

P l a n k t o n   C o m m i t t e e

By J.H. FRASER

1968

Belgium

(E. Leloup)



Nothing to report for 1968.

Programme for 1969

Etude du phyto- et zooplancton au large de la côte belge.

Canada

(L.M. Dickie)

The two productivity studies mentioned last year have been further developed. On the west coast of Canada in the Fraser River area of the Georgia Straits, estimates have been made during the spring period of primary and secondary production and its relation to food and survival of larval and juvenile fish. Primary production in the very shallow mixed layer associated with Fraser River discharge was over four times that of water outside river influence. Zooplankton production was approximately 10% of primary and was very little affected by grazing during the study period. Feeding experiments and field observations indicated adequate supplies of food suitable for zooplankters and juvenile fish, but there were indications that the micro-zooplankton was in low enough supply to affect survival of larval fish.

On the east coast of Canada, studies of production in St. Margaret's Bay, Nova Scotia have shown a marked seasonal sequence in both the phytoplankton and zooplankton. Annual primary production of phytoplankton was estimated to be of the order of  $150 \text{ gm.C/m}^2$  with short spring and fall peak periods of high productivity. An index, based on the degree of optical attenuation due to photosynthesis, has been developed for comparing primary production of different waters, and will be tested in connection with this programme. The production by sea-weeds is also being measured and appears to equal that of the phytoplankton. Zooplankton sampling has shown wide seasonal fluctuations in the standing crop, expressed as numbers or dry weights per unit volume. However, there was a 5-fold seasonal variation in caloric content per dry weight of zooplankton, and the relations of the variables were such that the weight of zooplankton carbon or numbers of calories per unit volume of water were relatively stable throughout the season. Seasonal changes in macro-zooplankton, ichthyoplankton, benthos and fish are being followed.

Denmark

(Vagn.Kr. Hansen)

1. 'Danmarks Fiskeri- og Havundersøgelser'

Kattegat: Measurements of the primary production and sampling of zooplankton with 8-litre water bottles were continued from the light vessels "Anholt Nord", "Aalborg Bugt", and "Halsskov Rev". The similar observations taken from the Swedish light vessel "Fladen Grund" were discontinued in April.

The gross production measured from the light vessels "Anholt Nord" and "Halsskov Rev" indicated the highest gross production measured so far, viz. resp.  $96 \text{ g C}$  and  $134 \text{ g C}$  produced per  $\text{m}^2$  and year, or resp. 12% and 41% higher than greatest annual production measured since 1954. The spring maxima were large but brief, the unusually large summer maxima lasted from June to October.

The annual gross production at a shallow water area - position "Aalborg Bugt" light vessel - varies only slightly from year to year (72-75g C/m<sup>2</sup>). In 1968 the seasonal variation was characterised by an exceptional high production in October.

North Sea: The October maximum coincided with the occurrence of discoloured water reported from the offshore waters along the west coast of Jutland from Esbjerg to the Skagen region. The first observation came from Thyborøn in late July, but from August to the end of October discoloured water was observed in large long patches scattered along the coast with the main concentrations between Thyborøn and Skagen. There were also heavy concentrations in the western part of the Limfjord. Simultaneously observations of fish mortality - mainly of the gadoids - were reported but only from the North Sea coastal region.

The phytoplankton bloom was caused by a naked flagellate of the genus Gymnodinium, which was tentatively identified to be Gymnodinium breve Davis, a species very variable in size and shape. The identification was confirmed by some foreign taxonomists, but Dr. W.B. Wilson, Texas, and Professor T. Braarud, Norway, are of the opinion that it may be another closely related but not yet described species. Our Gymnodinium species is a few  $\mu$  broader and has a tolerance to temperatures lower than Gymnodinium breve. The bloom continued in concentration of about 7-1 million cells per litre till late October. Then the sea temperature dropped below 9-10°C, the cell concentration decreased rapidly, and by the middle of November the species had disappeared completely. In the bloom the above species contributed 90-99% of all phytoplankters.

Experiments failed to demonstrate any toxic effect of the discoloured water on fish, nor was any toxicity demonstrated in Mytilus edulis collected from the mussel beds in the Wadden Sea.

A 25-litre water bottle has been constructed and zooplankton samples caught with this water bottle and the standard 8-litre water bottle have been compared.

