..	110		16·5	2	32	..	..
	21·0	..	600	..	50		20·7	..	31	..	..

* Not identified.

COELENTERATA

The coelenterates were numerically of no great importance in the plankton retained by the silk nets, their proportions throughout the year based on the average catches for each month being 1·7% and 0·6% for the coarse and fine silk nets respectively. They played a more important part in the composition of the larger plankton as shown by the catches of the stramin net with an average over the year of 9·5%. We give below the percentages of the total animals formed by the coelenterates on the average for each month for the different nets :

Number of Coelenterata as Percentage of Total Animals Caught in each Month.

	Oblique hauls.		
	Stramin.	Coarse silk.	Fine silk.
1928 :			
July	10·8	0·3	0·1
August	18·5	0·5	0·1
September	12·6	0·1	0·0
October	9·6	1·8	1·2
November	9·6	2·4	0·6
December	7·2 or 30·3*	2·8	1·4
1929 :			
January	15·1	4·8	1·7
February	25·2	2·9	0·9
March	32·9	2·1	0·8
April	1·2	1·7	1·2
May	3·7	0·3	0·2
June	2·9	0·6	0·3
July	1·5	0·3	0·1
Average for year (based on average catch for each month)	9·5*	1·7	0·6

It is evident that at certain times of the year the coelenterates played an important part in the larger plankton, reaching as much as 32·9% of the average monthly catch in the stramin net in March. In the coarse silk net the greatest percentage was only 4·8% in January.

* Excluding echinoderm larvae.

We give below the percentage composition of the coelenterates for each month divided into the three groups Medusae (including a few young anemones), Siphonophores and Coral planulae for the stramin and coarse silk nets :

Percentage Composition of Average Monthly Catches of Coelenterates.

	Oblique hauls.					
	Stramin.			Coarse silk.		
	Medusae.	Siphonophores.	Coral planulae.	Medusae.	Siphonophores.	Coral planulae.
1928 :						
July	2·1	97·9	..	7·6	92·4	..
August	4·1	95·9	..	17·2	82·8	..
September	4·5	95·5	..	5·0	95·0	..
October	7·7	92·3	..	17·3	82·7	..
November	11·0	89·0	..	12·2	87·8	..
December	12·7	87·3	..	20·2	62·2	17·6
1929 :						
January	15·5	84·5	..	13·5	86·5	..
February	34·2	65·8	..	2·8	97·2	..
March	30·4	69·6	..	14·4	85·6	..
April	26·6	73·4	..	69·4	30·6	..
May	27·0	73·0	..	49·2	50·8	..
June	31·3	68·7	..	83·3	16·7	..
July	35·6	64·4	..	41·9	58·1	..
Average for year (based on average catch for each month)	15·7	84·3	..	20·2	76·4	3·4

These figures show that on the average for the year the Siphonophores far outreached the Medusae in numbers. This preponderance of Siphonophores was consistent throughout the year, but it is noticeable that the medusae became more important in the second half of the twelve months; examination of the catches shows, however, that this was not due to an actual increase in the numbers of the medusae, but rather to a decrease in the numbers of Siphonophores. Coral planulae appeared in the catches only during December, 1928.

SIPHONOPHORA.

THE identification of the siphonophora has been done by Mr. A. K. Totton, and the results of his examination of the material have already been published in Volume IV, No. 10 of these Reports.

Some thirty-two species were found in the collections, and in addition a few specimens of *Physalia*, *Velella* and *Porpita* were seen in the neighbourhood of Low Isles. Of the species in the collections 4 were Physophorae and 26 Calycophorae. Two new species were found and described, *Cordagalma cordiformis*, Totton, and *Eudoxia russelli*, Totton. Four unnamed species were recorded.

Of the species taken the following 20 occurred in the barrier reef lagoon: *Agalma okenii*, Eschscholtz, *Stephanomia bijuga* (Delle Chiaje), *Abyla haeckeli*, Lens and Van Riemsdijk, *Abylopsis tetragona* (Otto), *Enneagonum hyalinum*, Quoy and Gaimard, *Abylopsis eschscholtzii* (Huxley), *Bassia bassensis* (Quoy and Gaimard), *Sulculeolaria quadrivalvis* (Blainville), *Sulculeolaria monoica* (Chun), *Galetta chuni* (Lens and Van Riemsdijk), *Galetta turgida* (Gegenbaur), *Diphyes dispar*, Chamisso and Eysenhardt, *Diphyes bojani* (Chun), *Diphyes chamissonis*, Huxley, *Chelophyes appendiculata* (Eschscholtz), *Eudoxia russelli*, Totton, *Chelophyes contorta* (Lens and Van Riemsdijk), *Eudoxoides mitra* (Huxley), *Eudoxoides spiralis* (Bigelow), and *Lensia subtiloides* (Lens and Van Riemsdijk).

All the above species, with the exception of *Sulculeolaria monoica*, were recorded from the collections from at least one or other of the stations taken outside the barrier reef and in Trinity Opening, and an additional 12 species were recorded which did not appear in the collections from the barrier reef lagoon, namely *Agalma elegans* (Sars), *Agalma* sp. indet., *Cordagalma cordiformis*, Totton, *Forskalia* sp., *Rosacea ? plicata*, Quoy and Gaimard, *Amphicaryon acaule*, Chun, *Hippopodius hippopus* (Forskål), *Abyla trigona*, Quoy and Gaimard,* *Dimophyes arctica* (Chun), *Lensia campanella* (Moser), *Lensia fowleri* (Bigelow), and *Lensia* spp. indet.

The two species, *D. chamissonis* and *L. subtiloides*, were the only really abundant siphonophores in the barrier reef lagoon.

The analyses of all the catches of siphonophores are given in Tables VIII–X (pp. 272–275). The numbers given in these tables have been obtained by apportioning the different species among the total numbers of siphonophores according to their proportions in the sorted samples from each station. While, therefore, these figures cannot be regarded as strictly accurate, it is felt that they do give a true picture of the relative abundance of the different species concerned. The agreement shown by the catches from the two different nets, stramin and coarse silk, also lends considerable support to the correctness of the conclusions reached as to seasonal abundance and distribution.

When sorting the siphonophores we have counted all loose nectophores, eudoxids and other component parts separately; the total numbers in the tables therefore do not refer only to complete individuals and are thus too high, since in many cases the siphonophore colonies become broken up.

We should like to thank Mr. Totton for the great care and trouble he has taken in counting the specimens from each sample, and the assistance he has given in re-examining and checking critical catches, and by searching through the complete catches.

* Found in collections since publication of Totton's report.

PHYSOPHORAE.

Family AGALMIDAE.

Genus *Agalma.*

Agalma okenii, Eschscholtz.

This species was only recorded once from the collections made in the barrier reef lagoon, at Station 32 (5.xii.28) in a coarse silk oblique haul.

In other localities it was recorded on five occasions, namely in and outside Trinity Opening at Stations 8 (24.viii.28), 19 (20.x.28), and 28 (23.xi.28), and inside Papuan Pass at Station 49 (17.iii.29).

Agalma elegans, Sars.

This species was only recorded once from the Great Barrier Reef Expedition collections, and on that occasion from outside Trinity Opening at Station 28 (23.xi.28).

Agalma sp.

Nectophores from an undetermined species of *Agalma* were found at Station 50 (18.iii.29), outside Papuan Pass in a stramin net haul from 400 metres.

Genus *Stephanomia.*

Stephanomia bijuga (Delle Chiaje).

This species occurred very sparingly in the barrier reef lagoon, and was also recorded from in and outside Trinity Opening and inside and outside Papuan Pass. In the barrier reef lagoon it was recorded in the months of October and December, 1928, and January, February, April, June and July, 1929, but it was never abundant.

Genus *Cordagalma.*

Cordagalma cordiformis, Totton.

The nectophores upon which Totton bases his description of this new species were taken at Station 19 (20.x.28) outside Trinity Opening. It was not recorded on any other occasion.

"*Athorybia*" *Larvae.*

Two "Athorybia" larvae of Agalmids were found, both occurring in collections from outside Trinity Opening at Station 19 (20.x.28).

Family FORSKALIDAE.

Genus *Forskalia.*

Forskalia sp.

No species of *Forskalia* were found in the collections except at Station 50 (18.iii.29), outside Papuan Pass. The nectophores taken on this occasion were, however, in too poor a condition to make certain identification possible.

CALYCOPHORAE.

Family Prayidae.

Genus *Rosacea.*

Rosacea ? plicata, Quoy and Gaimard.

Only one single nectophore of this species was found in the collections, and this occurred in the oblique haul with the stramin net at Station 26 (19.xi.28) in Trinity Opening.

Genus *Amphicaryon.*

Amphicaryon acaule, Chun.

This species was recorded on one occasion only, namely from Station 50 (18.iii.29), outside Papuan Pass in a haul with the stramin net from 400 metres.

