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Administrative Report

BIOLOGICAL OCEANOGRAPHY COMMITTEE

1977

by G. Hempel

Belgium

(R de Clerck)

Laboratory for Ecology and Systematics - University of Brussels and
Fisheries Research Station - Ostend

Studies were carried out in Atlantic waters (Fladenground and Channel) and North Sea waters, to find out the possible different pathways of energy in the food-cycles in both waters.

Phytoplankton measurements of the primary production with the 14_C method continued.

One laboratory started experiments to study the excretion of phytoplankton.

Bacterioplankton. The activities of bacteria were measured by the method of oxygen consumption. New methods are used to measure the activities by the incorporation rates of different organic molecules (isotopes).

The data obtained show that for the primary production results are too small or the consumption too high.

Zooplankton. The population dynamics of Zooplankton (mainly Copepods) were studied to make modelling possible.

Grazing on living phytoplankton was studied, using the radio-activity of the zooplankton. The nycthemeral rhythm was found through *in situ* experiments of adult Copepods.

Total grazing on particles together with selection of food was carried out by the coulter-counter method.

The study of the distribution in space and the density of sole eggs and larvae was continued during 1977.

The sampling took place from March till May along the Belgian coast by means of the Dutch type Gulf sampler.

Canada

(T Platt)

At the St. Andrews laboratory a sampling programme has been started in the Bay of Fundy to determine the seasonal cycle of occurrence of Gonyaulax toxins and their fate in the food chain. Mouse bioassay is used. In the smallest size fraction (20 µm net), toxin levels began to increase in mid-August and reached a peak (700 µg/g plankton) in mid-September. In the 570 µm net fraction the peak (8 µg/g) was reached at the end of September. Preliminary laboratory results suggest that toxins released into the medium from cultures of G. excavata may be lethal to killifish under certain conditions.

A 10-year study of the distribution and abundance of ichthyoplankton in the Gulf of St. Lawrence has been extended to cover the Nova Scotia Banks. The Gulf work has been summarised in five Canadian Fisheries and Marine Service Technical Reports (Nos. 285, 490, 521, 645, and 747) detailing species distribution of fish eggs and larvae, size distribution, related hydrographic data and abundance of various species for the total period.

In 1977, the St. John's, Newfoundland laboratory conducted a preliminary plankton and hydrographic survey of Flemish Cap (46°00'N-48°20'N; 43°30'-46°30'W) in conjunction with the ICNAF International Flemish Cap Experiment. Some 44 stations were occupied and examined to depths of 200 m using paired Bongo nets (333 µm mesh size) in double oblique tows. Identification and enumeration of samples is in progress.

At McGill University, a study has been completed of sea ice diatoms from the Gulf of St. Lawrence, western Hudson Bay, West Barrow Strait and Robeson Channel. Centric diatoms comprise 43% of the material from the Gulf of St. Lawrence, but only 4% from higher latitudes (% composition by numbers). Benthic pennate diatoms are common at the northern station but occur only infrequently in ice samples from the Gulf. Most of the algae growth occurs in the lower few cms of the ice; chlorophyll concentration there reached 13 mg/m^3 in the Gulf samples and 200 mg/m^3 in the northern stations.

Denmark

(E Ursin)

Plankton Studies off Greenland (E. Smidt)

Routine sampling with stramin net (2 m ring diameter 1/2 hour oblique hauls from about 50 m depth) was made in July at 4 east-west Standard Oceanographic Sections, off Holsteinsborg, Sukkertoppen, Godthåb, and Frederikshåb, and at the Standard Station at the entrance to Godthåb Fjord in March, April, and June. Further stramin net hauls were made in May in Disko Bay for shrimp larvae.

Finland

(J Lassig)

Institute of Marine Research, Helsinki

Benthos samples were taken at 8 standard stations in the Gulf of Bothnia in March, May, July, September and November. In the Gulf of Finland and the northern part of the Baltic proper about 42 stations were sampled in May - November in order to follow the occurrence of benthic macrofauna in areas with periodically unfavourable oxygen conditions. In co-operation with Tvärminne Zoological station studies on benthic macrofauna were continued in May and September in the archipelago of Tvärminne.

Chlorophyll-a was sampled in August in the open sea in the Gulf of Finland. Phytoplankton primary production (^{14}C *in situ*), hydrography, hydrochemistry and chlorophyll-a were sampled every third week (once during the ice-period) at two coastal stations in the Gulf of Finland and in the Gothland Sea in September during the BOSEX programme.

Zooplankton sampling (Hensen net, mesh size 150 µ m, vertical haul 25-0 m) has been continued at two coastal stations in the Gulf of Finland, one station in the Archipelago Sea and one in the Bothnian Bay. Samples were taken three times a month, once during the ice period.

Institute of Radiation Protection, Helsinki

Benthos studies were carried out in the vicinity of two nuclear power plants, one in the Gulf of Finland, and one in the Bothnian Bay. Samples have been taken three times at 9 stations in the Gulf of Finland and once at 7 stations in the Bothnian Bay.

Phytoplankton and primary production studies (^{14}C *in situ*) were performed once or twice a month during the ice-free period around the two nuclear power plants mentioned.

National Board of Waters, Waters Research Office, Helsinki

The influence of industrial pollution on the composition of benthic macrofauna were studied off Pori, Rauma and Naantali in the Bothnian Sea and off Kokkola in the Bothnian Bay.

Phytoplankton primary production and physico-chemical parameters were measured in winter (February - March) and in August, at about 25 coastal stations in the Gulf of Finland and the Gulf of Bothnia. Special investigations were performed off several residential areas.

Water Conservation Laboratory of Helsinki City

Macrobenthos studies were continued monthly during the ice-free period at one station off Helsinki, and three times at 9 stations off Espoo.

Phytoplankton, primary production (^{14}C *in situ* and *in vitro*) and bacteria were studied twice a month during the ice-free period in the eutrophied waters off Helsinki and Espoo at several stations from the severely polluted bays to the unpolluted area outside the archipelago.

Tvärminne Zoological station of the University of Helsinki

Macrofauna studies were continued at 14 stations in the harbour of an iron mill in the vicinity of the research station. Macrofauna was also sampled once in the summer from 45 stations and monthly from 2 stations in the Pojoviken and the vicinity of the research station. Meiofauna studies were continued on a soft bottom.

Åbo Akademi, Turku

Macrobenthos samples were taken at 20 fixed stations in the archipelago of Åland. Effects of artificial wave exposure of ferry traffic on zoobenthos and phytobenthos were continued.

Primary production and phytoplankton were studied in semienclosed meromictic bays in the Åland archipelago.

University of Turku

Dynamics of *Mesidotea entomon* (Isopoda) and the biology of *Polydora redeki* (Polychaeta) were studied in the Archipelago Sea.

Zooplankton was sampled in the Archipelago Sea for analyses of the PCB-group components.

University of Oulu

Studies on benthic macrofauna were continued in the Bay of Liminka.

Zooplankton investigations were performed in the sea area of the northern Bothnian Bay twice a month during May - November.

France

(S Arbault)

Travaux de l'Institut des Pêches Maritimes

Les actions sont menées, d'une part, en haute mer en vue de prévoir des évaluations de stock, d'autre part, près du littoral où l'implantation éventuelle de centrales thermo-nucléaires à circuit de refroidissement ouvert risque de modifier l'écosystème.

1. Planctonologie de haute mer

Tri des oeufs de maquereau dans le golfe de Gascogne du mois de mai 1977, en collaboration avec le laboratoire de Lowestoft, afin d'évaluer le stock total d'oeufs émis pendant la période reproductive. L'étude portait sur 38 échantillons prélevés au T.T.N. Cette étude a été demandée par le groupe de travail CIEM.

Synthèse sur les nombres d'oeufs et larves de sardine, sprat, anchois, dans le golfe de Gascogne de 1969 à 1973. Cette étude entre dans le cadre des recommandations du groupe de travail du CIEM. Elle porte sur 1 500 données rassemblées au cours de 20 campagnes.

Etude des nurseries de merlu sur le plateau continental du golfe de Gascogne en mai 1977. L'étude planctonique (180 pêches) proprement dite est un inventaire des Euphausiacés et Mysidacés constituant la principale nourriture des merlus dans la zone prospectée. Ces pêches ont été effectuées au moyen du filet Hensen.

2. Planctonologie côtière

Ces travaux contribuent à l'établissement d'un état de référence écologique (avant mise en service de centrales thermiques).

Etude écologique du littoral de la Manche orientale - campagne "Thalassa" et "Roselys" (6 mars - 5 avril 1976).

Ce travail permet d'apporter des données bio-écologiques complémentaires à l'étude d'un littoral où les projets d'installation de centrales nucléaires risquent d'entraîner des modifications de faune. Il comportait 150 échantillons effectués au filet Bongo.

Etude du secteur de Penly (mars à juin 1977).

Ce travail vient en complèment de celui effectué en hiver 1975 - 1976 sur ce littoral, en vue du projet d'implantation d'une centrale nucléaire à Penly (côtes de la Manche).

Etude des sites de Gravelines (à proximité de Dunkerque), Paluel (au nord de Fécamp), Penly (au nord de Dieppe), Flamanville (Manche, au sud du cap de la Hague).

L'échantillonnage mensuel s'effectue au filet Bongo (315 µ et 500 µ), il concerne les indicateurs, les prédateurs, le zooplancton à potentialités halieutiques (ichthyoplancton et larves de décapodes commerciaux).

Travaux du Laboratoire de Biologie Animale (Plancton) Marseille

Copépodes de la côte atlantique du Maroc (suite). Facteurs nutritionnels intervenant avec les phénomènes hydrologiques dans la succession des populations au cours du cycle saisonnier (M.L. FURNESTIN et M. BELFQUIH).

Etude infra-spécifique des Hoplophoridés (Décapodes pélagiques) des croisières du "Dana" (1922-1930) dans l'Atlantique (J.P. CASANOVA).

Composition chimique (C, N, P et Métaux lourds) et faunistique du zooplancton des eaux du Sénégal (Campagne CINECA, août 1973, "Thalassa"). Relations avec l'hydrologie (courant des Canaries, dôme de Guinée). (B. et J. P. Casanova, F. Ducret, J. Rampal).

Ecophysiologie de la nutrition chez les Copépodes en milieu expérimental. Differenciation histologique (ultrastructure) et histochimique des diverses catégories cellulaires du tube digestif (suite). (J. Arnaud, M. Brunet et J. Mazza).

