

SHELLFISH AND BENTHOS COMMITTEE

by F. A. Gibson

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MOLLUSCA AND BENTHOS

Belgium

(R. De Clorck)

Mollusca and Benthos

Research surveys on the formation of mussel beds along the Belgian coast were continued.

Canada

(D. G. Wilder)

Ostrea edulis and Crassostrea virginica

Mortalities of 0-100% apparently due to low salinities occurred in stocks of adult Ostrea edulis introduced to Ellerslie, Prince Edward Island in 1969. Release of larvae by two year old O. edulis began 30 June at 18°C and continued through July and early August. Three million larvae reared in the hatchery began to set 9-10 days after release. Spat set on shell and reared in suspension survived and grew well, averaging 16 mm in late fall. A light natural set of O. edulis occurred on commercial collectors in Malpeque Bay, P.E.I. Growth was excellent, spat averaging 24 mm in November, about 50% larger than Crassostrea virginica spat of the same age.

Approximately 3 000 Ostrea edulis spat were transferred from Prince Edward Island to Newfoundland to assess the suitability of this species for introduction on a commercial scale. These oysters of Dutch origin were imported from Maine, U.S.A., and reared under quarantine in Prince Edward Island.

Lipids of the American Oyster (Crassostrea virginica) and the European oyster (Ostrea edulis) grown in the same area differed only slightly and apparently are not species dependent. Twelve sterols were identified, cholesterol forming 25% of the total.

Preliminary results of studies to determine the nutritional requirements of oysters indicated that marine oils are a better source of lipids than corn oil and that a high carbohydrate diet gave best results compared to other synthetic diet.

Mya arenaria and Macoma baltica

Samples collected hydraulically in northwestern Newfoundland from low to high water marks showed a fairly low abundance of Mya arenaria and Macoma baltica, the only species encountered. Prospects for commercial digging seem poor.

Arctica islandica

Scuba studies show dense stocks ( $20-40/n^2$ ) of large (60-90 mm) old ocean clams off southwestern Nova Scotia. Growth in the Bay of Fundy is slow and affected by experimental handling. A commercial fishery, which began in July 1970, landed 950 metric tons of whole clams in 1971. Studies on sandy bottom with scuba and submersibles showed that a simple, non-hydraulic toothed dredge caught less than 1% of adult clams and killed 80% of the uncaught clams in its path. Hydraulic dredges caught more than 90% of the clams encountered.

Placopecten magellanicus

A survey of landed meat sizes showed that Georges Bank fishermen are continuing to fish small scallops. Up to 200 meats per kg were found in some samples corresponding to scallops 65-70 mm in diameter.

A scheme for managing the heavily exploited inshore Bay of Fundy fishery involves closure of the fishery when the catch per unit effort falls below a specified level.

Studies of an offshore dredge using underwater photography suggested that about 15% of the scallops in the path of the dredge were captured. With mesh covers over the dredge, recaptures of tagged scallops indicated that 1/3 of the scallops entered the dredge and about half of these escaped, mainly through inter-ring spaces. The 50% selection size was calculated to be 87.5 mm.

Inshore and offshore dredge tracks were recognizable from a submersible and both dredges roughened the bottom, dislodging buried boulders up to 40 cm in diameter. These preliminary observations suggest that about 17% of the uncaught scallops in the track are lethally damaged. There was a pronounced aggregation of predators and scavengers in the track.

The post-mortem accumulation of hypoxanthine in scallop muscle is highly correlated with organoleptic evaluation of ice-stored meats, indicating the potential of hypoxanthine content as an index of quality. In the scallop, the more important digestive process is glandular whereas in oysters, soft-shelled clams and mussels, non-glandular digestion plays a more important role.

Cephalopoda

Total landings of squid (Illex illecebrosus) during 1971 were 1 600 metric tons, considerably higher than in 1970 but far below average. Size distributions, growth, maturity and parasites were monitored through the season. The total catch in 58 otter-trawl sets off southern Newfoundland and Nova Scotia was only 2 100 squid. Of 402 squid tagged with a small metal clip tag, 18.7% were returned from the area of tagging, nearly all within 2 days.