#### Programme for 1969

The bi-monthly plankton observations made from the three Danish light vessels will be continued.

#### 2. 'Grønlands Fiskeriundersøgelser'

##### Report for 1968

West Greenland: From April 10th till July 19th four E.W. sections, Frederikshåb, Fyllas Banke, Lille Hollefiskebanke, Holsteinsborg were operated as far as possible once a month. In total 46 stations were operated with observations on temperature, salinity, and macro-plankton. The plankton was taken by the 2m ring net in oblique hauls.

Similar observations were made monthly from April till October at the permanent station at the entrance of the Godthåb Fjord. In total 68 plankton hauls were taken in West Greenland waters.

#### Programme for 1969

The plankton programme will be of a duration similar to that of 1968. The same observations and methods will be made with the similar frequencies.

#### France

(M.-L. Furnestin)

#### I. Travaux de l'Institut des Pêches Maritimes. Laboratoire de Paris.

Poursuite de l'étude de prélèvements saisonniers de zooplancton (1967-1968) entre la Bretagne et la côte nord de l'Espagne: 1) analyse volumétrique; 2) identification des oeufs et larves de Clupes (sardine, anchois, sprat), répartition géographique; 3) inventaire et répartition des oeufs et larves des autres espèces (1967); 4) études des communautés planctoniques indicatrices dans la zone du plateau continental du Golfe de Gascogne (Chaetognathes, Méduses, Siphonophores, Salpes et Doliolles); 5) relations entre l'abondance et la répartition de certains zooplanctontes et les concentrations de germon, dans le cadre de campagnes de prospection du thon (août 1967).

Les résultats ont fait l'objet de deux publications dans la Revue des Travaux (1968, fasc.4 et 1969, fasc.3) et de trois communications au CIEM, Oct. 1968.

#### Programme pour 1969

- Synthèse des analyses volumétriques de plancton total prélevé dans le Golfe de Gascogne entre les années 1964 et 1967.

- Poursuite de l'examen de l'ichthyoplancton, sur les récoltes de 1968 (identification, étude quantitative par espèce et relations avec les conditions hydrologiques).

- Estimation de l'abondance des larves de harengs prélevées au Gulf III et au Hensen vertical dans le sud de la Mer du Nord et en Manche orientale (campagne automne 1968).

- Relations entre la distribution du zooplancton et les concentrations de germon dans le Golfe de Gascogne (campagne 1968).

#### II. Travaux des laboratoires conchylicoles de l'I.S.T.P.M.

Poursuite des observations régulières: 1) sur les larves de mollusques comestibles et leur évolution dans les centres de captage, 2) sur les variations qualitatives et quantitatives du micro-plancton dans les zones d'élevage d'huîtres, 3) sur le verdissement des huîtres en claires; le rôle favorable des phosphates inorganiques dissous et l'influence des divers facteurs physico-chimiques dans le déterminisme du phénomène ont été particulièrement étudiés; les résultats ont été publiés dans Rev.Trav.Inst. Pêches marit., 33(4), 1968: "Les facteurs de verdissement de l'huître en claires: le milieu biologique et benthique et ses variations". (J. Moreau).

#### Programme pour 1969

Le même programme comme pour 1968.

#### III. Travaux du Laboratoire de Biologie animale (Plancton)

##### Faculté des Sciences, Marseille.

Dans l'optique de recherches conjointes Hydrologie-Plancton, étude du zooplancton d'une zone de remontée sur la bordure cantabrique d'après des échantillons recueillis par l'Institut des Pêches en 1967. Compte-rendu à Copenhague: "Plancton de l'upwelling ibérique. 1. Chaetognathes" par M.-L. Furnestin et Ch. Allain.

Suite des recherches écologiques et biogéographiques sur le plancton profond du Golfe de Gascogne (en coopération avec I.S.T.P.M.): notamment, recherche des formes entraînées par le courant "lusitanien".

Observations morphologiques sur les Chaetognathes: "Variations géographiques chez le Chaetognathe Sagitta maxima Conant, 1896" par F. Ducret et J.P. Casanova.

#### Programme pour 1969

Etude du plancton de pêches verticales opérées en 1968 dans la zone d'upwelling de la bordure cantabrique (Chaetognathes, Ptéropodes, Euphausiacés et autres groupes).