Travaux du Centre National pour l'Exloitation des Océans - Centre Océanologique de Bretagne

1. Ecophysiologie pélagique (appliquée aux organismes planctoniques).

Estimation de la physiologie du plancton in situ. Les études au laboratoire permettent d'envisager l'observation fine des adaptations du régime alimentaire des organismes du zooplancton. Sur le terrain, la campagne PEGASE (juillet-août 1977) portait sur la caractérisation des peuplements pélagiques et leurs activités physiologiques au sein du tourbillon océanique du proche atlantique.

2. Ecologie descriptive (étude des communautés abussales).

Synthèse des résultats sur les plaines abyssales atlantiques permettant de faire le point sur l'état des connaissances actuelles dans le domaine profond.

Etude systématique des contenus du système digestif des invertébrés benthiques; elle a pour but une meilleure définition de la structure trophique des communautés abyssales.

Observations sur le comportement alimentaire de la macrofaune vagile (poissons et décapodes).

3. Etude quantitative

Dynamique des populations littorales en vue d'une étude de production (croissance du pétoncle noir en Rade de Brest, praire en Rade de Brest et golfe normano-breton), mise au point d'une méthode d'évalution de la croissance à la mue chez la langoustine permettant de caractériser différents stocks (irlandais, écossais, golfe de Gascogne).

Gestion de l'environnement. Exploitation mathématique des données écologiques relatives aux projets du site d'installation de centrales nucléaires.

Ces préoccupations ont pour but de définir l'état écologique du milieu qui subira l'influence de la centrale. A moyen terme, la comparaison des états successifs du milieu avant et après la mise en service de la centrale, doit permettre de dégager les principes évolutifs d'un écosystème côtier soumis aux influences des rejets thermiques.

4. Physiologie de la reproduction chez les crevettes Péneides

Ce programme permet de déterminer les conditions de température et de photo-période favorables à la maturation et à la ponte de la crevette japonaise (P. japonicus). Les résultats permettent d'escompter que ces observations sur P. japonicus sont susceptibles de généralisations.

Travaux de la Station Biologique (Benthos) Roscoff

Campagne de 415 prélèvements benthiques du 16 juin au 4 juillet 1977, en coopération franco-irlandaise dans le secteur sud-Irlande.

La connaissance approfondie du benthos de cette région revêt une grande importance dans la compréhension de la biogéographie du plateau continental nord-ouest de l'Europe.

Etude de la baie de Seine en collaboration avec le CNEXO, l'ISTPM et la CEA. Ces études permettent de connaître les effets sur le benthos du creusement d'une souille expérimentale par dragage industriel.

Etude de la dynamique des Amphipodes des sables fins à Abra alba de la baie de Morlaix, de leur biomasse et de leur production. Ce travail servira de base de comparaison avec les phénomènes qui se déroulent dans les peuplements homologues de la baie de Seine.

Federal Republic of Germany

(G Hempel)

Biologische Anstalt Helgoland (M Gillbricht)

Routine investigations in measuring hydrographical, chemical and biological parameters at Helgoland Roads were continued. Five times a week temperature, salinity, nutrients (PO_4, NO_3, NO_2, NH_4, SiO_2) chlorophyll, and phytoplankton (inverted microscope) were measured. Further weekly determinations were made of the bacterial numbers (pour plate method) in the surface film and at a depth of 1 m, the BOD and the surface tension. The studies on distribution and ecology of Noctiluca miliaris were continued.

Four cruises in the German Bight were undertaken covering a station net of 10 nautical miles distance to investigate plankton distribution and production in relation to the hydrography. In March, July/August, September and November hydrographical parameters, micronutrients, phyto- and zooplankton stocks, phytoplankton production, seston composition and particle size distribution were measured.

After the blowout of platform "Bravo" (EKOFISK) intensive microbiological and chemical investigations were conducted in the central part of the Nort Sea during May.

In the Wadden Sea of Sylt (German Bight) observations of hydrography (t, S) and inorganic micronutrients as well as seston components were continued. Further measurements were done of the respiration rate of the dominating zooplankton species and of the phytoplankton primary production.

Institut für Meereskunde, Kiel

The institute's activities in plankton research and microbiology can be divided in main geographical areas:-

Kiel Bight The interaction of bacteria and phytoplankton was studied during the spring bloom. The role of microorganisms in the decomposition of seston was measured in water samples kept for 14 days in the laboratory. The uptake of organic substrate by heterotrophic bacteria was studied by various new methods in coastal waters and sediments and in a river mouth. For the second time a full annual cycle of sedimentation rates was obtained. Biosedimentation is highest in spring and autumn although phytoplankton production is highest in summer. The abundance of Aurelia aurita reaches very high values in summer, which surpass in terms of organic dry matter all other plankton. Studies in the vicinity of a power plant revealed better living conditions for fish and benthos due to better supply of food and oxygen. The occurrence of fish eggs and larvae in the course of the year was monitored along much of the Baltic coast of Schleswig-Holstein.

During the past few years extensive field and experimental benthic studies were conducted in the Kiel Bight with three major objectives (1) population dynamics of major elements of the macrofauna (e.g. Asterias rubens, Nephtys spp.), (2) role of macrobenthos as food of cod and flat fish, and (3) colonization of defaunated sediments placed in different depths on the bottom or on suspended trays in the water column. In situ measurements of metabolism of macrophyts were in progress both in the western Baltic and in Bermuda.

The native wild Nanochloris species was cultured in the frame work of studies on food chains in artificial seawater systems. Rotifers, Copepods, Mysids, and mussels and various flatfish were studied in the course of feeding experiments aiming at data on the potential production at different trophic levels.

Central Baltic Studies in the total production and mortality of cod eggs in Bornholm basin were the theme of a cooperation with the Danish Marine Institute, RV's "Alkor", "Havfisken" and "Solea" alternated in the sampling programme. International cooperation on a much larger scale was the basis of BOSEX-77 in the southern part of the Gothland Basin. The Institute's biologists participated by measuring sedimentation rates at 3 stations with 4 sediment traps each. Production parameters of surface plankton populations were measured in plastic tanks (1 m^3 each) under various admixtures of intermediate and bottom water. Microbiologists observed short-time fluctuations. Total bacterial counts, biomass, saphophyts, uptake of glucose and fructose showed virtually identical diurnal rhythms. Small scale variation of macrozooplankton in space and time was also monitored during BOSEX-77 as far as possible in spite of the very severe weather conditions.

North Sea A large scale survey by RV "Poseidon" of the distribution of demersal fish in the North Sea in winter provided an opportunity to some supplementary surveys: geographical distribution of fish parasites and fish diseases, regional differences in food composition of dominant fish species, particularly their role as fish eaters. Macrozooplankton and ichthyoplankton was sampled on most stations. At the same time RV "Anton Dohrn" collected large herring larvae by IKMT. In September the usual contribution to the international herring larvae survey was carried out in the northern North Sea.

Northwest Atlantic RV "Anton Dohrn" took part in the ICNAF Larval and Young Herring Surveys off the New England Coast. The data were contributed to the international pool of information on the distribution of ichthyoplankton and macrozooplankton in relation to the hydrographic situation in the study area, particularly Georges Bank.

Upwelling areas The material collected during the 1975 expedition of RVs "Meteor" and "Discovery" off NW-Africa was further analyzed with special emphasis on ichthyoplankton, feeding of Myctophids and dermersal fishes, distribution of euphausiids, copepods and chaetognaths. The stomach contents of pelagic fish were sampled in 1977 at various sites along the West-African coast. Feeding ecology of copepods was the theme of several studies carried out off NW-Africa on board RV "Meteor" in 1975 and 1977, in Gullmarsfjord and in the laboratory in Kiel, employing isotope and enzyme methods. Distribution of bacterial biomass and activity as well as plankton studies in relation to feeding in anchoveta were carried out during the Expedition ESACAN I and other investigations off Peru.

Antarctic The Institute participated in the 2nd German krill expedition November (1977) to April (1978). Main areas were west of Antarctic Peninsula, Bransfield Strait, Scotia Sea and South Georgia. In November/December the first part of the expedition was greatly hampered by ice.

The distribution of krill was quite abnormal with little extension to the north and low general abundance. Apart from surveys of general geographical distribution of krill in relation to water masses detailed studies were made on microdistribution of krill and its early life history stages as well as on respiration, moulting, swimming rates etc. In addition zooplankton was sampled at many stations, mainly by using the British RMT 8+1. Fluorescence and chlorophyll were measured and phytoplankton was sampled in January and February 1978. Fish collected during experimental trawling were analysed for growth, maturation and feeding. Much of the benthic by-catch was collected for further analysis by specialists.

Bermuda The Harrington Sound in Bermuda was the site of a multidisciplinary project to learn more about the interaction between sediment and the water column. Bio- and geochemical studies in sediment cores and bell jars at various depths layers were combined with measurements of sedimentation rate, decomposition, phytoplankton and nutrients in the water. Phosphate was recognized as grossly limiting primary production and bacterial activity in the water column. Large mats of Cladophora cover shallow parts of the Harrington Sound and reduce recycling of nutrients. Microbiological profiles in the deeper parts of Harrington Sound provided data on the number and biomass of bacteria, their heterotroph activity and turn-over rates of glucose and dissolved free aminoacids. The rich fish fauna of the Sound is characterized by large numbers of sediment feeders mainly grunts which cause a considerable bioturbation and translocation of the sediments and by enormous schools of juvenile clupeoids which graze on the relatively poor zooplankton.

Institut für Hydrobiologie und Fischereiwissenschaft, Hamburg

In spring 1977 a further cruise of RV "Meteor" covered the upwelling area off Northwest Africa, mainly south of Cape Blanc. The distribution of macrobenthos was studied on the continental shelf and slope comparing sections within and outside permanent upwelling. Bottom grabs, dredges, trawls and a photosledge were employed.

The horizontal distribution and vertical migration of zooplankton were analysed by using a multiple opening/closing net which seems adequate for the collection of copepods. Fish eggs and larvae were also sampled mainly by means of a neuston net.

In autumn 1977 benthos and zooplankton of the Central Red Sea were studied by a team of biologists joining a geological expedition of RV "Sonne". The institute was also engaged in studies in the distribution of plankton and seston in the Elbe Remote sensing by aircraft was combined with shipbased ground truth measurements.