Family Hippopodiidae.

Genus *Hippopodius.*

Hippopodius hippopus (Forskål).

This species was only recorded from Station 50 (18.iii.29) outside Papuan Pass in a haul with the stramin net from 400 metres.

Family Abylidae.

Genus *Abyla.*

Abyla haeckeli, Lens and Van Riemsdijk.

This species was recorded only once from the barrier reef lagoon, namely from the position three miles east of Low Isles at Station 15 (2.x.28) in the coarse silk net oblique haul. From other localities it was only recorded at Station 49 (17.iii.29) and Station 50 (18.iii.29) inside and outside Papuan Pass respectively.

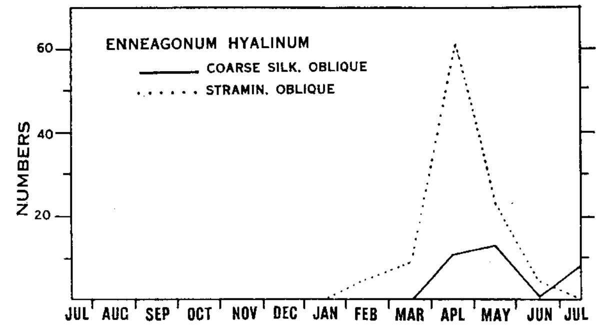
Abyla trigona, Quoy and Gaimard.

This species was found once only in the collections, namely at Station 49 (17.iii.29) in an oblique haul with the coarse silk net inside Papuan Pass. In this haul were found one eudoxid and one gonophore of a eudoxid, which are not recorded in Mr. Totton's report (Vol. IV, No. 10), since he found them whilst searching through the material after publishing.

Genus *Enneagonum.*

Enneagonum hyalinum, Quoy and Gaimard.

This species occurred in the barrier reef lagoon sufficiently frequently to give indications of its seasonal distribution. It was found in the oblique hauls of the coarse silk and stramin nets only during the period January to July, 1929, and was apparently entirely absent before this period. There is evidence that March, April and May were the months in which it was most abundant (see Text-fig. 22). *E. hyalinum* thus occurred in the barrier reef lagoon at the period when the salinity was at its lowest for the year, the averages at 10 metres being for March, April and May, $33{\cdot}47°/_{oo}$, $33{\cdot}44°/_{oo}$ and $34{\cdot}39°/_{oo}$ respectively. It seems that this species was one of the three which were able to withstand the conditions of the environment during this period of lowered salinity (see p. 270), and it is therefore possibly unusually suited for life in coastal waters.



TEXT-FIG. 22.—The average catches of *Enneagonum hyalinum* for each month in the oblique hauls with the coarse silk and 1-metre stramin nets at the position three miles east of Low Isles, in the barrier reef lagoon.

In the collections from localities other than the position three miles east of Low Isles *E. hyalinum* also occurred in those catches made during the above period of the year. It was found in the collections taken in February and March off Lizard Island in the barrier reef lagoon 100 miles north of Low Isles, and both inside and outside Papuan Pass and outside Cook's Passage. It was, however, never recorded from the region of Trinity Opening, since the collections were made there at the time of year when this species evidently is not prevalent.

Genus *Abylopsis*.

Abylopsis tetragona (Otto).

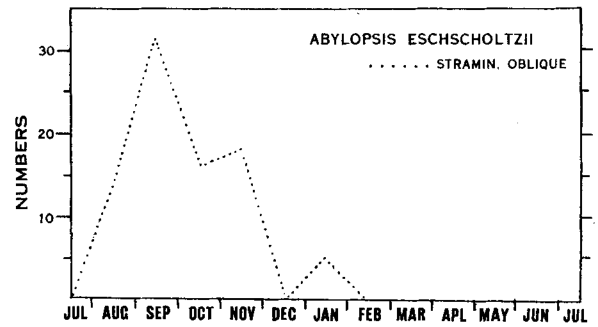
This species occurred very sparingly both in the barrier reef lagoon and outside the barrier. In the barrier reef lagoon it was recorded from collections in the months of August, September, October and November, 1928, and January and June, 1929. It was thus apparently absent during the period of lowered salinity in the lagoon from February to May.

From other localities it was reported from outside Trinity Opening, and also from outside Cook's Passage and Papuan Pass in February and March, during which months it was not recorded from inside the barrier.

Abylopsis eschscholtzii (Huxley).

This species occurred fairly frequently in the barrier reef lagoon, and in sufficient numbers to indicate its seasonal distribution. In Text-fig. 23 is given the curve for the average catches in the stramin net oblique hauls for each month at the position three miles east of Low Isles in the barrier reef lagoon. The period of chief occurrence for *A. eschscholtzii* evidently lay between July, 1928, and February, 1929, its period of greatest abundance being during the months of August, September, October and November. In December and February it was not recorded. An examination of all the collections made with the coarse silk net in the barrier reef lagoon, including the vertical distribution stations, shows that this species was also present in June and July, 1929. It was thus entirely absent in December, and during the period from February to May, when the salinity in the barrier reef lagoon was low.

This species was recorded both in and outside Trinity Opening in August, September, October and November. It was also recorded inside Papuan Pass in March, 1929, at Station 49 (17.iii.29), that is, during the period when it was absent from the barrier

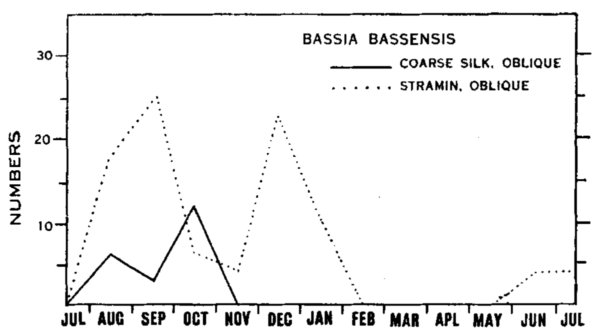


TEXT-FIG. 23.—The average catches of *Abylopsis eschscholtzii* for each month in the oblique hauls with the 1-metre stramin net at the position three miles east of Low Isles, in the barrier reef lagoon.

reef lagoon near Low Isles. It is noteworthy that the salinity inside Papuan Pass on that day was at the surface $34{\cdot}60°/_{oo}$, and at 10 m. $34{\cdot}54°/_{oo}$; two days before in the Low Isles region it was $33{\cdot}45°/_{oo}$ at the surface, and $33{\cdot}49°/_{oo}$ at 10 metres.

Bassia bassensis (Quoy and Gaimard).

This species occurred in the barrier reef lagoon in about the same abundance as did *Abylopsis eschscholtzii*, and it was recorded also during much the same period of time. It was found in both the coarse silk and the stramin net oblique haul catches at the weekly station three miles east of Low Isles during the months August, 1928, to January, 1929,



TEXT-FIG. 24.—The average catches of *Bassia bassensis* for each month in the oblique hauls with the coarse silk and 1-metre stramin nets at the position three miles east of Low Isles, in the barrier reef lagoon.

inclusive, and while being absent during February, March, April and May, reappeared in the catches in June and July (see Text-fig. 24). It was thus not recorded in the barrier reef lagoon during the period of low salinity.

From other localities it was recorded in and outside Trinity Opening in August, September, October and November, 1928. It was also found in February outside Cook's

Passage at Station 45 (28.ii.29), and in March inside Papuan Pass at Station 49 (17.iii.29), that is, during the months in which it was not recorded from the barrier reef lagoon near Low Isles. It is again noteworthy, as was mentioned before, under *A. eschscholtzii*, that the salinity at both these stations was considerably higher than the average salinity prevailing in the lagoon channel. It is thus evident that, while a stock is available close at hand in the more saline ocean waters, the species is apparently unable to survive on penetration into the barrier reef lagoon during the period of lowered salinity.

Family Diphyidae.

Sub-family Galettinae.

Genus *Sulculeolaria*.

Sulculeolaria quadrivalvis, Blainville.

In the barrier reef lagoon this species was only recorded in occasional catches and then in very low numbers, insufficient to give a reliable picture of its seasonal distribution. It is noticeable, however, that when its occurrences in all the different collections are surveyed together, it was only recorded in the barrier reef lagoon during the months August to December, 1928, inclusive, and in June, 1929. There is thus some evidence that, as with some other species mentioned above, it was absent during the period of low salinity from February to May. The species was found both in and outside Trinity Opening during August and November; but it was also recorded in February and March inside and outside Cook's Passage, and outside Papuan Pass at Stations 45 and 46 (28.ii.29), and Station 50 (18.iii.29). At all of these stations the salinity was considerably higher than that prevailing in most of the barrier reef lagoon during these months.

Sulculeolaria monoica (Chun).

This species was only recorded once from the barrier reef lagoon, in a stramin net oblique haul at Station 15 (2.x.28). It was not recorded from any other locality at which collections were made.