#### Iceland

(I. Hallgrínsson)

#### Zooplankton

A zooplankton survey was carried out in the waters off NW Iceland during 19th to 26th April. Only Hensen net hauls were taken, sampling from 50 to 0 metres.

From May 6th to November 11th zooplankton was collected in north Icelandic waters and the Norwegian Sea in connection with herring detection. This material was collected by Hensen net from 50 to 0 metres and Icelandic High Speed Samplers from two different depths.

Most of the zooplankton material was worked up at sea by a short-cut method.

As previously, a Continuous Plankton Recorder survey was continued on the Reykjavik-New York route and on the Reykjavik-Leith route in co-operation with the Oceanographic Laboratory, Edinburgh.

### Phytoplankton

Measurements of primary production in Icelandic waters were carried out by means of the  $^{14}\text{C}$  technique on samples from standard depths, 0, 10, 20 and 30 metres. As previously, samples for quantitative analysis of phytoplankton were collected wherever productivity was measured.

During the period 19th to 26th April the measurements were carried out at 9 stations off NW Iceland.

Measurements of productivity were carried out at 35 stations in the waters off the N and NE coast of Iceland during the period 28th June to 3rd July.

### Ireland

(F.A. Gibson)

No contribution for 1968.

### Netherlands

(P. Korringa)

In reports to the Demersal Fish (Northern) Committee and to the Pelagic Fish (Northern) Committee plankton work carried out by the Netherlands on the distribution and quantity of eggs and larvae of fish has been recorded.

Periodical observations in the coastal water of IJmuiden to detect plankton blooms which could lead to adverse conditions for fish and shellfish were continued in 1968.

### Norway

University of Oslo (T. Braarud)

#### I. Phytoplankton surveys

a) Trondheimsfjord. The report of the all-year quantitative survey, 1963-1965, has been prepared for publication. (E. Sakshaug).

b) The survey of phytoplankton populations at great depths based upon samples collected at weather ships A and M has been concluded and also the study of the spring development at 'M'. (P. Brettum).

c) The study of the phytoplankton of Nordfjord and an investigation of seasonal changes in the morphology of Skeletonema costatum in various localities of the Norwegian coast has been concluded.

d) The study of the vertical phytoplankton distribution in coastal waters with a pronounced halocline (Nordåsvatn and inner Hardangerfjord) was continued. (U. Lillemoen).

e) The quantitative survey of the phytoplankton in a section across Skagerrak was continued. (C. Almnes).

f) A study of the occurrence of Goniaulax temarensis and other dinoflagellates in polluted and non-polluted parts of the Trondheimsfjord was initiated. (E. Sakshaug).

g) An investigation of the spring phytoplankton in the spawning areas for cod and herring (Møre-Lofoten) was started in collaboration with the Marine Research Institute, Fisheries Directorate, as part of the Norwegian IBP programme. (I. Nygaard).

#### II. Special phytoplankton studies

a) Taxonomic studies with the use of electron microscopy (also scanning electron microscopy) were continued, on coccolithophorids (K. Ringdal Gaarder) and diatoms (G. Rytter Hasle and B. Riddervold Heimdal).

b) A report has been prepared on the survey of nanophytoflagellates in Norwegian coastal waters. (J. Thronsen).

c) A study of the life cycle of Coccolithus huxleyi has been initiated. (D. Klaveness).

d) Work on coccolith formation in Coccolithus huxleyi and other species was continued. An investigation of photometabolism of organic compounds by plankton algae was initiated. The collection of bacteria free cultures at the Institute of Marine Biology was expanded. (E. Paasche).

### III. Zooplankton

a) A paper on the planktonic larvae of bottom invertebrates in the polluted waters of the Inner Oslofjord was completed. Further work on the subject is in progress. (T. Schram).

b) A Master's thesis on the zooplankton (and benthos) throughout the year in a heavily polluted basin in the Oslofjord was completed. (B. Braaten).

c) The life cycles of the local stocks of Aglantha digitale and Sagitta elegans in the Inner Oslofjord are being studied. (O. Smestad, T. Jakobsen).

### Institute of Marine Research, Bergen

#### Phytoplankton (G. Berge)

1. The situation in the plankton development was analysed at the spawning fields of the Atlanto-Scandian herring and the Arctic cod between Stadt and Vesterålen.