Institut für Meeresforschung, Bremerhaven

Apart from microbiological studies mainly on the occurrence of marine fungi in the Norwegian Sea and off Northwest Africa the institute's sea-going activities concentrated on work in the North Sea with major emphasis on studies on bacteria, fungi, nematodes and macrobenthos. The following projects might be mentioned: Bacteria/invertebrate interaction was investigated, considering bacteria as food of zoobenthos and quantifying the importance of zoobenthos for growth and metabolism of sediment bacteria. Benthos communities in the German Bight has been surveyed in 1975. The very rich material was identified in 1976/77. Changes in the fauna of mud areas off the estuaries of Rivers Elbe and Weser were monitored at 4 stations about 10 times in 1977. The changes are related to the effects of storms on the sediment. The pattern of distribution of zoobenthos was studied by an extremely narrow grid of sampling stations. A further project was related to population dynamics and ecology of nematodes, bivalves, hermit-crabs and Echiurus in the German Bight. Population dynamics and distribution pattern of lower marine fungi at time stations in the same area were investigated. Higher fungi were found on drift woods, sunken wood and algae. Ecology of bacteria in marine sediments was the topic of a variety of studies dealing with various types of bacteria, sediments and areas.

Much of the work of the institute is directly or indirectly related to studies on the extent and effects of marine pollution, organisms of micro-, meio- and macrobenthos being important accumulators, indicators and decomposers of pollutants. See Administrative Report of Environmental Quality Committee.

Other Institutions

"Senckenberg am Meer", Wilhelmshaven, carried out studies on the content of pollutants in the sediments of the German Bight and of coastal waters including fjords, estuaries and mud flats along the German coasts of North Sea and Belt Sea. Further cruises by the new RV "Senckenberg" were related to surveys of North Sea benthos and to studies of the distribution of macrozooplankton in the North Sea along two long sections, where 24 hours time stations were worked in all four seasons. Pelagic molluscs, euphausiids and hyperiids were studied in detail.

"Forschungsstelle Norderney" continued its investigations of the benthos communities in the East-Frisian Wadden Sea and their changes under the influence of increasing eutrophication.

German Democratic Republic

(K Brosin)

Activities in the field of Marine Biology

The plankton investigations in the Baltic were continued by the Institute of Marine Research of the Academy of Sciences of the German Democratic Republic at five seasonal cruises in 1977. At standard stations in different regions of the Baltic the phytoplankton composition, the chlorophyll content, the primary production and the zooplankton biomass were investigated.

These parameters were also observed at two representative sites in the Arcona and Bornholm Sea twelve, respectively, ten times covering the whole year.

In July 1977 special experiments called "OKEX" on metabolic processes in the pelagic ecosystem in the Arcona Sea have been carried out. These investigations comprised a complex programme of plastic bag experiments and time series in which different physical, chemical and biological parameters were measured.

During "BOSEX-77" at the polygon, measurements of chlorophyll content, phytoplankton composition, zooplankton biomass and primary production were made.

In 1978 the investigations started in February and will be continued in the same manner as in 1977.

The section for Biology of the University in Rostock continued with taxonomical and ecological investigations on the zooplankton gathered in the area off North-West Africa.

Special attention was given to the Copepoda Calanoidea and the Thaliacea. Furthermore, the zooplankton sampled in the region off South-West Africa by the research vessel "Alexander von Humboldt" in 1976 was analysed in a rough qualitative and quantitative manner.

Investigations started on zooplankton from the Baltic proper, first of all from the middle part. The material was sampled by the fishery research vessel "Eisbär" in summer 1977.

Zooplankton gathered normally every month in the coastal region of the Western Baltic between Warnemünde and Kühlungsborn was analysed.

In connection with investigations on herring eggs and larvae qualitative and quantitative work was done on zooplankton, obtained every month on 6 stations in the Greifswalder Bodden.

Plankton samples were regularly taken in the chain of shallow estuaries south of the Darz-Zingst peninsula in 1977. The quantity and quality of phyto- and zooplankton were estimated. These investigations form a part of a complex analysis of this ecosystem regarding its structure and function. These observations have been carried out for a period of 10 years.

Iceland

No report received

Ireland

(B McK Bary, M M Parker)

1. Department of Fisheries, Aquatic Environment Unit.

Benthic and littoral ecological surveys form part of the marine protection programme of the Unit. (See Marine Environmental Quality Committee Administrative Report)

Following a bloom of Gyrodinium aureolum off the south coast in 1976, with associated mortalities of coastal organisms, a watch was maintained on bloom incidents in 1977. Several very extensive blooms of Noctiluca were reported but no mortalities occurred.

2. University College Galway, Faculty of Marine Sciences.

a) Extensive and intensive mapping and ecological studies of both soft and hard sub-littoral benthos is being carried out in the Galway Bay area by a team from the Zoology Department, University College, Galway.

b) Plankton and oceanographic studies in the same area are being undertaken by the Oceanography Department of University College, Galway. Projects have dealt with copepod abundances, decapod larvae, and with occurrences and distributions of fish larvae in Galway Bay. The department of Oceanography has concentrated on zoo- and phytoplankton ecology, and especially relations of populations or species to changes in origins of waters affecting western Ireland. The Department has also recently completed the initial stage of a study relating herring fluctuations in abundance, over 80 years or so, to variations of oceanic and meteorological influences. At present studies are in progress in Galway Bay, the Shannon river and estuary, Bantry Bay, and western coastal waters (to 30 km offshore) between these locations.

3. Other studies, mainly benthic and littoral are being carried out as part of baseline surveys. See Marine Environmental Quality Committee Administrative Report.

Netherlands

No report received

Norway

(F Beyer & H Bjørke)

1. Institute of Marine Research, Bergen and Biological Station Flødevigen, Arendal

1.1 Phytoplankton

1.1.1 The long-term monitoring of primary production and standing stocks of phytoplankton over the coastal banks off western and northern Norway continued. The programme covered the spring season and the results are being combined with the previous material in a study of the annual primary production and its fluctuations. The study constitutes a component of a biological monitoring study preceding a planned oil exploitation programme on the shelf. The following parameters were measured at selected stations: primary production rates, chlorophyll a, zooplankton taxa and biomasses, light extinction, particle size frequency, hydrography and nutrients. Turbidity and chlorophyll in vivo flourescence were continously recorded at the 5 m level. However, due to the emergency caused by the Ekofisk Bravo blow-out, the programme was discontinued last April.

1.1.2 As part of the "Joint Norwegian Coastal Current Project" sponsored by the Norwegian Oceanographic Committee, investigations into the spatial and temporal changes of biological parameters were made at one section off the Norwegian coast (Svinøy Section) in August. The same parameters as in the above-mentioned programme were observed plus continuous analysis of particles vertical distribution.

1.1.3 A long-term programme on environmental conditions in the Norwegian fjords was continued. About 30 fjords along the whole Norwegian coast were surveyed in November-December and samples for analysis of nutrients, oxygen, salinity, temperature, chlorophyll a and particle size frequency were obtained.

1.1.4 Continuous and sumultaneous measurements of water transparency and chlorophyll in vivo were carried out during the production season on all the Institute's cruises. The obtained results confirmed again the usefulness of the relationship between the two parameters to identify and roughly quantify the presence of non-planktonic particles affecting the transparency of the water. An analysis of the relationship between the chlorophyll in vivo flourescence and the production capacity made in 1976 suggested the possibility of using flourescence readings as a measurement of primary production. A detailed study on this particular use of in vivo flourescence measurements was carried out during the emergency of the Ekofisk Bravo blow-out. The results will be reported in 1978.

1.1.5 Biological Station, Flødevigen, Arendal

In connection with the planning of thermic power stations, the baseline studies of phytoplankton, zooplankton, ichthyoplankton and fish productivity in the Oslofjord and adjacent coastal waters continued. During 1977, 7 surveys of the area were made. The results were published in Fisken og Havet, Serie B, and in a report to the Norwegian Authority of Waterways and Electro-power.

1.2 Zooplankton

1.2.1 Sampling was continued at the permanent oceanographic stations along the coast of Norway and at station Mike in the Norwegian Sea. The working up of the plankton material lagged behind because of the high priority given to investigations in connection with the oil blow-out at the Bravo platform in April in the North Sea.

1.2.2 In the Coastal Current Project zooplankton was sampled at 370 stations in five sections across the continental shelf and slope along the coast. At each station two vertical hauls were taken with Juday nets (J.36, mesh size 180 micron) and surface hauls with the Otter surface sampler (OSS 40, mesh size 243 micron).

In August, two research vessels operated the Svinøy section north of Cape Stad, taking the same stations and plankton hauls with one hour's delay in between. Considerable differences were observed in plankton volumes and composition.

1.2.3 In the base line investigations for the oil prospecting programme in North Norway, vertical hauls 200-0 m and 50-0 m were taken with a J.36, from the weather ship "Ami" stationed at 71°30'N 19°00'E once a week. The material has been worked up following methods described in earlier reports.

1.2.4 The oil blow-out at the Bravo platform in the Ekofisk field in the North Sea caused extra work. A large number of plankton hauls were collected and had to be given priority in working up. In all, 200 plankton samples were collected in vertical hauls with Juday nets and in horizontal hauls with OSS plankton samplers. The material has been worked up, and reports prepared.

1.2.5 Investigations in connection with commercial exploitation of zooplankton (Calanus) continued. Off Bergen the plankton in May was abundant close to the shore, 40-70 ml/m^2, and farther offshore about 30 ml/m^2.

In the Masfjord north of Bergen very high concentrations were observed, especially at the head of the fjord where up to 500 ml/m^2, or 20-50 ml/m^3 were taken in the uppermost 5 m. The figures corresponded very well with those obtained from the aquaculture station at Matredal in the Masfjord where plankton samples were taken daily from the seawater inlet during the whole year.

The plankton volumes started to increase in the middle of April, reaching a maximum of 40-50 kg per 1000 tons of seawater and then decreasing abruptly to a minimum at the end of the month, possibly because the freshwater run-off from the electro-power station decreased.

1.3 Ichthyoplankton

1.3.1 All fish eggs and larvae collected by the Institute since 1976 have been identified and recorded. This is partly a component of a biological base line study preceding a planned oil exploitation programme on the continental shelf. The recordings also go towards an increased knowledge about spawning seasons and behaviour of the larvae of different fish species. About 4000 samples have been worked up since 1976. The data are recorded on magnetic tape and are easily available via a computer.

2. University of Bergen. Institute of Marine Biology

2.1 The working up of material from a small land-locked fjord, Fauskangerpollen, has continued. The work includes measuring of primary production in spring and summer, the occurrence and composition of the meroplankton, and the diurnal vertical migration of zooplankton in relation to grazing.