Galetta chuni (Lens and Van Riemsdijk).

This species was only recorded on two occasions at the position three miles east of Low Isles in the barrier reef lagoon, namely at Station 13 (20.ix.28), when it occurred in both the coarse silk and the stramin nets oblique hauls, and at Station 38 (21.i.29) in a coarse silk net oblique haul.

In other localities its presence was more frequent, and it was found from collections in and outside Trinity Opening, and inside and outside Papuan Pass.

Galetta turgida (Gegenbaur).

This species was recorded only once in the barrier reef lagoon, namely in a stramin net catch at Station 13 (20.ix.28). It was also recorded twice outside Trinity Opening, at Stations 19 and 20 (20.x.28), and once outside Papuan Pass, at Station 50 (18.iii.29).

Sub-family Diphyinae.

Genus *Diphyes*.

Diphyes dispar, Chamisso and Eysenhardt.

This species occurred fairly frequently in the barrier reef lagoon, but not in sufficient numbers to give a curve of its seasonal distribution. It was, however, recorded at the position three miles east of Low Isles from both the coarse silk and the stramin net catches in each of the months September, 1928, to January, 1929, inclusive. It was not recorded from either net for any other month. It is thus likely that this species was seasonal in its occurrence in the barrier reef lagoon and not present during the period of low salinity.

It was recorded from in and outside Trinity Opening, and also from the regions of Cook's Passage and Papuan Pass in February and March, in which months it was not recorded from the low salinity water of the barrier reef lagoon.

Diphyes bojani (Eschscholtz).

In the barrier reef lagoon this species was only recorded in the months of September and October at Station 12 (11.ix.28) and Station 13 (20.ix.28) in the stramin net catches, and at Station 16 (3.x.28) at the vertical distribution station with the coarse silk net.

It was recorded much more frequently from other localities, being found in Trinity Opening, and quite abundantly outside Trinity Opening at Station 19 (20.x.28); it was also recorded inside and outside Papuan Pass.

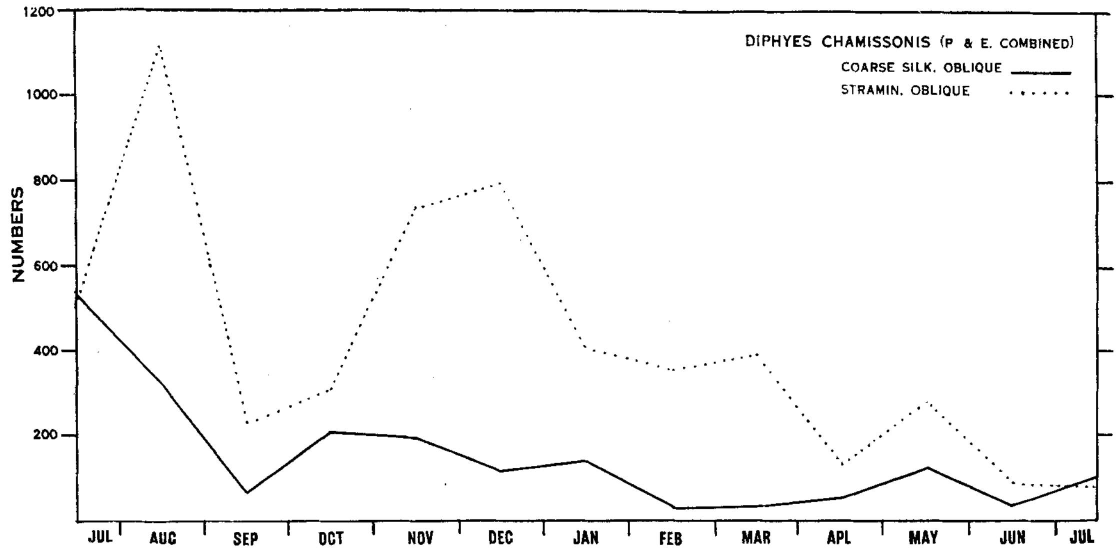
Diphyes chamissonis, Huxley.

This was the most prevalent species in the Great Barrier Reef Expedition collections, and, next to *Lensia subtiloides*, the most abundant. Its presence was recorded at every station at the position three miles east of Low Isles in the barrier reef lagoon with the exception of one, Station 64 (5.viii.29).

In Text-fig. 25 are given the curves for the average catches for each month of *D. chamissonis* (polygastric and eudoxid individuals and component parts combined) in the oblique hauls with the coarse silk and stramin nets at the position three miles east of Low Isles. It shows that on the whole this species was most abundant during the months of July, August, November and December, 1928, and that, while being present throughout the year, there was a tendency for it to decrease in abundance after January, 1929. This decrease is shown more definitely by the curve for the stramin net, and this curve can perhaps be taken as the more reliable of the two, owing to the greater amount of water that the stramin net filters and the consequent high numbers of specimens caught compared with the coarse silk net.

An examination of Tables VIII and IX shows that this species was subject to rather violent fluctuations in numbers from station to station. These fluctuations in the catches have been carefully compared with the variations in the transparency of the water, and, while it was found that some days high numbers caught coincided with the occurrence of very opaque water, on other days the reverse held good. It can be safely concluded after a careful study of this factor that the decrease in abundance of *D. chamissonis* after January, 1929, was actual, and was not a false impression brought about by considerable changes in the vertical distribution of the animal, although, as shown below, this species tended to keep rather deep in the water on days when the water was transparent. No connexion could be found between the week-to-week variations in abundance and the phases of the moon as has been shown for the salps (p. 211).

It is noticeable that the gradual decrease in abundance of *D. chamissonis* occurs over the period of lowered salinity in the barrier reef lagoon, and it is possible that the low salinity may be responsible. The species is, however, on the whole apparently well able to withstand this lowering of salinity, and is possibly especially well suited to be a coastal form. Evidence that this species may indeed be a coastal form is afforded on examination of the results of the collections from localities other than in the barrier reef lagoon. We find that while present in Trinity Opening, it was never recorded from any of the stations

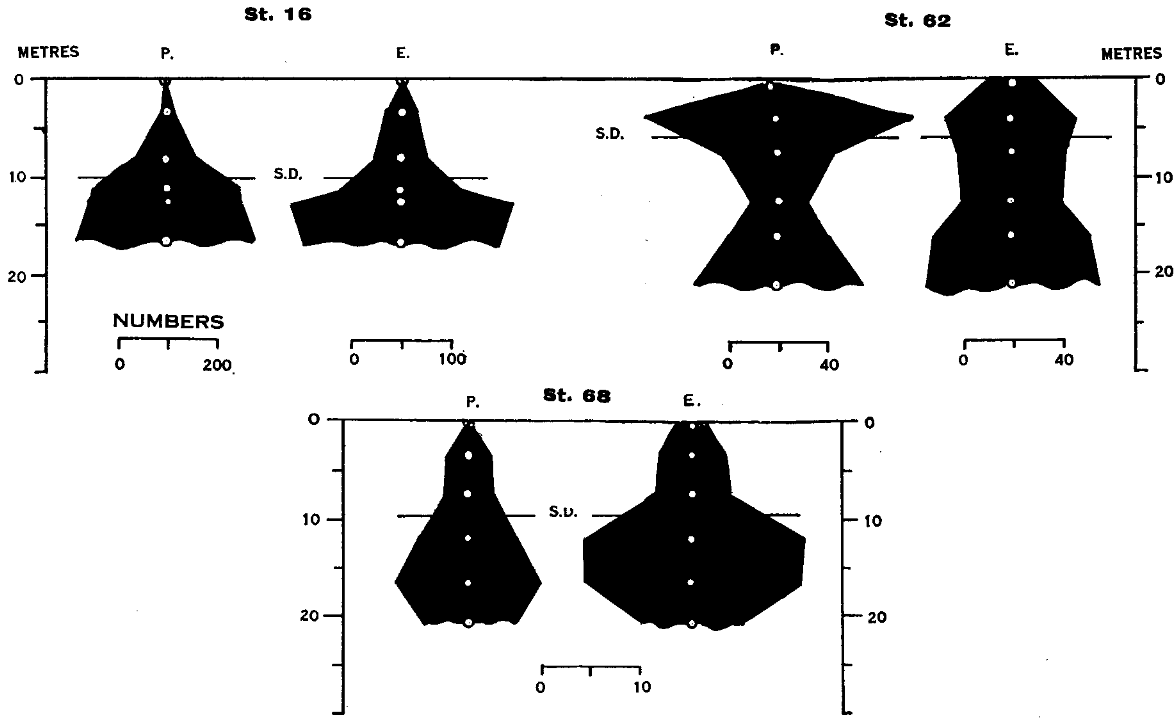


TEXT-FIG. 25.—The average catches of *Diphyes chamissonis* (polygastric and eudoxid individuals combined) for each month in the oblique hauls with the coarse silk and 1-metre stramin nets at the position three miles east of Low Isles, in the barrier reef lagoon.

outside Trinity Opening, and these collections have been very thoroughly searched by Mr. Totton. Furthermore the collections outside Trinity Opening were made during the period of the year when *D. chamissonis* was most abundant in the barrier reef lagoon.