The study is part of a 5 years IBP-programme on the recruitment mechanism of these fish, and covers taxonomic analysis, measurements of the primary production, chlorophyll determinations and particle size frequency measurements.

2. An adaptation of the celloscope with a multichannel-analyser to size frequency analysis of particles in sea-water within the ranges of 5-3000  $\mu$  was continued.

#### Zooplankton (K.F. Wiborg)

1. Sampling was continued at the permanent oceanographical stations along the coast of Norway and at Station 'M' in the Norwegian Sea. In May, and in July-October, the quantity of zooplankton per square unit of sea surface was about twice as large in the Lofoten area as during the same periods in 1967.

2. The possibility of a commercial fishery for zooplankton was studied during a survey in the fjords near Bergen in May-June. Clarke-Bumpus plankton samplers were towed both day and night in the upper 30 m layer, and up to eight ml of wet plankton per  $m^3$  were found. A fine-meshed trawl, opening area 20  $m^2$ , towed at a speed of two n.miles/hour, may theoretically catch 600 kg of plankton per hour.

Echo-sounders were run continuously during the survey. On some occasions the records were tentatively related to phytoplankton, copepods, euphausiids and medusae.

In February, April-June and November, surveys were made with a three foot Isaacs-Kidd pelagic trawl towed at various levels in the fjords near Bergen for studying the biology of krill. Myctophid fish, caught during the cruises, are also being studied.

3. (H. Bjørke). The availability of zooplankton and the feeding habits of larvae at the spawning fields of the Atlanto-Scandian herring and the Arctic cod during the first 7 weeks of larvae development (IBP-programme) were analysed.

The Royal Norwegian Society of Science and Letters, Trondheim (T. Strømngren)

Zooplankton sampling with Juday net, bottom - 0 m and 100 - 0 m were undertaken monthly at the following localities in the Trondheimsfjord:-

1. One station in the inner and one in the outer part of the fjord.
2. Two localities in the central part, subjected to pollution by sewage.
3. Four localities in a land-locked branch, the Borgenfjord.

Determinations were made of volume, biomass, general composition, annual variations (number, stage distribution, vertical and horizontal distribution) for all copepod species and main groups of non-copepods.

Poland

(W. Mańkowski)

1. The Baltic Sea

The plankton investigations continued the research from 1967, into the southern Baltic, from Arkona Deep to Gdańsk Deep, up to 56°N.

The observations were carried out in connection with the International Biological Programme. Accordingly much consideration was given to <sup>14</sup>C determinations in primary production and 246 such measurements were made. Determinations were also made of chlorophyll (104), pH (87), alkalinity (102), and light (463).

Zooplankton was sampled by zooplankton nets at 253 stations: Hensen net 482 samples, Copenhagen net 222 samples, Nansen net 86 samples. Hensen and Copenhagen nets were used vertically from the bottom to the surface and horizontal catches were taken in particular layers by Copenhagen and Nansen nets.

Plankton samples are already partly analysed, for ichthyoplankton, its quantitative occurrence and distribution, the volume of whole plankton samples, macroplankton and dry mass of microplankton.

For qualitative investigations on phytoplankton the samples were taken by the Copenhagen net. For qualitative determinations using the Utermöhl microscope 477 water samples were taken with a Nansen bottle.

2. Szczecin Firth

The observations on production and development of plankton, depending on the changing environmental factors were continued. In the period from February until December 1968 48 plankton samples were taken from 3 permanent stations. The samples were taken with a plankton net of the Apstein type and with a water sampler of the Patalas type at intervals of two weeks. The collected material has been analysed in respect of seasonal changes in the amount of biomass.

The observations on the rate of primary production, carried out in the years 1964-1968 using the oxygen technique, have been completed.

3. The North Sea

Two cruises were made (May-June and September-October). For zooplankton investigations the samples were taken from 116 stations:-

192 samples with Hensen net

106 samples with Apstein net

47 samples with ring-trawl of the diameter 210 cm.

On the basis of the samples taken with the Hensen net the volume of zooplankton was determined for the whole water mass, from bottom to the surface, with the calculation of the volume of plankton per 1 square metre of surface and per cubic metre of water.

The materials obtained from the ring-trawl were used for determination of the number and distribution of fish larvae with particular consideration of herring larvae.