2.2 The material sampled in conjunction with the Norwegian coastal current project during 1976 is being worked up.

2.3 Modelling of the land-locked marine echo-system in Lindåspollen has continued, in which the estimated production of phytoplankton and zooplankton occupy central positions.

2.4 The investigations in Korsfjorden continue. The objective is to obtain a picture of the productivity of a west Norwegian fjord by studying the varied production by different phytoplankton size fractions throughout the year and the production dependence on the local milieu. This will be coordinated with an investigation of the effect of herbivores on the phytoplankton and will form a part of a larger investigation into the nutrition of the pelagic community of Korsfjord.

3. Norwegian Institute for Water Research (NIVA), Oslo

3.1 Phytoplankton

3.1.1 Eutrophication effects in the Oslofjord were studied by means of chlorophyll measurements of quantitative field samples and growth potential experiments in the laboratory. Quantitative samples and net samples were also collected and stored for later analyses.

3.1.2 In order to study pollution effects in the heavily polluted Frierfjord and surrounding areas chlorophyll measurements were made of quantitative samples, which were also collected and stored together with net samples for later treatment.

3.1.3 Phytoplankton in the Trosbyfjord in Bamble was studied by means of quantitative chlorophyll measurements.

3.1.4 Phytoplankton in the Hellefjord by Kragerö was studied by means of quantitative chlorophyll measurements.

3.2 Zooplankton

3.2.1 As part of the eutrophication studies in the Oslofjord zooplankton samples were collected in the innermost basin, the Bunnefjord.

4. University of Oslo, Institute of Marine Biology and Limnology

4.1 Phytoplankton

4.1.1 Phytoplankton Surveys

4.1.1.1 The investigation of the spring phytoplankton in the spawning areas of cod and herring (Lofoten to Møre) was continued, in collaboration with the Marine Research Institute of the Fisheries Directorate, Bergen. This investigation is part of the Norwegian IBP/PM programme. A report is in preparation (T Braarud, I Nygaard)

4.1.1.2 Phytoplankton was examined as part of oceanographic surveys carried out in connection with the hydroelectric power-plant projects. The final report of a survey in the Ryfylke Fjords is in preparation (I Nygaard)

4.1.1.3 A report on the summer and autumn phytoplankton of Nordåsvatn, a land-locked fjord near Bergen, is in preparation (K Tangen).

4.1.1.4 A survey of dinoflagellate cyst distribution along the Norwegian Coast is in progress (B Dale).

4.1.2 Special Phytoplankton Studies

4.1.2.1 Taxonomic studies on coccolithophorids, by means of transmission and scanning electron microscopy, will be continued (K R Gaarder)

4.1.2.2 Morphology, taxonomy, and distribution of marine plankton diatoms were studied by means of light and electron microscopes (G R Hasle).

4.1.2.3 Influence of growth conditions on diatom frustule morphology was investigated (E Syvertsen).

4.1.2.4 An investigation of the annual cycle of silicon in the water and plankton of the Oslofjord was begun. Studies were continued on the nutrient status of Oslofjord phytoplankton as evaluated by various physiological and biochemical criteria (E Paasche, students).

4.1.2.5 Experiments on the suitability of water in the inner Oslofjord as a growth medium for representative plankton algae were concluded (E Paasche).

4.1.2.6 A report on dinoflagellate mass occurrence associated with fish kills along the Norwegian west coast has been published (K Tangen).

4.1.2.7 Taxonomy and morphology of dinoflagellates were studied by means of light and transmission and scanning electron microscopes (J Throndsen, B Dale, K Tangen).

4.1.2.8 Smaller field investigations were carried out on phytoplankton composition and distribution at several inshore localities in southern Norway, outside the Oslofjord area (Students, staff).

4.1.2.9 Dinoflagellate blooms were studied in enclosed water columns ("plastic bags") (K Tangen).

4.1.2.10 Investigation of the role of cysts in toxic dinoflagellate blooms is in progress. (B Dale, in cooperation with Bigelow Institute for Ocean Sciences).

PROGRAMME for 1977

Investigations mentioned above (I d, II a, b, c, d, g, h, i, and j) will be continued.

PROGRAMME for 1978

Of the investigations mentioned above the following will be continued: 4.1.1.4; 4.1.2.1; 4.1.2.2; 4.1.2.3; 4.1.2.4; 4.1.2.7; 4.1.2.8; 4.1.2.9; 4.1.2.10.

4.2 Zooplankton

All the investigations mentioned in the report of 1976 were continued in 1977.

5. University of Tromsö, Institute of Biology and Geology and Marine Biological Station

5.1 Phytoplankton

5.1.1 Studies of primary production, standing crop, as well as the abundance and species composition of phytoplankton were continued in 1977. Investigations were made contemporaneously of temperature, salinity, stability, light, and particulate material. (Inst. Biol. & Geol.)

5.1.2 Phytoplankton studies were conducted in Skjomen fjord at the same stations as the zooplankton studies. Samples were taken at 8 depths from 0-75 m to study species composition and seasonal variability for later comparison with results from 1970-1973 (Marine Biological Station).

5.2 Zooplankton

5.2.1 Ecological studies of zooplankton population dynamics and production in Balsfjord, started in 1976, have been continued during 1977. Investigations of seasonal changes in basic biochemical body components and "condition" of the zooplankton have been extended and include Calanus finmarchicus, Sagitta elegans, Metridia longa, Thysanoessa inermis, T. raschii, and Meganyctiphanes norvegica. Zooplankton sound scattering layers are being examined using Simrad EK 120A and EK 38A echosounders coupled with a Scase echointegrator system. Studies have also been started on hyperbenthos, which include a rich zooplankton component (Inst. Biol. & Geol.).

5.2.2 The influence of crude oil and oil dispersants is being investigated on zooplankton, especially sea-urchin larvae, fish larvae, and copepods. (Inst. Biol. & Geol.)

5.2.3 In 1977 a 3 year sampling programme using vertical zooplankton hauls was started in Skjomen fjord. It includes a study of 24-hour and seasonal variability in the zooplankton community and detection of changes in standing stock and composition. The results are being compared with those from 1970-1973 conducted before the building of a hydroelectrical power plant, which was finished in 1976 (Marine Biological Station).

6. University of Trondheim, Biological Station

6.1 Phytoplankton

6.1.1 The chemical composition of a pure bloom of Skeletonema costatum in the Trondheimsfjord was investigated in March - April. This investigation also included measurements of the activity of bacteria living on extracellular products excreted by Skeletonema.

6.1.2 The chemical composition of natural communities of dinoflagellates and coccolithophorids has been investigated on weekly cruises in the Trondheimsfjord in August - October.

6.1.3 The chemical composition of laboratory cultures of the coccolithophorid Emiliania huxleyi and the dinoflagellate Amphidinium carteri has been studied as a function of nutrient deficiency.

6.1.4 The growth rate of various diatom species has been measured as a function of the light regime in outdoor dialysis cultures in October - December.

PUBLICATIONS

Sakshaug, E., 1977. Limiting nutrients and maximum growth rates for diatoms in Narragansett Bay. J. exp. mar. Biol. Ecol, vol. 28, 109-123.

Sakshaug, E. & O. Holm-Hansen, 1977. Chemical composition of Skeletonema costatum (Grev.) Cleve and Pavlova (Monochrysis)lutheri (Droop) Green as a function of nitrate-, phosphate-, and iron-limited growth. Ibid. 29, 1-34.

Myklestad, S., 1977. Production of carbohydrates by marine planktonic diatoms. II. Influence of the N/P ratio in the growth medium on the assimilation ratio, growth rate, and production of cellular and extracellular carbohydrates by Chaetoceros affinis var. willei (Gran) Hustedt and Skeletonema costatum (Grev.) Cleve. Ibid. 29, 161-179.

Poland

(K Siudziński)

Baltic Sea Fisheries Institute in Gdynia

The long-term and complex observations on hydrographic conditions and plankton were continued in 1977 in the southern Baltic on standard stations along the transect through Arkona Sea, Bornholm Basin, Slupsk Furrow and Gulf of Gdańsk.

The research included, apart from hydrographic conditions, observations on:- primary production intensity, and concentration of chlorophyll, measured with standard methods.

- quantitative and qualitative distribution of phyto-, zoo-, and ichthyoplankton using Hensen, Bongo, Nansen, and Copenhagen nets;
- zooplankton biomass determined by volumetric method.

Samples were collected every month, except for January and June, at 25 stations for plankton studies and at 42 stations for hydrographic observations.

Institute of Oceanography of the Gdańsk University

Monitoring of influence of eutrophication on Gulf of Gdańsk biocenosis was carried out monthly at 15 stations by means of standard methods. Studies were focussed on the following parameters:-

- Chlorophyll content in the surface layer to 15 m depth,
- composition and abundance of phytoplankton and zooplankton,
- photosynthesis in relation to the light intensity (laboratory studies)
- distribution, composition, abundance and biomass of phyto- and zoobenthos (excluding meiofauna).

Studies on crustaceans (Crangon crangon, Neomysis integer, Gammaridae) as food for commercial fish with emphasis on their biology, biochemical composition and caloric value in a yearly cycle were carried out on the basis of field observation and laboratory experiment.

Experimental studies on reproduction and development of larval stages of cockle (Cardium sp.) were done in 1977.

North Sea

Sea Fisheries Institute in Gdynia

As in previous years larval herring were sampled in September. For the first time m/t "Birkut" was working within the scope of ICES "International Herring Larvae Survey".

Sampling was carried out on 89 stations in the area 56° - 58°N and 00° - 03°30'W using Gulf III samplers supplied on board by Marine Laboratory in Aberdeen.

Samples of water were taken for determination of salinity from the surface and near-bottom layer. Temperature was measured by means of BT.

Portugal

(A Ribeiro, T Neto)

1. Plankton

Upkeep of the phytoplankton cultures stock (phytoflagellates, diatoms, dinoflagellates, Chlorophycea); development of ten liter's monoalgal cultures to feed the zooplankton stock cultures. - (M A Sampayo).

Upkeep of the zooplankton cultures stocks (copepods and rotifers) at the laboratory. (M H Vilela).

Continuation of the study of phyto- and zooplankton samples collected from March till December 1977 in the "Musgos" fishpond on the right side of Sado estuary. (M H Vilela and M A Sampayo).