Denmark  
(E. Smidt)

*Nya arenaria*

A population investigation of the soft clam in Roskilde Fjord was finished in 1971.

Finland  
(J. Lassig and P. Bagge)

Institute of Marine Research. The quantitative study on the bottom fauna in the seas around Finland which was started in 1961 in accordance with an ICES recommendation in Moscow 1960, was continued in June and July on standard stations. A number of reference stations were visited in the southern Baltic. The number of stations sampled was about 100.

In cooperation with the Finnish IBP-PII and Tvärminne Zoological Station, studies on benthic macrofauna were continued at 5 standard stations in the archipelago of Tvärminne. The stations were sampled in May and August.

The benthos of polluted Finnish coastal areas was studied at about 80 stations in August. This work is connected with the environmental studies of the Institute.

The tolerance of benthic invertebrates to different concentrations of ferrous sulphate was studied experimentally at Tvärminne Zoological Station.

Tvärminne Zoological Station, University of Helsinki. Items of study : a) Mesidotea entomon (Isopoda): The effect of oil and oil emulsifiers was studied experimentally. Ecological studies on this species were continued. b) Harmothoe sarsi (Polychaeta): Ecological studies were continued. c) Lamellibranchs: Studies on the reproductive cycle were continued. d) The uptake and elimination of Pb and Po in benthic organisms were studied. e) The macrofauna was studied in the harbour of an iron mill in the vicinity of Tvärminne Zoological Station.

Archipelago Research Institute, University of Turku. Studies on the ecology and abundance of macrobenthos were continued at about 20 localities near the Island of Seili/Själö.

France  
(L. Marteil)

Hûîtres. La reproduction d'Ostrea edulis et de Crassostrea angulata a bénéficié en 1971 d'excellentes conditions climatiques; l'évolution des larves et leur fixation ont été très satisfaisantes.

l'hûître dite "japonais", C. gigas, s'est également reproduite dans les secteurs français du sud de la Loire (Marennes-Arcachon). Le processus

s'est déroulé aussi bien chez les huitres élevées depuis 1969-1970 que chez les sujets adultes importés de Colombie britannique (Canada) en mai-juin 1971, immergés sur d'anciens bancs naturels de C. angulata. D'importantes fixations de larves ont eu lieu; la croissance et le taux de survie ont été satisfaisants jusqu'à la fin de l'année 1971. Il semble que des températures estivales particulièrement élevées et une chute exceptionnelle des salinités aient favorisé la ponte et l'évolution des larves de C. gigas.

La "maladie des branchies" est restée stationnaire chez les huitres portugaises françaises; on n'observe plus d'altérations graves en proportions notables comme auparavant. En revanche, l'aggravation constatée, à l'arrivée, dans l'état des branchies des huitres importées du Portugal a conduit à interdire leur élevage en France; seules, les huitres de consommation ont pu être introduites pendant une courte période.

La mortalité qui avait massivement frappé certains élevages de C. angulata en 1970 s'est étendue à tous les secteurs pendant le premier semestre 1971. Elle a nettement régressé en août et la croissance, arrêtée depuis plusieurs mois, a repris chez les sujets survivants. Bien qu'on ait pu établir une relation entre la mortalité et un dérèglement du cycle sexuel, les causes de ce phénomène ne sont pas encore connues. Les examens pratiqués en microscopie photonique et électronique n'ont jusqu'ici donné aucun résultat probant. Ni les huitres plates et japonaises ni les moules élevées dans les mêmes biotopes n'ont été touchées par cette mortalité.

Les études sur l'organisme parasite, responsable de la mort d'Ostrea edulis dans certains secteurs littoraux, ont progressé. Les examens effectués en microscopie électronique ont montré que les corpuscules isolés en 1970 présentaient des analogies avec certains organites ou avec des particules virales, notamment avec celles observées chez les crustacés.

Pecten maximus. L'étude des gisements des côtes bretonnes a été poursuivie. En rade de Brest, les groupes d'âge 2, 3, 4 et 5 prédominent, tandis que dans la région de Belle-Ile, où l'on note une légère amélioration du stock par rapport à 1970, ce sont les groupes 1, 2 et 3.