#### 4. North-west Atlantic

During two cruises, one in the period February-April and another in September-October, 665 samples from 171 stations were taken for zooplankton investigations using a net of the Apstein type.

#### 5. The waters of the shelf of north-west Africa

No new materials were collected in 1968. On the basis of materials collected in June and July 1967 there was established for this period the distribution of eggs and larvae of fish in the region of the shelf, extending between 22°N and 8°N. These investigations will be continued in 1969.

#### Portugal

(Estila Sousa e Silva)

##### Phytoplankton

1. An all-year survey of primary productivity (since May 1967) by means of spectrophotometric quantitative determination of the three chlorophylls, non astacin carotenoids and astacin carotenoids, in sea-water samples from Tagus and Sado estuaries (west coast) and from Ria de Faro (south coast). (E.S. Silva, M.E. Assis, M.A.M. Sampaio).

2. Study of living phytoplankton from these samples. (E.S. Silva).

3. Taxonomical study of diatoms from Sado estuary. (M.A.M. Sampaio).

4. Culture of some marine dinoflagellates to study their life cycle. (E.S. Silva).

##### Zooplankton

1. Preparation for publication of the taxonomic study of Copepods, caught during the "Faial" cruise in 1958-59. (M.H. Vilela).

2. Observations made on the life cycle of Tisbe sp. (Copepoda Harpacticoida), under laboratory conditions, have been arranged for publication. (M.H. Vilela).

##### Publications in 1968

"Plancton da lagoa de Obidos (III). Abundância, variações sazonais e grandes "blooms"", by E.S. Silva - Notas e Estudos do Inst. Biol. Mar., no. 34.

"Copepodes da campanha do N.R.P. "Faial", 1958-59", by M.H. Vilela - Idem. no. 35.

##### Programme for 1969

##### Phytoplankton

a) The work mentioned above (3), (4) will be continued.

b) Taxonomical studies of diatoms and dinoflagellates from the Tagus estuary and from Ria de Faro (E.S. Silva).

c) Chromatographic and spectrophotometric studies of the pigments in three species of marine dinoflagellates (M.E. Assis).

##### Zooplankton

a) Samples will be collected for qualitative and quantitative studies, throughout the year in the estuary and mouth of the Sado river.

b) Qualitative studies on living and fixed zooplankton from these samples. (M.H. Vilela).

c) Studies on pelagic larvae of different bivalves living in Ria de Faro. (M.H. Vilela).

Sweden  
(A. Lindquist)

Investigations on the distribution of fish eggs and larvae have been continued and samples have been taken on the west coast in March. The number of eggs and larvae was much less than during March 1967, when water temperatures were considerably higher. Collecting plankton samples continued in the Baltic where special attention was paid to the decreasing oxygen values in the deeper water.

From the light-vessel Finngrundet in the Gulf of Bothnia twice a month measurements of primary production with the  $^{14}\text{C}$  method have been made.

United Kingdom

1. England and Wales

(D.H. Cushing)

Plankton were collected on these cruises:-

Cruise	Date	Area	Number of samples
"Corella" 1/68	2/1 - 14/1	North Sea	44
" " 2/68	22/1 - 3/2	North Sea	67
" " 3/68	9/2 - 21/2	North Sea	96
" " 4/68	27/2 - 11/3	North Sea	125
" " 5/68	18/3 - 30/3	North Sea	55
" " 6/68	5/4 - 17/4	North Sea	120
" " 7/68	23/4 - 5/5	North Sea	113
"Clione" 7/68	16/5 - 27/5	North Sea	93
"Corella" 9/68	31/5 - 12/6	North Sea	110
"E. Holt" 1/68	12/1 - 1/2	S.W. Approaches } Irish Sea }	70
"E. Holt" 3/68	12/3 - 9/4	Irish Sea	67

2. Scotland

Aberdeen (J.H. Fraser)

Surveys in the Rockall Bank area to assess the stocks of Micromesistius (Gadus) poutassou were continued in 1968 and, associated with these, plankton samples were taken to investigate the environmental conditions. These surveys were made in March, April, May, June and October.

Sampling in the northern North Sea, using the Gulf III sampler in particular, was undertaken in February/March, April/May, July and November.