Study of the zooplankton samples from Lagoa de Óbidos (Foz do Arelho) collected during the year 1977. (T Neto and I de Paiva).

Continuation of the study of the zooplankton, mainly copepods and Siphonophora, collected by the RV "G O Sars" SW of Portugal and at the Azores in November/December 1975, with a Juday net. (I de Paiva and T Neto).

2. Benthos

Qualitative and quantitative biocenotic studies in rocky and motile substracts, mainly from infra- and circalittoral zones. Estimates of biomass. (L Saldanha et al)

Preliminary catches were made in Sado estuary in order to recognize benthic forms from shallow bottoms. (A Ribeiro).

Basic studies in the coastal zone off Sines and Lagoa de St.° André (analysis of material collected in March-September 1974).

Assessment of benthic fauna in the coastal zone off Sines (May-December 1977)

3. Outside the ICES Region

"Sur la présence à l'île de Saint Hélène du Copépode Harpacticoide Porcellidium clavigerum Pesta" Rev. Zool. Afr., 91(4). E Marques.

Spain

No report received

Sweden

(L Hernroth, H Hallbäck)

Gulf of Bothnia

In the neighbourhood of the Forsmark nuclear power plant, samples for determination of primary production, chlorophyll, phytoplankton, micro-zooplankton and mesozoo-plankton were taken three times per month by the University of Uppsala.

Baltic proper

In the Askö area, weekly sampling from the Askö laboratory has been carried out for a number of parameters, e.g. primary production, secondary production, chlorophyll content, distribution of pelagic bacteria, phytoplankton, microzooplankton and mesozooplankton. Ichthyoplankton has been collected in hauls with a Bongo-net.

At the Institute of Marine Research in Lysekil, the results from the long-term studies of Baltic off-shore plankton has been compiled and published.

Oresund and Kattegat

In cooperation with Denmark (Belt project), regular sampling for primary production, chlorophyll and phytoplankton composition has been carried out in the Oresund. The University of Lund has been responsible for the measurements.

On a transect between Göteborg and Fredrikshavn, phytoplankton and zooplankton have been sampled 21 times during 1977 in connection with hydrographic expeditions carried out by the Fishery Board of Sweden.

Skagerrak

During 1977 a number of ichthyoplankton samples have been taken during ordinary fishery expeditions in the Skagerrak and Kattegat area. The gears used have mostly been Bongo-net and IKMT. Special interest has been laid on eel, herring and sprat larvae. All expeditions have been arranged by the Institute of Marine Research in Lysekil.

In the autumn of 1977, a research project covering the pelagic echosystem in the Gullmarsfjord was started at the Institute of Marine Research. Weekly measurements of hydrography, currents, light, primary production, chlorophyll and composition of pelagic fauna and flora (including ichthyoplankton) have been carried out.

Molluscs

The culture experiments on Mytilus edulis started in 1976 on the Swedish west coast have been successful and the studies on settling, growth, predation and handling the mussels will increase.

Benthos

Diving studies on the effects of water discharge from nuclear power stations, petrochemical industries and fish processing plants on macrobenthos were continued.

United Kingdom

England and Wales

(D J Garrod)

1. Lowestoft Fisheries Laboratory, Lowestoft

A. North Sea Studies

(i) Analyses of material collected in a year round series of surveys off the north-east coast of England in 1976 have been reported for publication in Annales Biologiques. These record the distribution and abundance of fish eggs and larvae with associated observations on the environment, primary production (chlorophyll a) and preliminary estimates of zooplankton biomass. These data will be made available for comparison with the results of the international FLEX programme. The information is also being used in the development of a two-dimensional model of primary and secondary production to investigate the biological significance of 'patchiness' and zooplankton population stabilizing mechanisms.

(ii) An estimate of the distribution of vertical tidal mixing in the North Sea has been made (ICES C.M. 1976/C:1). This gives some indication of the likely position of thermal fronts between stratified and well mixed water. Thermal infra-red satellite imagery for 1976 and 1977 confirms that, in the zone of interest, the West Central North Sea, the most likely region for a persistent feature is off Flamborough Head, on the north-east coast of Britain.

A cruise in August 1977 confirmed the general stratification picture in this area and found a weak surface front with an associated chlorophyll a and nutrient distribution. The feature was neither as strong nor as extensive as earlier satellite imagery suggested, but this is probably due to the lateness of the cruise in what was in any case a poor year for surface warming.

A second cruise in May/June 1978 hopes to make a similar survey when the front is in its early development stages. More emphasis will be placed upon the vertical distribution of chlorophyll a, particularly within the recently formed thermocline, augmented with observations on particle size frequency distributions recorded by an on-line HIAC particle counting system.

(iii) RV "Corella" carried out two cruises within the International Herring Larval surveys and RV "Cirolana" carried out the first of what is intended to be an annual (August) survey of North Sea demersal resources. These cruises are to establish a time series of stock estimates independent of commercial fishery data, which may also be relevant to problems in biological oceanography.

B. Western Approaches

Five ichthyoplankton surveys were conducted along the western edge of the continental shelf 45°N-54°N in conjunction with French scientists. The primary objective was to determine the seasonal distribution and abundance of mackerel eggs to estimate the adult stock of 'western' mackerel for management purposes. Results have been reported to the ICES Mackerel Working Group. The surveys were supported by experimental studies of the development of mackerel and monitoring of the hydrographic and biological environment. Particle size frequency distributions of chlorophyll a demonstrate increased levels of biological activity in the vicinity of 'frontal' systems in the area.

C. Irish Sea

A comparative study is being undertaken of the physical factors controlling primary production in the Irish Sea and in the southern North Sea to explain and confirm the apparent relatively low productivity of the Irish Sea. This study was begun in 1977 and is expected to be at a report stage in 1979.

D. Experimental Studies

Studies of the development rates of selected species of fish and zooplankton are being continued to provide a basis for quantitative estimation of production rates from field survey data.

E. Current and Future Programme

(i) Studies of biological productivity in the vicinity of hydrographic 'fronts' will be continued.

(ii) Plankton Patch Study. A pilot study of a plaice egg patch was carried out in February 1978 to test the techniques required to maintain quasi-synoptic monitoring of an identified 'patch' of planktonic organisms. The results will be reported to the Annual Meeting 1978 for consideration in conjunction with a summary of the objectives and logistics of a 'patch study' which the Lowestoft Laboratory hopes to undertake in 1980 and in which other countries will be invited to participate.

(iii) Preliminary consideration has been given to participation in an international survey of eel spawning and egg and larval development in the west Atlantic in 1981.

2. The Continuous Plankton Recorder Survey (IMER)

The survey by the Continuous Plankton Recorder was continued in 1977 on the same lines as in previous years. Recorders were towed at a depth of 10 m at monthly intervals along the standard routes shown in Figure 1. In addition, three routes were operated by the US National Marine Fisheries Service.

During the past year Recorders were towed for 118,000 miles by 20 ships of nine nations (Denmark, France, West Germany, Norway, Iceland, the Republic of Ireland, the Netherlands, USA and UK). The survey by the Continuous Plankton Recorder Survey began in 1930; since 1948, the plankton has been collected and the results have been processed in a constant manner. Measurements of temperature were taken on the K, L, LR, C, IS, IN, and PR routes. An inventory of the survey is produced every year and is available on request to the Director, Institute for Marine Environmental Research, Prospect Place, The Hoe, Plymouth, PL1 3DH. Details of the data processing procedures are given by J M Colebrook in Bull. mar. Ecol., 8, 193-142.

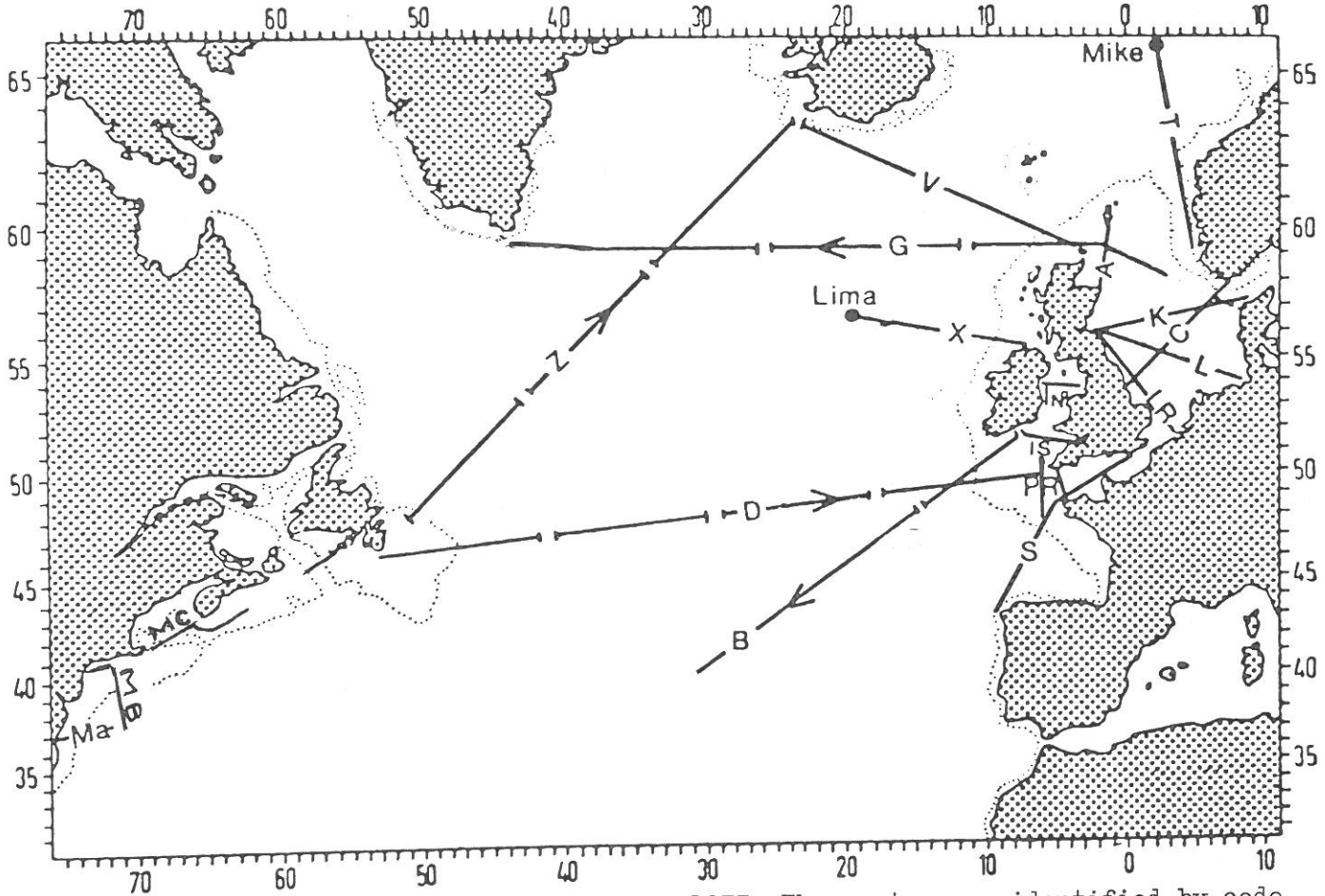

Figure 1 The Continuous Plankton Survey 1977. The routes are identified by code letters.