In the other localities examined, namely Cook's Passage and Papuan Pass, we have further indications supporting the conclusion that this species is a coastal form. While quite abundant inside these passages through the reef, they were present in much diminished numbers outside the passages only a short distance from the barrier reef lagoon.

VERTICAL DISTRIBUTION.—At three of the stations made with the coarse silk net at the position three miles east of Low Isles to study the vertical distribution of the zooplankton, *D. chamissonis* occurred in sufficient numbers to show its vertical distribution in the daylight. We are greatly indebted to Mr. Totton for his kindness and care in sorting and counting the siphonophores from these collections. This species was evidently affected to a certain extent in its behaviour by the transparency of the water, being nearest the surface when the water was least clear (see Text-fig. 26). On clearer days both polygastric and eudoxid stages avoided the surface layers, having their region of maximum abundance



TEXT-FIG. 26.—The vertical distribution of *Diphyes chamissonis* in the daylight at the position three miles east of Low Isles, in the barrier reef lagoon at Station 16 (3.x.28), Station 62 (15.vi.29), and Station 68 (18.vii.29). The white spots indicate the average depths at which the hauls were made. Coarse silk townet. S.D., Secchi disc reading; P., polygastric; E., eudoxid.

below the 10-metre level. It is doubtful, however, whether changes in their vertical distribution will have effected the results shown by the oblique hauls except on the days of greatest transparency.

Genus *Chelophyes*.

Chelophyes appendiculata (Eschscholtz).

This species occurred in fair numbers in the collections from the barrier reef lagoon, but only during the months August to November, 1928, inclusive, and in June, 1929. There is thus evidence that this was another of those species which were absent from the lagoon during the period of lowered salinity.

It was found both in and outside Trinity Opening, but was not recorded from the collections taken in any other locality. It is interesting, therefore, to note that during its period of absence in the barrier reef lagoon it was also absent from the few collections made in February and March in the waters outside the reef in the neighbourhood of Cook's Passage and Papuan Pass.

Chelophyes contorta, Lens and Van Riemsdijk.

This species occurred only sparingly in the collections, and was recorded from the weekly station in the barrier reef lagoon on only three occasions, namely at Station 13 (20.ix.28) and Station 27 (21.xi.28) in the stramin net catches, and at Station 35

(27.xii.28) in the coarse silk oblique haul. Single individuals were also found at two of the vertical distribution stations three miles east of Low Isles, Station 16 (3.x.28) and Station 68 (18.vii.29).

Its presence in the barrier reef lagoon was therefore only recorded for the months of September, October, November and December, 1928, and July, 1929. It would thus appear to have been absent during the period of lowered salinity.

Eudoxia russelli, Totton.

This eudoxid was recorded on one occasion from the barrier reef lagoon, at Station 13 (20.x.28) in a stramin net catch. It was also recorded from one other locality, namely outside Trinity Opening at Station 19 (20.x.28) in a haul with the coarse silk net.

This species is now thought by Mr. Totton to be very probably the eudoxid of *Chelophyes contorta*.

Genus *Eudoxoides*.

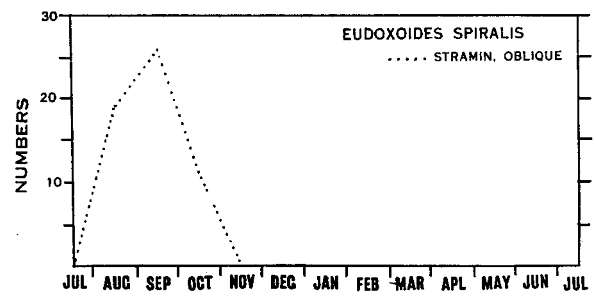
Eudoxoides mitra (Huxley).

This species was recorded only twice from the collections in the barrier reef lagoon, namely in September at Station 12 (11.ix.28) in a stramin net haul, and in October at the vertical distribution Station 16 (3.x.28).

In collections from other localities it was only recorded from outside Trinity Opening and outside Papuan Pass.

Eudoxoides spiralis (Bigelow).

In the collections from the barrier reef lagoon this species was recorded in the months of August, September and October, 1928, and July, 1929. It was quite evidently seasonal in its occurrence, as is shown by the curve for the average catch for each month in the stramin net oblique hauls at the position three miles east of Low Isles (Text-fig. 27). It was also recorded as present at Station 34 (19.xii.28) as a result of a further examination of the residue of the unsampled catch.



TEXT-FIG. 27.—The average catches of *Eudoxoides spiralis* for each month in the oblique hauls with the 1-metre stramin net at the position three miles east of Low Isles, in the barrier reef lagoon.

In localities other than in the barrier reef lagoon it was recorded from in and outside Trinity Opening, and from inside and outside Papuan Pass.

Totton (Vol. IV, No. 10, p. 361) gives figures for the vertical distribution of this species, which show that the few that were caught were distributed well up in the water in the barrier reef lagoon in the daylight.

Genus *Dimophyes*.

Dimophyes arctica, Chun.

This species was recorded from the collections of the Great Barrier Reef Expedition on one occasion only, when one eudoxid was caught in a haul from 580 metres with the coarse silk net at Station 28 (23.xi.28) outside Trinity Opening.

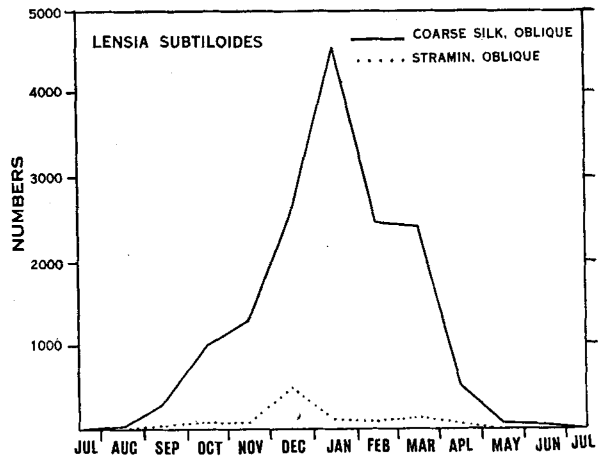
Genus *Lensia*.

Lensia subtiloides (Lens and Van Riemsdijk).

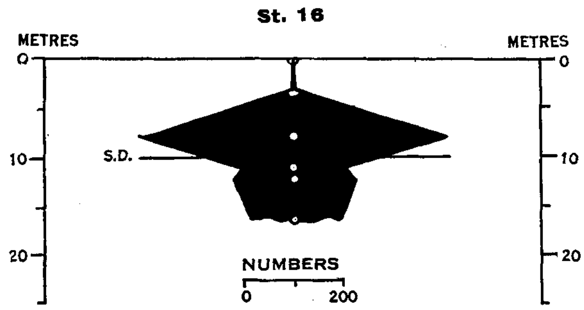
Although not such a constant feature of the zooplankton throughout the year as *Diphyes chamissonis*, *L. subtiloides* was easily the most abundant siphonophore during its period of occurrence. It was recorded in the catches of one or other net every month in the year in the barrier reef lagoon. In Text-fig. 30 (p. 269) are given the curves for the average catches for each month of all siphonophores for all nets. It can be seen that during the period October to March there was a great increase in the numbers of siphonophores indicated. Examination of Tables II and III shows that this increase is produced in the coarse silk net catches by large numbers of very small unidentified siphonophores. The tables show also that the seasonal distribution of these small siphonophores coincides more or less with that shown by the stramin net oblique hauls and those of the coarse silk net for *Lensia subtiloides*. Mr. Totton made a special examination of the collections with the stramin net from Stations 32, 35 and 36, and with the coarse silk net from Stations 27, 33, 34, 36, 38 and 41, at which these small siphonophores were exceptionally numerous. His examinations showed that, while there were a few small polygastric and eudoxid specimens of *D. chamissonis* present, the bulk of these small siphonophores consisted of *L. subtiloides*. The numbers of these small unidentified siphonophores have therefore been used to construct the curve for the monthly abundance of *L. subtiloides* in the coarse silk net oblique catches in Text-fig. 28 ; the same figure shows also the curve for the identified specimens from the stramin net catches. While the stramin net shows a similar seasonal distribution to that shown by the coarse silk net, the very much greater numbers taken in the coarse silk net are at once evident. The majority of these small individuals were too small to be retained by the stramin material. Examination of Text-fig. 30 shows how this species predominated over all others in abundance in the coarse silk net catches when it was present, the form of the curve from September to May following that for *L. subtiloides* in Text-fig. 28.