Plankton work from the Aberdeen laboratory has been on the following lines in 1968:-

- a) Plankton and its relation to the general environment and the fisheries (zooplankton J.H. Fraser, phytoplankton D.D. Seaton).
- b) Routine collections of zooplankton standing crop data from the northern North Sea and west coast waters, biomass and dry weight (J.A. Adams), chlorophyll a (J.A. Adams and I.E. Baird).
- c) Herring-plankton relationships in the northern North Sea (J.A. Adams).
- d) Plankton of the Rockall Bank area (J.H. Fraser, D.D. Seaton) and larval fish (R.S. Bailey).
- e) Study of problems associated with handling and behaviour of plankton nets, particularly high-speed samples (J.A. Adams).



- f) Food of predatory species, especially medusae (J.H. Fraser).
- g) Studies of plankton populations of inshore lochs (N.T. Nicoll).
- h) Sampling of autumn spawned herring larvae in the area 57°N, 59°30'N to 0° and 4°W in September (A. Saville).
- i) Plankton associated with pollution in general (J.A. Adams and D.D. Seaton, and with pulp mills (J.H. Fraser).
- j) Plankton investigations associated with the bloom of Gonyaulax tamarensis of the east coast of Britain (J.A. Adams and D.D. Seaton).
- k) A study of the phytoplankton of a mussel cultivation area (Linnhe Mhuirich) with a view to the prediction of toxic blooms (D.D. Seaton).

#### Programme for 1969

Work will continue on similar lines to 1968.

#### Edinburgh (R.S. Glover)

The Plankton Recorder survey of the Edinburgh Oceanographic Laboratory was continued in 1968 on the same basis as in recent years. The standard routes of the survey are shown in the Administrative Report of the Hydrography Committee. During the year Recorders were used by ships of eight nations to provide a total of 108,410 miles in the North Atlantic Ocean (north of 45°N) and the North Sea. This work was supported by the Natural Environment Research Council, and, through Contract No. F61052 67 C 0091, between the Scottish Marine Biological Association and the United States Department of the Navy, Office of Naval Research.

The Edinburgh Laboratory also continued the study of plankton in relation to the herring fisheries off the north east coasts of Scotland. Samples were taken nightly throughout the fishing season from April to September.

#### U.S.S.R.

(S.G. Fedorov)

In 1968, as in previous years, zooplankton was sampled mainly:  
a) in feeding areas of adult herring and b) in areas of drift of larvae of Barents Sea fish. In addition, some material was obtained from the north-western area of the Atlantic. Samples of phytoplankton were taken in the Norwegian Sea. Samples of macroplankton were collected in autumn and winter in the Barents Sea to determine the abundance and distribution of Euphausiacea.

Data collected are given in the following table:

<u>Areas of sampling</u>	<u>Number of samples</u>
1. The Norwegian Sea; the feeding area of herring (zooplankton)	1749
2. The north-eastern Barents Sea; in the drift of fish larvae (zooplankton)	1283
3. The north-western area of Atlantic (zooplankton)	587
4. The Norwegian Sea (phytoplankton)	317
5. The Barents Sea (macroplankton)	111
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Total	4047
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In 1968 in the Gulf of Riga and Finland the distribution of zooplankton was studied during different seasons of the year. The data collected give an opportunity to determine the available food supply for fish there. All in all there were collected 415 samples of zooplankton in different regions of the Baltic Sea.

Material was collected to study the relationship between zooplankton and the hydrometeorologic regime and the distribution of plankton-eaters. Also collected were materials for the continuation of work on the application of mathematical methods for investigation of zooplankton.

Investigations on plankton in 1969 will be carried out under the same programme as in 1968. Samples of zooplankton will be taken in feeding areas of herring and areas of drift of larvae of the Barents Sea fish. Investigations on phytoplankton in the Norwegian Sea and macroplankton of the Barents Sea will be continued.

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Germany

(J. Krey)

"Institut für Meeresforschung", Bremerhaven

Plankton sampling has been carried out in the Weser estuary paying special attention to increasing pollution. The taxonomic and ecological studies of the zooplankton of an Indian estuary were continued.

As constituents of the plankton the lower fungi were quantitatively indicated in water samples from the North-Atlantic as well as from the German Bay and the Weser estuary.

Work on the diatom material of the "Meteor" Expedition is in progress.

"Institut für Küsten- und Binnenfischerei"

Plankton sampling for the study of the distribution of Crangon larvae in relation to hydrographic and other factors along the German North Sea coast was continued.