Scotland

(J A Adams)

1. Marine Laboratory, Aberdeen (DAFS)

Although some of the biological oceanography projects at the Marine Laboratory are aimed at studying the factors determining the distribution and abundance of commercial resources and others at investigating pollution related matters, there are many ways in which both types of project can be considered as contributing to a better understanding of the marine ecosystem. In the following sections details are therefore included which are also referred to in the report of the Marine Environmental Quality Committee.

The Plankton of Inshore Waters

Samples were obtained from two areas (Sullom Voe in the Shetland Islands and the Firth of Forth) as part of a long-term programme of describing, at least superficially, the plankton populations in Scottish inshore areas where changes in the ecosystem could result from pollution. A preliminary examination of the Sullom Voe material showed that during April phytoplankton was abundant and was dominated by the diatom, Thalassiosira nordenskeoldii. Crustaceous zooplankton was present in very low numbers in marked contrast to the extreme abundance of young jellyfish, Aurelia aurita (dia. 1-1.5 cm). In early July phytoplankton was again abundant, particularly in the outer part of the Voe. The dominant diatoms were Chaetocoeros spp with C. curvisetum being the most numerous. A. aurita was still very abundant; their median diameter had increased to approximately 16 cms. (D D Seaton).

The Benthos of Inshore Areas

During 1977 analysis was completed for material obtained previously in (i) the Sound of Raasay, the site of the construction of a concrete platform, and (ii) Sullom Voe, an area of much oil-related development. In addition work was carried out at the proposed sludge dumping grounds off the Firth of Forth (St Abbs Head and Bell Rock).

The Sound of Raasay samples showed a diverse community dominated by sedentary polychaetes (mainly Cirratulids) and small bivalves (Thyasira and Abra). There was no evidence of any detectable effect of the construction activities on the diversity, abundance and biomass of the community.

The Sullom Voe study revealed a highly diverse fauna which totalled 300 species. On the basis of the data available the area could be separated into three distinct areas: the head of the Voe with a deep, muddy and intermittently anoxic basin inhabited by a sparse fauna consisting of only a few polychaetes and juvenile bivalves; the middle sandy/gravel part inhabited by a diverse community characterised by the bivalve Modiolus; the outer area, predominantly sandy/clayey with a highly diverse but not so abundant fauna.

The preliminary data from St Abbs Head and Bell Rocks showed an invertebrate fauna of approximately 80 species dominated by sedentary polychaetes and bivalves which account for more than half the total number of species. The biomass was dominated by a large population of ophiuroids.

The other main theme in the inshore investigations relates to the food chains of flatfish nursery areas. Ten years invertebrate benthos data from Loch Ewe on the north-west coast of Scotland has been re-examined showing a community of dynamic equilibrium.

A study of the benthos of intertidal plaice nursery grounds on the east coast of Scotland has continued with the aim of providing data which can be compared with those obtained previously from the west coast of Scotland. (A Eleftheriou, D J Murison, D C Moore).

Open Sea Studies

Although some sampling has been carried out in the open sea with regard to benthic ecology, the bulk of the work refers to plankton. Details of the individual projects follow.

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(a) Horizontal surveys. Analysis of the samples, and plotting of the data obtained continued during 1977. It is hoped that the bulk of the work will be completed and reports prepared during 1978. (J A Adams, E V Henderson and others).

(b) Zooplankton feeding experiments. The experiments conducted on board the 'Meteor' while the spring diatom bloom was declining have been evaluated and written up for publication. During the initial period, when Chaetoceros was the dominant diatom, constant ingestion rates were observed in Calanus at suspended particle concentrations above 300 µg Carbon l^{-1}. A maximum daily intake of 50% body carbon was measured. The feeding response of the smaller copepods was not so well defined although a 56% maximum daily intake was recorded.

In both groups initial feeding thresholds were at particle concentrations around 50 µg C l^{-1}. The small copepods filtered out slightly smaller particles than Calanus although both groups showed some filtering adjustment to accommodate a change in the modal diameter of the phytoplankton cells from 20-30 µm to 10 µm. (J C Gamble).

Scyphomedusae of the North Sea

The seventh survey of the distribution and abundance of scyphomedusae was conducted during June-July, again with the co-operation of the other institutes taking part in the international 0-group gadoid survey. All the data have not yet been evaluated but a preliminary examination of the data for the north-western North Sea showed that, as in previous years, Aurelia aurita was the most abundant species, particularly in the Moray Firth. Cyanea spp were present generally in low numbers apart from two hauls, both off Shetland were C. capillata was caught in relatively high numbers and one haul off Buchan Ness were high numbers of C.lamarckii were found. (S J Hay and J R G Hislop).

Distribution and Abundance of Larval Fish

The normal surveys to determine the distribution and abundance of herring larvae were carried out in the Firth of Clyde in the spring and off the west, north and east coasts of Scotland in the autumn. (D W McKay).

Ecology of 0-Group Gadoids during Early Winter

During 5-25 October, the first of what is hoped will be a series of cruises investigating the ecology of 0-group gadoids during early winter, was conducted by FRV "Scotia". The particular aims of the cruise were to:-

(i) Make a preliminary attempt to establish what proportion of the various 0-group gadoid populations were still living pelagically and to investigate the factors (stock size, food and abundance etc.) which may determine the timing and extent of the change-over to demersal life and

(ii) Obtain at least limited data on the geographical distribution and abundance of the pelagic 0-groups.

Considerable numbers of whiting were still living pelagically in marked contrast to cod, haddock and Norway pout which appeared to have changed to a demersal mode of life. Many of the whiting were extremely small (<5.0 cm) suggesting either that they were growing very slowly or that they were the product of a very late spawning. (J R G Hislop and J A Adams).

Experimental Studies at Loch Ewe

As in previous years Loch Ewe has been the location of a number of important experimental studies. Three of these are described below.

The bag experiments. During August four 5 m diameter (approx 350 m^3) bags and one 3 m diameter (approx. 100 m^3) bag were deployed in Loch Thurnaig at the head of Loch Ewe. The latter bag was used for a study of the distribution, movement and form of selected metals (Hg, Cd, Pb and As) (G Topping), while of the four larger bags two (C and D) were stocked with herring eggs collected on 18 September off Melvaig, Wester Ross, one (B) was used for oil experiments and one (A) as a control.

The oil was found to have a marked effect on the zooplankton and this was associated with changes in the phytoplankton (J M Davies & others).

Different population densities of herring larvae developed in bags C and D and density dependent growth became apparent. The population with lower numbers of larvae had a larger average individual size and a narrower size range than the denser population. (J C Gamble, I G Baxter and others).

Experimental studies of the Lobate Ctenophore Bolinopsis infundibulum

In addition to a field study of the population of B. infundibulum in Loch Ewe from March to July simultaneous experimental studies were carried out on feeding and fecundity. These were summarised in a contribution to the 1977 ICES meeting (Doc. C.M. 1977/L:16) (J C Gamble).

Modelling

Further work has been done on a model investigating the effect of vertical processes on horizontal plankton patches. (G T Evans).

2. Dunstaffnage Marine Research Laboratory, Oban (SMBA)

Zooplankton Studies

Various aspects of the biology of the calanoid copepod Pareuchaeta norvegica have been examined in Loch Etive, Argyll and offshore in the vicinity of 55°N 12.5°W. This copepod is a major component of the zooplankton in these very different environments and consequently comparative studies of its biology are being attempted. The importance of wax esters in its lipid metabolism is being examined as well as seasonal and ontogenetic changes in its chemical composition.

A model describing growth of higher crustaceans has been developed that has allowed empirical analyses of the growth of the Antarctic krill. Euphausia superba and other crustanceans living in open environments as opposed to land-locked situations such as Scottish sea lochs or Norwegian fjords.

Investigation of the meso- and bathypelagic environments in continuing. Integumental organs, comprising predominantly of sensilla and opening of sub-integumental glands, have been examined in a wide variety of crustaceans. Parallel studies on organisms such as chaetognaths are being made elsewhere. It is becoming increasingly clear that pelagic organisms are monitoring many parameters of their environment, both immediate and at some distance from them. A major challenge is to discover the function of specific sensilla. The dimensions of most of these organs are measured in μm and are such as to preclude conventional neurophysiological techniques.

USA

(K Sherman and G D Grice)

Ichthyoplankton-Zooplankton Assessment

During 1977 laboratories of the National Marine Fisheries Service, Northeast Fisheries Center (at Woods Hole, Narrangansett, and Sandy Hook) continued MARMAP surveys of ichthyoplankton, zooplankton, chlorophyll, and hydrography. Six surveys were made over the continental shelf from the Gulf of Maine to Cape Hatteras (2 spring; 2 summer; 1 autumn; 1 winter) in cooperation with Poland and the USSR. The Woods Hole Laboratory also conducted monthly surveys of larval herring mortality and dispersal from the onset of spawning in September through metamorphosis in February. Scientists and vessels of the Federal Republic of Germany, German Democratic Republic, Poland, and the USSR participated in the joint studies. The results of the 1971-1976 larval herring surveys are being summarized by the staff at the Woods Hole Laboratory, including a comparison of estimated larval mortality rates amont the six years. Studies have also been initiated on larval herring growth using age estimates based on otolith examinations. In addition to the macroscale MARMAP surveys, and mesoscale larval herring surveys, microscale (patch) studies were planned for October 1978 to investigate patches of herring larvae on Georges Bank, their zooplankton food, and the growth, survival, and dispersal of larvae in relation to circulation on a scale of days ond kilometers. Among the countries scheduled to participate in the patch studies are: Canada, Poland, Federal Republic of Germany, and the USSR. Staff of the Woods Hole, Narragansett and Sandy Hook Laboratories are working on an energy budget for Georges Bank. Initial calculations have been made using available data to estimate the production and biomass of the principal components. An energy flow model has been constructed based on the energetics of representative species and esti-

mates of their growth, reproduction, maintenance, metabolism, and excretion rates. A time-series of ichthyoplankton and zooplankton samples was made in the vicinity of the "Argo Merchant" oil spill. Initial observations detected "Argo" oil in the zooplankton within 20 days of the spill; subsequent samplings through spring and summer showed no evidence of "Argo" petroleum hydrocarbon residues.