It is evident that this species was fully able to withstand the conditions of lowered salinity in the barrier reef lagoon during the period from February to May. It is noticeable, however, that during this period the numbers of individuals were rapidly decreasing, but it is not possible to decide whether this decrease is a result of the lowered salinity, or whether it is not perhaps the normal decrease in the sequence of the seasonal distribution of this species. In this connexion it is interesting to note that the general trend of the curve for seasonal abundance follows very closely that for the temperature of the water, the period of maximum abundance coinciding with the time of highest temperature when temperatures of 28° C. and over were recorded. *L. subtiloides* became relatively very rare when the temperature dropped below 24° C.

This species thus seems specially suited for living in coastal waters of high temperature, and it is perhaps significant that it was never recorded from the collections made in February and March outside Cook's Passage and outside Papuan Pass, while the small unidentified siphonophores were abundant inside Papuan Pass.



TEXT-FIG. 28.—The average catches of *Lensia subtiloides* for each month in the oblique hauls with the coarse silk and 1-metre stramin nets at the position three miles east of Low Isles, in the barrier reef lagoon.



TEXT-FIG. 29.—The vertical distribution of *Lensia subtiloides* in the daylight at the position three miles east of Low Isles, in the barrier reef lagoon, at Station 16 (3.x.28). The white spots indicate the average depths at which the hauls were made. Coarse silk tow-net. S.D., Secchi disc reading.

VERTICAL DISTRIBUTION.—Only one of the stations for the study of the vertical distribution of the zooplankton in the barrier reef lagoon was made during the period when *L. subtiloides* was at all common, namely Station 16 (3.x.28), when this species was just beginning to become abundant. The vertical distribution on this occasion is shown in Text-fig. 29, and it can be seen that, while avoiding the surface layers, the species was living well up in the water in the daylight.

Lensia subtilis (Chun).

This species was not recorded from any of the collections in the barrier reef lagoon. In the collections from other localities it was only recorded at Station 49 (17.iii.29) inside Papuan Pass and Station 50 (18.iii.29) outside Papuan Pass.

Lensia campanella (Moser).

This species was not recorded from any of the collections in the barrier reef lagoon. In the collections from other localities it was only recorded from Station 19 (20.x.28) outside Trinity Opening, Station 49 (17.iii.29) inside Papuan Pass, and Station 50 (18.iii.29) outside Papuan Pass.

Lensia fowleri (Bigelow).

There is only one record of this species in the Great Barrier Reef Expedition collections, and that was the presence of a single nectophore at Station 28 (23.xi.28) outside Trinity Opening.

Lensia spp. indet.

A few specimens of unidentified *Lensia* species occurred outside Trinity Opening at Stations 19 and 20 (20.x.28) and Station 28 (23.xi.28), and also at Station 50 (18.iii.29) outside Papuan Pass.

RHIZOPHYSALIAE.

Family PHYSALIDAE.

No specimens of *Physalia* were collected during the expedition, but one or two were recorded as having been seen in August, and on 20th and 23rd September, 2nd October and 6th November, 1928. They were never seen abundantly.

CHONDROPHORAE.

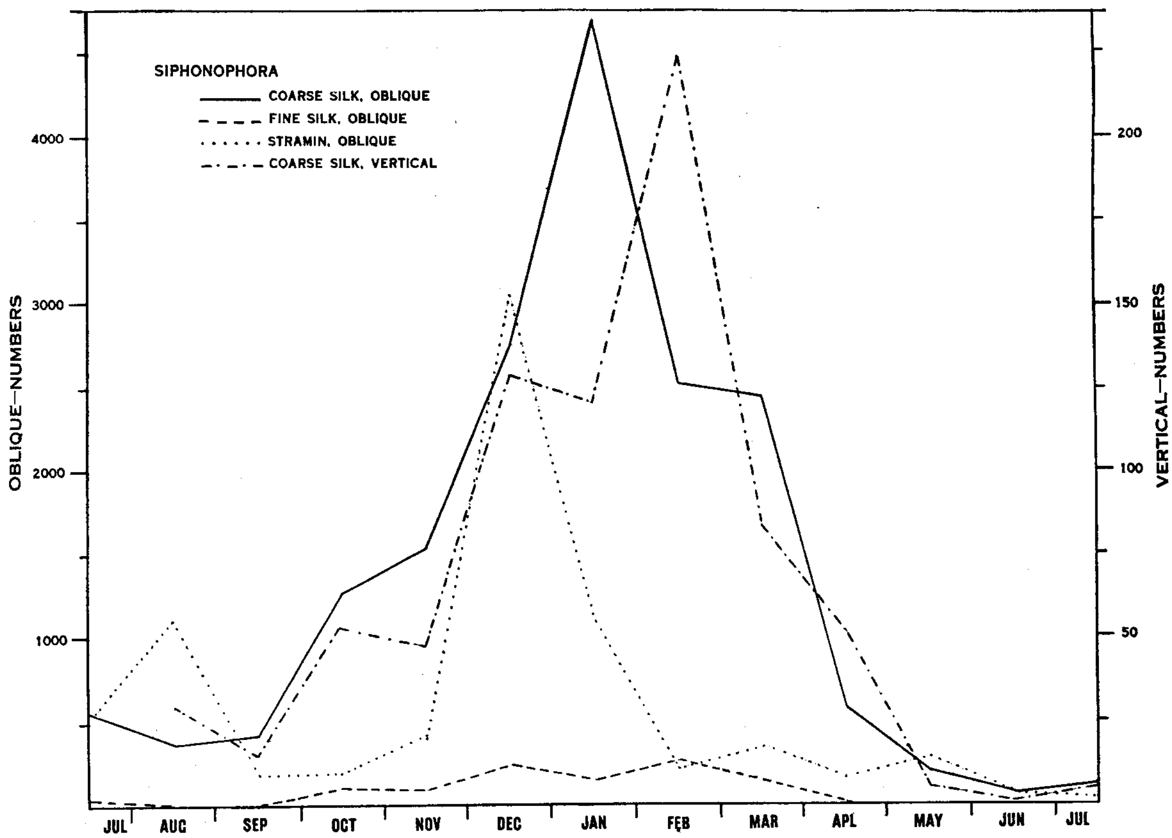
On 12th August, 1928, a *Velella* sp. was seen, and on 15th September a *Porpita* sp., both washed up on the shores of Low Isles. They were never seen at sea in abundance.

ON THE OCCURRENCE OF SIPHONOPHORES.

In Text-fig. 30 are given the curves for the average catches of all siphonophores for each month at the weekly station in the barrier reef lagoon for all nets. We have seen above that two species alone predominated in these catches, *Lensia subtiloides* and *Diphyes chamissonis*; the curves in Text-fig. 30 are therefore practically a replica of those for these two species combined, and of these *L. subtiloides* was responsible for the major fluctuations in abundance during the year.

In Table VII we have indicated the months in which each species was recorded in one or other net, either at the weekly station, or the vertical distribution stations in the barrier reef lagoon near Low Isles. In this table a thin cross indicates that the species was recorded for the month in question in a catch or catches of one type of net only, either coarse silk or stramin; a thick cross indicates that the species was recorded from both the coarse silk and the stramin net catches. The stramin net is perhaps more usually responsible for the thin crosses, since it is more likely to have caught the rarer species on account of the greater amount of water it filters compared with the coarse silk net. Thus while the thin crosses can be taken to indicate the range of seasonal occurrence, the thick crosses will generally be found in those months in which the different species were most abundant.

Twenty species were recorded from the barrier reef lagoon, and we have indicated at the foot of Table VII the number of species occurring in each month. It is at once evident that there was a period during the months of February, March, April and May when the number of species was very low compared with the rest of the year, *Enneagonum hyalinum*, *Diphyes chamissonis* and *Lensia subtiloides* being the only species occurring regularly during this period. At other times of the year many more species occurred, the maximum number recorded being 16 in October. It is likely also that a closer examination of the catches might have led to a slight increase in the numbers of species for some of the other months, since the numbers recorded in October were raised by the very careful



TEXT-FIG. 30.—The average catches of all Siphonophora for each month in the oblique hauls with the coarse and fine silk and 1-metre stramin nets, and in the vertical hauls with the coarse silk net, at the position three miles east of Low Isles, in the barrier reef lagoon.

search made on the catches from the hauls taken at the vertical distribution station. The low numbers in July, 1928, may perhaps also be disregarded, as the results rest only on the collections from the first two stations. It is remarkable that not a single specimen of the remaining 15 species should have been recorded from the large number of collections (28 in all) made during the period from February to May inclusive, and this can surely be taken as evidence that these species must have been almost entirely absent from the barrier reef lagoon in the area studied. The same held good also for the collections made further to the north off Cape Bedford.