Routine investigations on the plankton composition in the Elbe estuary were also continued.

In repetition of a previous investigation the plankton distribution in the Ems estuary was studied in November.

"Institut für Meereskunde", Universität Kiel

1. The long-term observations on the productivity in the western Baltic have been continued. (Krey).

2. A survey of the primary production of the Baltic was carried out on several cruises. (Sarma).

3. Methodological investigations on biochemical parameter of the plankton (e.g. nucleic acids) were finished.

4. Problems on the short-term variability of some parameters of the productivity were followed (Boje, Lenz).

5. The influence of breaking waves on the phytoplankton was investigated. (Schöne).

6. The food intake of some species of Euphausiaceae was followed. (Weigmann).

Spain

(M. Duran)

"Laboratorio Oceanográfico de Santander"

Routine net-phytoplankton sampling in Santander Bay and adjacent waters has been carried out during 1968.

"Laboratorio Oceanográfico de Vigo"

As a part of the hydrographical and biological survey of the Ria de Arosa, a series of net-phytoplankton samples has been taken in order to list the dinoflagellate and diatom flora of that locality.

"Laboratorio de Investigações Pesqueiras de Vigo"

As a continuation of phytoplankton production studies performed during the preceding years, measurements of the phytoplankton photosynthetic rate have been extended to the bottom waters of the Ria de Vigo. Measurements of suspended particulate organic matter have been conducted in order to find the correlation between plankton production and the amounts of this kind of organic matter.

"Laboratorio Oceanográfico de Santa Cruz de Tenerife"

Mr. and Mrs. J. Corral have studied a series of phyto- and zooplankton samples gathered by the hydrographical ship "Tofino" during her cruises in September-October 1966 and March-April 1967 in the waters between the Canary Islands and the coasts of Rio de Oro. The results of this study, which refer mainly to diatoms, dinoflagellates and copepoda, are to be published shortly.

From September 1968 zooplankton sampling in waters off Santa Cruz de Tenerife has been undertaken at regular intervals in order to study the phenology of several zooplankton groups, mainly copepods.

"Laboratorio de Investigações Pesqueiras de Cádiz"

Phytoplankton production measurements have been performed during 1968 in the Bay of Cadiz at intervals.

"Laboratorio Oceanográfico de Baleares"

From May 1968 onwards, Mr. M. Duran has undertaken the study of phytoplankton production in Palma de Mallorca Bay, by means of the  $^{14}\text{C}$  method for primary production and by spectrophotometric measurement of the phytoplankton pigments.

In the neighbourhood of the southern coast of Mallorca monthly surface zooplankton sampling has been undertaken to detect any arrival of zooplankton species of Atlantic origin, which could have been carried by a branch of the Atlantic Current that eventually reaches the Balearic Islands.

"Laboratorio de Investigações Pesqueiras de Barcelona"

Dr. R. Margalef and co-workers have pursued their taxonomical and ecological studies on phytoplankton samples from the Mediterranean and Caribbean Seas, paying special attention to the application of mathematical methods and with the aid of computers, to study the affinities between phytoplankton samples and to ascertain the ecological parameters of the different species.

In order to study the micro-distribution of phytoplankton populations and to find the most suitable methods for its continuous study, an intensive survey has been performed within a small area, two nautical square miles and 50 m mean depth, off the coast of Castellón. This study has furnished very interesting information concerning the heterogeneity of the distribution of phytoplankton species within such a small area.

Laboratory algal cultures have been improved by means of the use of antibiotics and vitamins. A study has been performed on the biology of axenic cultures of Chlamydomonas, concerning qualitative and quantitative pigment analysis, measurement of nitrogen assimilation rate, and nitrate and nitrite assimilation rate in darkness.

Mr. A. Ballester has prosecuted his work on the chromatographic separation and study of chlorophylls from marine algae.

Mr. F. Vives and co-workers have pursued the study of zooplankton samples from the coastal waters of Castellón, and have initiated a programme for the survey of planktonic larvae of marketable molluscs, crustaceans and fish along the coast of Catalonia.

Mr. Vives has also studied a collection of zooplankton samples gathered during the R.V. "Meteor" Seamount Cruises 1967, and has also begun the study of several zooplankton groups from the Tyrrhenian Sea.