Studies are continuing on the bioenergetics of larval fish at the Narrangansett Laboratory. Studies of the influence of prey density on growth and survival, studies of digestion and assimilation rates, and embryological development of cod are underway. In cooperation with the Danish Institute of Marine Fisheries, stochastic and empirical models of larval growth and survival are being developed. A large enclosure for handling larval fish in situ was developed and successfully tested. Also underway is a study of the DNA/RNA content of fish larvae as an index of physiological condition. The Plankton Ecology Group at Narragansett is providing summaries of zooplankton biomass and species composition and abundance for the 1971-1975 time-series of collections made during autumn and spring bottom trawl surveys of the continental shelf from the Gulf of Maine to Cape Hatteras.

The MARMAP Field Group at Narragansett continued their joint work with the Institute of Marine Environmental Research, Plymouth. Two Continuous Plankton Recorder routes were maintained during the year off the northeast coast. In addition, cooperating vessels of the US Coast Guard collected monthly samples of neuston during fishery patrols from Hudson Canyon to the Scotian Shelf.

The Sandy Hook Laboratory, NEFC, initiated a study of sand lance (Ammodytes) distribution and abundance for the period 1971-1977. Initial indications suggest a significant increase in the population of this species over the past seven years. They also completed a series of measurements of primary production and chlorophyll fractions in the Mid-Atlantic Bight; included in the study are estimates of benthic respiration rates.

The Division of Oceanography of the Brookhaven National Laboratory continued their investigation of the meteorological, hydrographic, and biological events controlling the initiation of spring plankton production in the New York Bight. Their studies include the cycling of nutrients, particularly at the outer shelf break, as part of a comprehensive study of the pelagic ecosystem of the New York Bight. A series of in situ zooplankton grazing experiments were also conducted.

Studies at the Beaufort Laboratory are continuing on the cycling of energy in a coastal estuarine system. Investigations on the influence of Ekman-drift on larval menhaden survivals are nearing completion.

The Division of Marine Fisheries, State of South Carolina, continued MARMAP ichthyoplankton surveys from Cape Fear, North Carolina, to Cape Canaveral, Florida. Several reports describing the results of earlier surveys were completed including observations on neuston abundance, and the distribution and composition of ichthyoplankton of the South Atlantic Coastal Bight.

The Miami Laboratory of the Southeast Fisheries Center, NMFS, is planning a joint ichthyoplankton survey of the Gulf of Mexico and Caribbean Sea in May with the Instituto Nacional de Pesca, Mexico. The survey is designed to define spawning times and areas of the principal fish species and estimate the biomass of selected spawning stocks.

Plankton Ecology Investigations

Investigations at the Woods Hole Oceanographic Institution included a major multi-disciplinary effort to study the physics, chemistry and biology of Gulf Stream cold core rings through time. The field programme consisted of four cruises in the northwestern Atlantic Ocean. Five cold core rings were intensively sampled. Comparative data were taken from the Sargasso Sea regions adjacent to the rings and from the slope water north of the Gulf Stream. Biological work consisted of sampling the upper 2 000 m for chlorophyll a and phytoplankton species and sampling the upper 1 000 m for the vertical distribution of zooplankton and nekton biomass and species composition. In addition, the biochemistry and physiology of selected zooplankton species were examined in relation to the hydrographic regime and depths from which they were collected. Studies on gelatinous zooplankton involved measurements of feeding, metabolism and growth of salps, feeding biology and systematics of oceanic ctenophores and carbon fixation and symbiosis in colonial radiolaria. In Massachusetts Bay the vertical and horizontal distribution of plankton was examined in response to high frequency waves. In experimental work on calanoid copepods, Labidocera aestiva has been maintained through seven generations for the purpose of investigating the biological and physical conditions which may be responsible for inducing the production of resting eggs.

At the Bigelow Laboratory for Ocean Sciences the physiological ecology of phytoplankton is the major research area. Recent work has been concerned with remote sensing of chlorophyll throughout the Gulf of Maine with the purpose of understanding the seasonal sequence of primary production.

Research continued at the Biological Laboratories at Harvard University on the nitrogenous nutrition of plankton in the Sargasso and Caribbean Seas.

Investigations at the Graduate School of Oceanography of the University of Rhode Island included work on phytoplankton, protozoa, zooplankton, and fish. Some of the projects listed here include work on the role of diatom resting spores and the genetic variability of neritic diatom species. The studies of phytoplankton succession based on ca. an 18 year weekly time-series are continuing, this last year including zooplankton interactions as well as light and nutrients and various biochemical measurements. Zooplankton and phytoplankton of Campeche Banks and the nearby oligotrophic waters were intensively studied on a month-long cruise in July. The studies of the interaction of phytoplankton, bacteria, and protozoa were continued on a cruise to the North Atlantic. Analyses of the growth and distributions of tropical dinoflagellates were carried out. Biweekly sampling of demersal fish in Narragansett Bay was continued as part of an eleven year study monitoring changes in demersal fish populations in Narragansett Bay. The feeding behavior of fish and zooplankton in Narragansett Bay was studied.

At the Marine Sciences Research Center, at Stony Brook, New York a variety of plankton research is underway. Currently, data on nitrogen cycling in the euphotic zone is being processed from a series of four cruises to the southern Sargasso and eastern Caribbean Seas. Similar field studies on nitrogen cycling are being initiated in Great South Bay on southern Long Island.

Using natural phytoplankton assemblages growing in dialysis membrane chambers in a tidal marsh on Long Island's north shore, the impact of organochlorine pollutants on growth, photosynthesis, size distribution and species composition of the algal

community is being examined. Zooplankton have been included in recent studies, since pollutant-induced changes in the abundance and size of phytoplankters may result in alterations in copepod feeding behavior and fecundity. The fate of PCB's in experimental systems consisting of phytoplankton and sediments is also being examined as is the ability of sediment-transported PCBs to affect phytoplankton growth and photosynthesis.

The role of tidal and headland fronts as a physical driving mechanism for controlling the productivity and distribution of phytoplankton in Long Island Sound is under investigation. This study involves intensive three-dimensional mapping of temperature and chlorophyll using a towed fluorometer system. Frontal systems in the New York Bight and the English Channel will also be studied.

Research at Lamont-Doherty Geological Observatory is concerned primarily with the environmental regulations of phytoplankton growth, the influences of circulation and grazing on the distribution and abundance of phytoplankton populations, and the effects of phytoplankton on the distribution and abundance of suspended particles in coastal environments. Field programmes focus on the influences of cell size and chain length on the reponse of phytoplankton populations to their environment and on the coupling between phytoplankton production and zooplankton grazing. Laboratory programmes are oriented toward quantifying time-dependent relationships between phytoplankton growth and photosynthesis.

Plankton research at the Chesapeake Bay Institute continued on the role of plankton metabolism in regenerating nutrients in the water column and in depletion oxygen in deeper Bay waters. A minimum disturbance multiple corer was constructed to permit sediment sampling for measurements of sediment-water nutrient exhange under controlled conditions. Studies have been initiated on the abundance and distribution of microzooplankton in the estuary. Several microzooplankters have been isolated from Chesapeake Bay for studies of nutritional requirements and metabolism, and preliminary studies have been undertaken to examine fine-scale distributions in relation to physical water parameters and to distributions of the phytoplankton crop. Studies are also in progress to characterize dissolved organic carbon released by natural phytoplankton assemblages and laboratory isolates.

The Virginia Institute of Marine Science has completed a two year baseline survey of plankton in the waters of the Middle Atlantic Bight. Analyses were made of biomass diversity and community structure. An hypothesis of circulation, mixing and zooplankton distribution is being developed that accounts for annual differences in abundance of northern forms and the annual appearance inshore of Carolinian fauna. The model considers anticyclonic eddies from the Gulf Stream, trans-shelf mixing in warmer seasons and relative strength of currents in the Coastal Boundary Layer.

Plankton research at Duke University Marine Laboratory was focused on the processes responsible for large scale variations in productivity. The physical and chemical observations taken since 1965 are being analysed to establish whether or not the large-scale oceanographic variability is responsible for the variation in productivity. Other studies that are continuing are: 1) Taxonomic and zoogeographic studies of oceanic radiolaria; 2) investigation of copepod reproductive and feeding strategies; 3) the regulation of primary production by secondary growth factors and trace metals; and 4) analysis of the spatial and temporal heterogeneity of phytoplankton species composition in small lateral estuaries.

Plankton research at the Skidaway Institute of Oceanography consisted of field and laboratory studies. The field research concentrated on temporal and spatial (vertical) changes in phyto- and zooplankton composition and abundance in isolated Gulf Stream intrusions by following these water parcels with sets of drogues. Through particle size determination, combined with primary productivity measurements, the amount of particulate matter available to different abundant zooplankton groups was measured.

Laboratory studies on pelagic tunicates and juvenile and adults of abundant copepod species complemented the field research by determining rates of intake, growth and reproduction at in situ temperatures, food concentrations and food species composition.

At the Rosenstiel School of Marine and Atmospheric Sciences experimental studies are being conducted on the feeding of plankton carnivores, particularly chaetognaths, in relation to environmental food levels. The role of detritus as a food source is being evaluated for inshore copepods as well as the association between cyclopoid copepods and Trichodesmium in the Florida Current. A seasonal survey is being made of water column production on a transect from the mangrove edge of Biscayne Bay into the Florida Current. The relationship between larval fish survival and growth and availability of microzooplankton prey is being studied in Biscayne Bay.

Benthic Investigations

During the past year extensive field and experimental benthic studies were conducted on the continental shelf between the US-Canadian Border and Cape Hatteras. Scientists at the Woods Hole Oceanographic Institution (WHOI) continued their investigations of abyssal benthic species. These studies emphasized experimental measurements to detect perturbations and their effects on benthic species. Samples of defaunated sediments are placed in deep waters and monitored to assess the colonization process. Other experiments are designed to exclude predators and to follow the dynamics and development of community structure free of normal predators. Scientists have also introduced organic materials such as blocks of wood and large fish bodies to determine community change and behavior in response to organics. As expected, different disturbances result in differential changes in populations, dynamics and responses.