There must be some factor to account for the continued disappearance of so many species from the area, and we must now turn to the hydrographical data. At the foot of

Table VII we have inserted the average salinities and temperatures at a depth of 10 metres in the barrier reef lagoon for each month. It can at once be seen that the period of absence of most of the species of siphonophores from the barrier reef lagoon coincided with that for low salinity, which was a result of the heavy rains prevalent at that time of year. The average salinities for the months of February, March, April and May were lower than those for any other month in the year, being 33·63°/₀₀, 33·47°/₀₀, 33·44°/₀₀ and 34·39°/₀₀ respectively. Now it was during this period of lowered salinity that the

TABLE VII.—*Occurrence of Different Species of Siphonophores in the Barrier Reef Lagoon.*

	1928.						1929.						
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.
Agalma okenii						+							
Stephanomia bijuga				+		**+**	+			+		+	+
Abyla haeckeli				+									
Abylopsis tetragona		+	+	+	+		+					+	
Enneagonum hyalinum							**+**	+	+	**+**	**+**	**+**	+
Abylopsis eschscholtzii	+	**+**	**+**	+	+		+					+	+
Bassia bassensis		**+**	**+**	**+**	+	**+**	+					**+**	**+**
Sulculeolaria quadrivalvis		+	+	+	+	**+**						+	
Sulculeolaria monoica				+									
Galetta chuni			**+**	+		+	+						
Galetta turgida						+							
Diphyes dispar			**+**	**+**	**+**	**+**	**+**						
Diphyes bojani			+	+									
Diphyes chamissonis	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**	**+**
Chelophyes appendiculata		+	**+**	**+**	+							+	
*Chelophyes contorta**			+	+	+	+							+
Eudoxides mitra			+	+									
Eudoxoides spiralis		+	**+**	+									+
Lensia subtiloides	**+**	+	**+**	**+**	**+**	**+**	**+**	**+**	+	**+**	+	+	+
Small, unidentified		+	+	+	+	**+**	**+**	+	**+**	**+**	**+**	+	+
Number of species†	3	8	13	16	9	10	9	3	3	4	3	9	8
Salinity‡ (average monthly) °/₀₀	35·16	35·11	35·30	35·34	35·20	35·16	34·43	33·63	33·47	33·44	34·39	34·73	34·99
Temperature‡ (average monthly) °C.	22·2	22·3	24·4	25·8	27·1	28·4	28·7	28·8	28·1	26·8	24·4	22·9	21·5

+ Present in both stramin and coarse silk nets. + Present in one net only.

* *Eudoxia russelli* has been excluded in this list as possibly belonging to this species.

† Excluding "small, unidentified", which are mostly *L. subtiloides.*

‡ At 10 metres at the position three miles east of Low Isles.

collections were made in the region of Cook's Passage and Papuan Pass, and we have seen in the previous pages that many species were recorded from these localities, especially from the outside waters, and of these species some were those which were then absent from the waters of the barrier reef lagoon, near Low Isles. It is a significant fact that the salinity of these outside waters was in the neighbourhood of 34·5°/₀₀ and above, and that it is just about at this salinity that the majority of the species begin to disappear from the catches in January, and reappear in June. Examination of the tables shows that by 14th January the period of scarcity of species had begun. The salinities at 10 metres in the lagoon during January were as follows: 4th January, 34·95°/₀₀; 14th,

$34{\cdot}43^\circ/_{\circ\circ}$; 21st, $34{\cdot}50^\circ/_{\circ\circ}$, and 30th, $33{\cdot}82^\circ/_{\circ\circ}$. The salinities at the end of May and beginning of June, when many species reappeared in the lagoon, were on 31st May, $34{\cdot}53^\circ/_{\circ\circ}$, and on 7th June, $34{\cdot}93^\circ/_{\circ\circ}$. Meanwhile on 28th February, outside Cook's Passage the salinity was $34{\cdot}53^\circ/_{\circ\circ}$; outside Papuan Pass on 18th March it was $34{\cdot}56^\circ/_{\circ\circ}$; and inside Papuan Pass on 17th March, $34{\cdot}54^\circ/_{\circ\circ}$; at these positions there was no scarcity of species.

It is thus very difficult to avoid the inference that from February to May the water in the barrier reef lagoon, owing to its lowered salinity, becomes uninhabitable to the majority of siphonophore species which are probably present in the more saline waters outside the reef, and can invade the lagoon successfully at other times of the year. Bigelow (1911, p. 381) has said that siphonophores " are almost a negligible factor in waters with a salinity less than 35 per mille ", and it seems that this generalization holds good for the waters of the barrier reef lagoon, where the limiting salinity is more accurately about $34{\cdot}5^\circ/_{\circ\circ}$. It should, however, be pointed out that two of the three outside species that occurred in any numbers, *Eudoxoides spiralis* and *Abylopsis escholtzii*, were already showing indications of a decrease some time before January (see Text-figs. 23 and 27, pp. 260 and 265). The numbers taken were, however, very low, and it is impossible to say whether this early decrease is of real significance.

The occurrence of *Diphyes chamissonis*, *Lensia subtiloides* and *Enneagonum hyalinum* during this period of lowered salinity is of great interest, and points to the possibility that these species are specially adapted to life in shallow coastal waters. If this be true it is the first time that any species of siphonophores have been definitely recognized as coastal species in a group which is so predominantly oceanic. *Enneagonum hyalinum* indeed was peculiar in that it only appeared in the collections in January, when the salinity was decreasing, and was then prevalent right through the period of low salinity.

In considering these results the possible importance of temperature must not be lost sight of, and there is a chance that the majority of the species cease active reproduction when the temperature is reaching its maximum between December and February. It seems unlikely, though, that this should have been the cause of the paucity of species in the barrier reef lagoon after February, since in that month and in March the temperature was just as high in the waters outside the reef where the absent species were still found.

Another possible cause in the decrease in numbers of species might be looked for in the turbidity of the water. One might suppose that during the rainy season much silt might have been brought down into the lagoon from the land and destroyed the siphonophores, which require very pure water. But there was no indication that such was the case; observations showed that perhaps if anything the water was slightly more transparent in February on account of the unusually calm conditions then prevailing, although in March and April it was at times very turbid (Orr, Vol. II, No. 3, p. 46).

Among the siphonophores recorded from the Great Barrier Reef Expedition collections *Amphicaryon acaule*, *Lensia subtilis* and *Chelophyes appendiculata* have so far been recorded only from the Atlantic and Pacific Oceans, and *Diphyes chamissonis* and *Lensia subtiloides* only from the Indo-Pacific region. All the rest with the exception of the two newly described species are known from all three oceans (Bigelow, 1911 and 1931; Lens and Van Riemsdijk, 1908; Moser, 1925). All are warm-water species except *Stephanomia bijuga*, which has a wide distribution, occurring both in warm and cold water (if its synonymy with *S. cara* be correct), and *Dimophyes arctica*, which is a bipolar form that has been recorded widely over all oceans, and probably occurs in the warmer zone, chiefly in

[*Continued on p. 276.*

TABLE VIII.—*Siphonophora Occurring in Oblique Hauls of the 1-metre Stramin Net at the Stations in the Barrier Reef Lagoon 3 miles East of Low Isles.*

Station number.	Date.	*Stephanomia bijuga.*	*Abyla haeckeli.*	*Abylopsis tetragona.*		*Enneagonum hyalinum.*		*Abylopsis eschscholtzii.*		*Bassia bassensis.*		*Sulculeolaria quadrivalvis.*	*Sulculeolaria monoica.*	*Galetta chuni.*	*Galetta turgida.*	*Diphyes dispar.*		*Diphyes bojani.*		*Diphyes chamissonis.*		*Chelophyes appendiculata.*		*Chelophyes contorta.*	*Eudoxia russelli.*	*Eudoxoides mitra.*	*Eudoxoides spiralis.*	*Lensia subtiloides.*	Small, unidentified.
		P.	P.	P.	E.	P.	E.	P.	E.	P.	E.	P.	P.	P.	P.	P.	E.	P.	E.	P.	E.	P.	E.	P.	E.	E.	P.	E.	
1	27.vii.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	356	252	..	..	..	..	..	..	2	..
2	30.vii.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	347	62	..	..	..	..	..	..	..	..
3	4.viii.28	..	..	..	..	..	..	..	1	..	27	..	..	..	..	..	..	..	..	163	1213	1	..	..	..	..	..	14	..
5	11.viii.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	212	424	..	..	..	..	..	..	..	..
6	17.viii.28	..	..	3	..	..	..	2	3	3	3	3	..	..	..	..	..	..	..	165	1585	9	..	..	..	..	93	155	..
7	22.viii.28	..	..	1	2	..	..	2	8	2	7	..	..	..	..	..	..	..	..	8	156	5	..	..	..	..	..	..	..
9	31.viii.28	..	..	..	..	..	..	..	49	12	37	..	..	..	..	..	..	..	..	161	1490	..	..	..	..	..	..	..	..
10	4.ix.28	..	..	2	..	..	..	..	9	..	31	..	..	..	..	..	..	..	..	69	235	11	..	..	..	..	9	..	..
12	11.ix.28	..	..	1	..	..	..	20	60	..	53	2	..	..	..	3	8	..	2	24	76	2	..	..	..	8	28	2	..
13	20.ix.28	..	..			..	..	1	25	1	11	1	..	+	+	..	1	1	11	56	210	23	11	23	10	..	..	79	..
14	26.ix.28	..	..	..	..	..	..	..	11	2	4	..	..	..	..	..	..	..	..	15	197	20	..	..	..	..	66	..	..
15	2.x.28	..	2	..	..	..	..	2	5	..	2	..	2	..	..	2	..	..	..	53	45	9	..	..	..	..	22	111	..
18	15.x.28	..	..	..	..	..	..	..	24	..	20	..	..	..	..	..	..	..	..	44	200	12	..	..	..	..	12	24	..
22	23.x.28	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	258	310	..	..	..	..	..	..	124	..
23	2.xi.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	13	778	2	..	..	..	..	..	..	..
24	6.xi.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	27	..	..	..	9	424	..	..	..	..	..	..	27	..
25	16.xi.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	874	1173	..	..	..	..	..	..	183	..
27	21.xi.28	..	..	..	..	..	..	4	85	..	21	..	..	..	..	..	..	..	..	26	247	..	..	2	..	..	..	106	..
30	28.xi.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11	92	..	..	..	..	..	..	..	..
32	5.xii.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	184	491	..	..	..	..	..	..	1105	2600
33	14.xii.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	17	..	..	488	280	..	..	..	..	..	..	505	1600
34	19.xii.28	2	..	..	..	..	..	..	..	..	91	..	..	..	..	..	137	..	..	1100	366	..	..	..	..	..	+	366	..
35	27.xii.28	1	..	..	..	..	..	..	..	..	..	13	..	..	..	14	..	..	..	272	..	..	..	..	..	..	..	+	2600
36	4.i.29	2	..	..	1	..	..	20	..	..	40	..	..	..	..	2	..	..	..	125	160	..	..	..	..	..	..	20	2740
37	14.i.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	424	30	..	..	..	..	..	..	46	..
38	21.i.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	511	77	..	..	..	..	..	..	102	..
39	30.i.29	2	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	105	187	..	..	..	..	..	..	247	..
40	6.ii.29	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	99	187	..	..	..	..	..	..	43	..
41	13.ii.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	49	478	..	..	..	..	..	..	33	..
42	18.ii.29	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	178	59	..	..	..	..	..	..	178	..
47	4.iii.29	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	86	80	..	..	..	..	..	..	80	460
48	15.iii.29	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	197	469	..	..	..	..	..	..	49	..
51	25.iii.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	191	143	..	..	..	..	..	..	176	..
52	6.iv.29	3	..	..	..	18	123	..	..	..	..	..	..	..	..	..	..	..	..	108	180	..	..	..	..	..	..	108	..
53	13.iv.29	..	..	..	..	4	81	..	..	..	..	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	100	..
54	20.iv.29	..	..	..	..	1	6	..	..	..	..	..	..	..	..	..	..	..	..	17	86	..	..	..	..	..	..	..	..
55	26.iv.29	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	51	30	..	..	..	..	..	..	30	200
56	7.v.29	..	..	..	..	6	42	..	..	..	..	..	..	..	..	..	..	..	..	6	6	..	..	..	..	..	..	..	400
57	18.v.29	..	..	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..	126	26	..	..	..	..	..	..	26	600
58	25.v.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	37	543	..	..	..	..	..	..	..	..
59	31.v.29	..	..	..	..	4	11	..	..	..	..	..	..	..	..	..	..	..	..	74	301	..	..	..	..	..	..	..	..
60	7.vi.29	..	..	2	..	..	..	..	..	..	12	1	..	..	..	..	..	..	..	2	2	11	..	..	..	..	..	..	..
61	14.vi.29	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	59	45	..	..	..	..	..	..	..	..
63	24.vi.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	63	85	..	..	..	..	..	..	12	..
64	5.vii.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
66	11.vii.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20	10	..	..	..	..	..	..	..	..
67	17.vii.29	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	103	103	..	..	..	..	..	..	..	..

P. = polygastric stage. E. = Eudoxid.

+ Implies that specimens were found only during examination of the remainder of the total catch from which the samples for counting had been taken.

TABLE IX.—*Siphonophora Occurring in Oblique Hauls of the Coarse Silk Tow-net at the Stations in the Barrier Reef Lagoon 3 miles East of Low Isles.*

Station number.	Date.	*Agalma okenii.*	*Stephanomia bijuga.*	*Abylopsis tetragona.*		*Enneagonum hyalinum.*		*Abylopsis eschscholtzii.*		*Bassia bassensis.*		*Sulculeolaria quadrivalvis.*	*Galetta chuni.*	*Diphyes dispar.*		*Diphyes bojani.*	*Diphyes chamissonis.*		*Chelophyes appendiculata.*	*Chelophyes contorta.*	*Eudoxoides spiralis.*	*Lensia subtiloides.*	Small, unidentified.
		P.	P.	P.	E.	P.	E.	P.	E.	P.	E.	P.	P.	P.	E.	E.	P.	E.	P.	P.	P.	P.	
1	27.vii.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	553	340	..	..	..	..	..
2	30.vii.28	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	25	144	..	..	..	15	..
3	4.viii.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	43	332	1	..	..	..	..
5	11.viii.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	231	39	..	..	..	..	..
6	17.viii.28	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	188	253	..	..	..	..	..
7	22.viii.28	..	..	..	..	..	..	..	13	13	..	..	..	..	..	..	13	172	..	..	..	..	200
9	31.viii.28	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	76	254	..	..	..	..	..
10	4.ix.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	82	1	..	..	..	600
12	11.ix.28	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	42	..	..	14	..	..
13	20.ix.28	..	..	..	..	..	..	1	..	..	2	12	+	..	..	..	11	53	1	..	..	1	600
14	26.ix.28	..	..	..	..	..	..	..	..	4	7	..	..	4	..	4	11	38	116	..	38	..	..
15	2.x.28	..	..	4	4	..	..	..	..	7	9	4	..	..	..	..	4	7	33	..	..	..	600
18	15.x.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	432	137	..	..	..	11	2000
22	23.x.28	..	..	..	..	..	..	..	..	..	17	..	..	..	17	..	3	34	..	..	..	51	400
23	2.xi.28	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	4	176	..	..	..	13	200
24	6.xi.28	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	10	119	..	..	..	..	1400
25	16.xi.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	194	377	..	..	..	229	1600
27	21.xi.28	..	..	..	1	..	..	..	..	..	..	..	..	..	20	..	2	42	..	..	..	+	3200
30a	29.xi.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12	23	..	..	..	..	..
32	5.xii.28	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	33	144	..	..	..	78	1400
33	14.xii.28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	36	20	..	..	..	41	3600
34	19.xii.28	..	2	..	..	..	..	..	..	..	46	..	..	..	5	..	18	113	..	..	..	+	3200
35	27.xii.28	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	61	40	..	10	..	30	2000
36	4.i.29	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	87	28	..	..	..	14	3400
37	14.i.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	70	20	..	..	..	10	1400
38	21.i.29	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	170	12	..	..	..	+	12,400
39	30.i.29	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	168	..	..	..	..	12	1000
40	6.ii.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2410
41	13.ii.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	40	..	..	..	+	3600
42	18.ii.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30	10	..	..	..	10	1400
47	4.iii.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1420
48	15.iii.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20	35	..	..	..	..	1400
51	25.iii.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13	23	..	..	..	..	4400
52	6.iv.29	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	45	35	..	..	..	10	400
53	13.iv.29	..	..	..	..	8	12	..	..	..	..	..	..	..	..	..	12	38	..	..	..	..	800
54	20.iv.29	..	..	..	..	1	2	..	..	..	..	..	..	..	..	..	3	62	..	..	..	..	200
55	26.iv.29	..	..	..	..	3	8	..	..	..	..	..	..	..	..	..	8	3	..	..	..	28	600
56	7.v.29	..	..	..	..	..	37	..	..	..	..	..	..	..	..	..	15	7	..	..	..	..	..
57	18.v.29	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	8	68	..	..	..	..	..
58	25.v.29	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	19	270	..	..	..	..	200
59	31.v.29	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	20	70	..	..	..	..	..
60	7.vi.29	..	..	..	..	1	..	..	10	..	1	..	..	..	..	..	14	23	..	..	..	..	..
61	14.vi.29	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	12	45	..	..	..	..	..
63	24.vi.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	90
66	11.vii.29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..
67	17.vii.29	..	..	..	..	..	17	..	..	..	17	..	..	..	..	..	83	83	..	..	..	..	..