At the same time Sandy Hook Laboratory, National Marine Fisheries Service (NMFS), conducted cruises to investigate benthic community structure at the Deepwater Dumpsite 106; samples from the site, located in 2 000 m of water, as well as from other uncontaminated locations in similar water depths, were analysed. Papers based on the earlier cruises to this site were published. There was no indication that dumping of industrial wastes had impacted deepwater benthic resources.

The Woods Hole Laboratory of the National Marine Fisheries Service (NMFS) is carrying out a quantitative survey of macrobenthic invertebrate fauna of the continental shelf and slope along the east coast of the United States. Samples were taken in the 1960s throughout the entire region extending from Nova Scotia, Canada, southward to Florida; water depths sampled ranged from 3 to approximately 4 000 meters. This sampling was conducted in cooperation with the US Geological Survey and the Woods Hole Oceanographic Institution. Bottom sediments from the same samples were analysed for numerous geological properties, however those most important for our purposes were the grain-size composition and organic content. Relationships of these parameters to the kinds and quantities of benthic animals are being studied. Because of the wide north-south range in geographic coverage of the sampling area, the faunal differences associated with latitude are discernible. Of special interest in connection with this series of samples

is that biomass (damp weight) of the fauna was determined in addition to the numerical density. All samples have been processed and present efforts are devoted to analysing the data, primarily for the purpose of determining geographic and bathymetric distribution associated with bottom sediment composition, and the inter-relationships between various faunal groups or species.

Several institutions continued their investigations of benthic communities in the Middle Atlantic Bight. Research conducted by Virginia Institute of Marine Science (VIMS) focused on the continental shelf and slope of the Middle Atlantic Bight and the Chesapeake Bay estuarine system. Offshore research included studies of the distribution, sediment relationships, and community structure of bottom feeding fishes, large invertebrates (captured by dredge), macrobenthos (sampled by grab), meiobenthos and foraminifera. The existence of a unique shelf break community was discovered. The distribution of benthos on the continental shelf was found to be a mosaic response to the complex topography of the shelf. Communities of macro- and meiobenthos in topographic swales are very distinct from those on ridges and the more exposed coarser sand bottoms.

Research on Chesapeake Bay macrobenthos was continued by VIMS scientists, focusing in the lower York River estuary. Studies of the long-term dynamics of mid-bottom macrobenthic communities continued. Other investigations documented the effects of petroleum contamination of sediments near an oil refinery on the macrobenthos.

Personnel of the Sandy Hook Laboratory, Northeast Fisheries Center, NMFS, worked up historical (1974) benthic samples collected from stations on the mid-shelf off New Jersey and Delaware as well as from stations in the near shore area off the New Jersey coast. These samples are providing important benthic data to be used in multivariate analyses to relate benthic community structure to sediment type, heavy metals in sediment and other factors. The data and analyses provide a benchmark for more recent benthic studies in areas proposed for oil development. NMFS scientists also continue to collect benthic samples from the solid waste (sludge and dredging spoils) disposal areas in the New York Bight Apex. Data resulting from almost a decade of benthic research in the Apex were incorporated into several published major data reports and papers. NMFS personnel also conducted significant experiments concerned with seabed respiration to determine: 1) the relative importance of various components of the benthos in using oxygen from overlying waters, 2) the relationship between organic loading of the benthos and oxygen uptake, and 3) the effects of high water column productivity on benthic community metabolism.

The College of Marine Sciences, University of Delaware, conducted studies in Delaware Bay and the Middle Atlantic Bight off the Bay as well as on Georges Bank. Studies in Delaware Bay emphasized seasonal changes in feeding types of benthic organisms. It was found that finer sediments were dominated seasonally by deposit feeders; coarser sediments contained both deposit and suspension feeders. Delaware personnel were also involved with an investigation of seasonal fluctuations of benthic assemblages at sites proposed for large ocean outfalls for waste. Specific species were studied to determine their possible significance as important indicators of environmental change.

The effects on the benthos of severe hypoxia (low dissolved oxygen) which occurred on the inner shelf off New Jersey were investigated by VIMS and the NMFS and the recovery process was followed. Populations of echinoderms and crustaceans were virtually eliminated in areas which had experienced the anoxia in 1976. Although

some species of mollusks and annelids were affected, other species survived. VIMS scientists reported that species with planktonic larvae quickly recolonized in affected areas, but those without planktonic dispersal, particularly the peracarid crustaceans, i.e., amphipods and isopods, had not recovered after one year. Other species, including two polychaetes and a cerianthid anemone, occurred opportunistically after the disturbance. Recovery from the disturbance was also investigated by VIMS by following recruitment in azoic sediments placed on the outer shelf. Surface dwelling macrobenthos, including the diverse populations of tube-dwelling amphipods, repopulated within a few weeks but repopulation by more deeply burrowing forms lagged. The opportunistic Capitella capitata, which usually is not found in the area, established quickly in the azoic sediments.

Experimental research on benthic populations in the field and laboratory has been emphasized by personnel of the US Environmental Protection Agency (EPA), Environmental Research Laboratory, Narragansett, Rhode Island (ERL-N). The ERL-N Marine Ecology Research Laboratory (MERL), together with an inhouse ERL-N study on microcosms, is attempting to duplicate real ecosystem stresses in small and mid-scale, experimental enclosed estuarine systems. Operated by a multidisciplinary, multi-institutional consortium, MERL has spent most of this year implementing and testing the systems for accurate representation of physical, chemical and biological phenomena.

CEAS (Coastal Ecosystem Analysis Survey), initiated this year by ERL-N, was designed to integrate closely with the National Marine Fisheries Service's Ocean Pulse Programme. It traces pollution effects upon benthic biota and sediments from the headwaters of an estuary out to the open ocean, and has direct application to domestic and industrial waste disposal permitting activities of EPA as well as dredging and filling permits issued by the Army Corps of Engineers.

During 1977 the Northeast Fisheries Center implemented its new environmental assessment programme, Ocean Pulse. This programme is designed to integrate and coordinate the coastal and marine environmental assessment activities of NMFS with those of other Federal agencies and universities. The Ocean Pulse Programme emphasized extensive cruises during which physiologists, biochemists, pathobiologists, geneticists, benthic ecologists and behavioral scientists perform standard measurements at selected sampling strata. The sampling strata include benthic areas known to be heavily impacted by contaminants as well as portions of the shelf that are pristine or relatively free of pollution. Three Ocean Pulse cruises have already been conducted to the Deepwater Dumpsite 106 located approximately 175 kilometers seaward from New York Harbor. Data from these cruises are being worked up for reports and publications.

USSR

(A Nyman)

In spring-summer 1976 plankton was collected in the southwestern Barents Sea and in the waters of northern Norway and in 1977 an analysis of them was made.

The material collected for many years on phytoplankton, zooplankton biomass and feeding of the Barents Sea capelin were generalised. 216 phytoplankton, 1 884 zooplankton and 423 euphausiid samples were collected. A quantitative-weight analysis of the feeding of 362 specimens of cod fry and 700 specimens of the adult Polar cod was carried out.

On the basis of analysis of the material collected in 1971-1977 a list of the phytoplankton species (143) observed in the Barents Sea was compiled.

The relationships between spring plankton biomass and water temperature and also between summer plankton biomass and survival index of the pelagic young cod were investigated in the course of a study of feeding, biological indexes and survival of the Barents Sea 0-group young cod of the 1976 year class.

Winter survey of euphausiid stock in the Barents Sea gave an opportunity to evaluate in advance the abundance and locations of euphausiid concentrations - the most important feeding object of fish in the summer period.

In 1978 the plankton investigations in the Barents Sea will be continued according to the previous programme.

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(Netherlands Institute for Sea Research)

The series of measurements of microphytobenthic primary production on a tidal flat in the western Wadden Sea is by now the longest known. Especially the large annual variation is an interesting aspect of this series. Measurements of primary production of phytoplankton in high-tide water in the western Wadden Sea have now been done for several years.

In the last few years the production and consumption of phytoplankton before, during and after the spring bloom of the southern North Sea received much attention. This year a number of cruises was made in June and July in the Southern Bight to study the weekly fluctuations in the plankton during the summer. A new development in this program was the introduction of thin-layer chromatography for the analysis of chlorophylls and their degradation products. Occasionally, high concentrations of chlorophyll allomers were found, which signifies that bacteria were main consumers of the primary summer production. An estimate of the mean primary production during one year can now be given for the eastern part of the Southern Bight: 200-250 g $C\ m^{-2}\ year^{-1}$ (particulate plus dissolved organic matter).

The distribution of all zooplankton species in the Southern Bight of the North Sea in 1973 and 1974 was mapped. In 1973 secondary production by zooplankton was highest in an area within 30 miles off the Dutch coast ($45\ g\ C\ m^{-2}\ year^{-1}$). The possible influence of carnivorous zooplankton (fish larvae, hydromedusae) on the populations of herbivores was investigated. The first simulation runs with the newly-developed ecosystem model SIMPEL (simulation of the dynamics of a pelagic ecosystem) have been discussed.

As to studies of the benthos in the southern North Sea: the distribution pattern of the bottom infauna was mapped between Den Helder-Hoek of Holland and 50 miles off the Dutch coast. A few species were followed in their growth, mortality and abundance. The most instable but also in biomass the most important community was found along the coast, and varied in productivity between 0 and 30 g Ashfree Dry Weight.

In the autumn the euphotic zone of the North Equatorial Current of the Atlantic Ocean was investigated with special emphasis on stability, vertical

structure, diel variations and rate processes within the plankton compartment of the pelagic ecosystem. At a number of stations on an east-west section from the African coast to mid-Ocean the activity of the electron transport system (ETS) was estimated, primary production was measured in situ, detailed vertical profiles of chlorophyll were obtained with a VarioSens, and zooplankton was sampled with a plankton torpedo. Of course, hydrographical, physical and chemical characteristics of the area were studied as well. The trophic relations of the pelagic system appeared to be complicated, most primary producers being no larger than 1 mμ. Near the bottom of the euphotic zone a chlorophyll maximum was found, consisting mainly of degradation products at the most western oceanic stations. Here the heterotrophic activity was much lower than at the station close to the African mainland. The contribution of zooplankton to the total potential respiration activity of heterotrophs was probably less than a few percent.