P. = Polygastric stage. E. = Eudoxid.

\+ Implies that specimens were found only during examination of the remainder of the total catch from which the samples for counting had been taken.

TABLE X.—*Siphonophora from Stations o*

Station number.	Date.	Position.	*Agalma okenii.*	*Agalma elegans.*	*Agalma* sp.	"*Athorybia*" larvae.	*Stephanomia bijuga.*	*Cordagalma cordiformis.*	*Forskalia* sp.	*Rosacea ? plicata.*	*Amphicaryon acaule.*	*Hippopodius hippopus.*	*Abyla haeckeli.*	*Abyla trigona*	*Abylopsis tetragona.*		*Enneagonum hyalinum.*		*Abylopsis eschscholtzii.*		*Bassia bassensis.*	
																						COARSE
			P.	P.	P.		P.	P.	P.	P.	P.	P.	E.	E.	P.	E.	P.	E.	P.	E.	P.	E.
8	24.viii.28	I.T.O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	1
11	6.ix.28	I.T.O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19*	20.x.28	O.T.O.	5	..	..	+	2	+	..	..	..	..	..	..	..	..	..	..	3	14	..	11
20	20.x.28	O.T.O.	..	..	..	+	..	..	..	..	..	..	..	..	..	..	..	..	..	2	4	2
21	22.x.28	3 m. E. night.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
26	19.xi.28	I.T.O.	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	23.xi.28	O.T.O.	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..
43	26.ii.29	C.B.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
44	27.ii.29	Li.I.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..
45	28.ii.29	O.C.P.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..
46	28.ii.29	I.C.P.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
49	17.iii.29	I.P.P.	3	..	..	..	4	..	..	..	..	..	1	+	..	..	3	3	..	..	..	..
50	18.iii.29	O.P.P.	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
																						1-METRE
8	24.viii.28	I.T.O.	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	1	..
11	6.ix.28	I.T.O.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1
19	20.x.28	O.T.O.	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	..	3	8	8	..
21	22.x.28	3 m. E. night.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	18	..	..
26	19.xi.28	I.T.O.	..	..	..	..	..	..	..	+	..	..	..	..	..	..	..	..	..	..	..	..
28	23.xi.28	O.T.O.	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8	3	5	5
29	24.xi.28	O.T.O. B.S.N.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
31	2.xii.28	3 m. E. B.S.N.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
43	26.ii.29	C.B.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
44	27.ii.29	Li.I.	..	..	..	..	..	..	..	..	..	..	..	..	..	6	..	2	..	..	..	..
45	28.ii.29	O.C.P.	..	..	..	..	..	..	..	..	..	..	..	..	3	6	..	..	..	..	..	6
46	28.ii.29	I.C.P.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..
49	17.iii.29	I.P.P.	+	..	..	..	7	..	..	..	..	..	..	..	..	..	1	27	..	10	10	20
50 (i)	18.iii.29	O.P.P.	..	..	10	..	..	..	+	..	+	..	..	..	4	..	..	26	..	..	..	..
50(ii)	18.iii.29	O.P.P.	..	..	..	..	1	..	..	..	..	+	+	..	2	2	5	..	..	..	..	..

P. = Polygastric stage. E. = Eudoxid.

I.T.O., in Trinity Opening ; O.T.O., outside Trinity Opening ; C.B., off Cape Bedford ; Li.I., off Lizard Island ; O.C.P., outs Cook's Passage ; I.C.P., inside Cook's Passage ; I.P.P., inside Papuan Pass ; O.P.P., outside Papuan Pass ; B.S.N., bottom stran net. St. 50 (i) = 400 m. St. 50 (ii) = 170 m. (For positions see Chart II, Vol. II, No. 1.)

that 3 miles East of Low Isles.

Sulculeolaria quadrivalvis.	*Galetta chuni.*	*Galetta turgida.*	*Diphyes dispar.*		*Diphyes bojani.*		*Diphyes chamissonis.*		*Chelophyes appendiculata.*	*Chelophyes contorta.*	*Eudoxia russelli.*	*Eudoxoides mitra.*		*Eudoxoides spiralis.*		*Dimophyes arctica.*	*Lensia subtiloides.*	*Lensia subtilis.*	*Lensia campanella.*	*Lensia fowleri.*	*Lensia* spp.		Small, unidentified.	Station Number.
ILK.																								
P.	P.	P.	P.	E.	P.	E.	P.	E.	P.	P.		P.	E.	P.	E.	E.	P.	P.	P.	P.	P.	E.		
..	..	..	..	1	..	..	9	30	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	**8**
1	1	..	..	..	..	..	1	61	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	**11**
2	+	+	9	30	6	16	..	..	12	5	4	..	3	..	..	..	..	+	1	..	11	3	86	**19***
..	2	1	..	..	2	6	..	..	2	..	..	..	..	9	..	..	2	7	..	..	12	15	68	**20**
..	..	..	..	..	..	..	54	126	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1800	**21**
4	+	..	3	26	..	..	65	197	..	26	..	..	..	26	..	..	181	..	..	..	..	..	1400	**26**
..	..	..	..	..	..	9	..	..	..	2	..	..	..	..	..	+	..	10	..	+	1	..	85	**28**
..	..	..	..	..	..	..	17	85	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1400	**43**
..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	800	**44**
..	..	..	..	2	..	..	2	..	..	2	..	..	..	..	..	..	18	..	..	..	..	..	..	**45**
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20	**46**
..	2	..	3	3	..	..	10	26	..	..	..	..	..	..	..	..	28	..	..	..	..	..	1194	**49**
.	+	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	**50**
TRAMIN.																								
1	..	..	..	1	..	7	30	104	..	..	..	..	..	7	..	..	7	..	..	..	..	..	..	**8**
1	..	..	..	9	1	1	..	28	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	**11**
.	+	..	..	2	7	34	..	..	3	8	..	2	8	17	..	..	..	..	5	..	..	..	..	**19**
.	..	..	..	..	..	..	75	846	..	..	..	..	..	..	..	..	74	..	..	..	..	..	..	**21**
.	..	..	..	..	1	..	20	360	1	..	..	..	..	..	..	..	79	..	..	..	..	..	..	**26**
.	..	..	3	5	8	5	..	..	8	16	..	10	..	26	26	..	32	..	..	..	..	..	..	**28**
.	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	**29**
.	..	..	..	..	..	..	536	166	..	..	..	..	..	..	..	..	128	..	..	..	..	..	..	**31**
.	..	..	..	..	..	..	14	268	..	..	..	..	..	..	..	..	60	..	..	..	..	..	..	**43**
.	..	..	..	..	..	..	105	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	**44**
3	..	..	3	..	..	..	7	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	**45**
2	..	..	1	..	..	..	30	41	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	**46**
.	+	..	..	1	..	10	40	70	..	1	..	..	..	+	..	..	20	..	1	..	..	..	342	**49**
4	+	..	..	..	..	..	7	31	..	..	..	..	..	+	..	..	31	..	..	..	..	..	..	**50 (i)**
.	3	+	..	..	2	..	6	32	..	3	..	2	..	..	..	..	17	..	1	..	+	..	..	**50 (ii)**

* St. 19, coarse silk, two hauls here combined together.

+ Implies that specimens were found only during examination of the remainder of the total catch from which the samples for counting d been taken.

the deeper cooler layers. It is significant that the single specimen recorded here came from outside the barrier reef in the deepest haul taken during the expedition, when the net went down to a level at which the temperature was at least as cool as 12° C. This record fills in a wide gap in the known distribution of *D. arctica* in the Western Pacific.

The presence of *Lensia subtiloides*, which had up to now only been recorded from the collections of the " Siboga " Expedition, in such large numbers is interesting, especially as its period of greatest abundance occurs during the hottest time of the year. Actually the approximate lower limit of its abundance lies at about 25° C., and this may be an indication that this species is likely to be confined in its distribution to waters of this temperature and above, and therefore thrives in a narrower equatorial zone than do most of the other species of warm-water siphonophores.

Considering the very few collections that were made in the waters outside the barrier, the number of species recorded is quite high, and it is to be expected that a greater number of collections would have brought to light the presence of most of the commoner widely distributed warm-water siphonophores. Apart from the three species which exhibited apparent adaptability to coastal conditions, it is probable also that in other years the species recorded in the barrier reef lagoon during the period of high salinity might be different from those recorded here. The different species of siphonophores are probably distributed in swarms irregularly over the ocean waters, and their presence in the barrier reef lagoon would thus depend upon their chance occurrence near the openings in the reef through which they might invade the lagoon, or to their being carried at night by high tides over the tops of the outer reefs.

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