#### Germany

(K. Tiems)

#### Mytilus edulis

Routine investigations on the growth and quality of wild and cultured mussels and on their infection rate with Mytilicola intestinalis, Modiolicola insignis and Cercaria have been continued at the Institut für Küsten- und Binnenfischerei. Experiments on the raft culture of mussels were continued in the western Baltic (Flensburger Förde) at the same Institut and initiated at the Institut für Meereskunde in heated water effluents of a power station in the Kiel Bight.

#### Oysters:

Raft culture experiments with Ostrea edulis and Crassostrea gigas were initiated in the Wadden Sea off the isle of Sylt at the Institut für Küsten - und Binnenfischerei.

Cockles:

Cockle beds along the coast of Niedersachsen were surveyed by the Institut für Küsten- und Binnenfischerei.

Benthos:

The Biological Station Heligoland continued its sampling of benthic communities on special stations in the North Sea with the aim to study changes in species distribution and dynamic aspects of the eco-system.

The Institut für Meeresforschung at Bremerhaven has continued its study on the distribution of microbenthos in the southern North Sea with special emphasis on nematodes, fungi and bacteria.

The development of benthos communities were studied in a brackish water pond at the Institut für Küsten- und Binnenfischerei.

The Institut für Meereskunde continued its studies on the importance of benthos communities for the fish population of the Kiel Bight.

Iceland

(H. Eiríksson)

Chlamys islandica

A February survey revealed that Iceland scallops were abundant in many fjords in northwest Iceland. Up to 200 kg of live scallops were caught per five minute's tow at depths ranging from 16-52 m. Surveys in June - August also showed the existence of Iceland scallop grounds in north and northeast Iceland where catches reached 150 kg and 80 kg respectively per tow.

Proposed research work for 1972/73 will include further exploratory surveys, underwater photography of scallop grounds and tagging programmes. Sampling will also be continued with particular reference to age, growth and maturity. The collection of catch/effort data is already under way.

Ireland

(F.A. Gibson)

Escallops (P. maximus). Investigations of the escallop stocks off the east and south coasts of Ireland were continued in 1972, regular sampling being made of catches and research vessel cruises were undertaken. An unfished escallop stock was located off the south east coast. At the end of 1971 it had yielded some 2 million escallops and at time of reporting, catches were 3 000 to 4 000 per landing.

A research vessel survey along the 29-31 fathom line, which includes a large area from Hook Head to Mine Head, produced evidence of the presence of a developing stock; only a few of the scallops caught were over 3+ years and by far the greatest number were in the 1+ and 2+ categories.

Queen (Chlamys opercularis). A commercial concentration of queens was located in Galway Bay in June 1971. It covered an extensive area but the substrate being rough and hazardous, caused extensive damage to fishing gear. From June to October, about 102 tons of queens (size range 55 to 60 mm) were caught. These were smaller than east coast individuals which ranged from 65 to 80 mm landed.

Cockle (Cardium edule). Preliminary surveys of cockle beds were carried out at two bays in 1971. The first of these, Dungarvan Bay on the south coast, provided evidence of a limited stock, which at present offers no prospect of commercial exploitation. This bay is subject to considerable industrial pollution. The second bay, at Dundalk on the east coast, provided evidence of a somewhat larger stock of good quality cockles. An area of some 500 hectares was estimated to contain at least 1 000 tons of cockle biomass of which between 500 and 600 tons are commercially valuable at present.

Mussels (Mytilus edulis). Work continued with respect to growth rates of mussels in the chief Irish mussel fishing centres. Mussel culture studies were continued using rafts, net bags and bouchots, and including the use of Norwegian net bags with promising results.

Various areas of the south west coast were surveyed for mussel stocks and for their possible potential for mussel farming.

A comprehensive survey of parasites of mussels was undertaken. The growth in the mussel industry has increased from 757 tons valued at £ 7 600 in 1966 to 4 280 tons valued £59 000 by 1971. A thesis on the feeding, growth and reproduction of mussels was completed in 1971 and it is hoped to publish this in another form in the Irish Fishery Investigation series.

Oysters (Ostrea edulis). Investigations of the oyster stocks at Tralee and Clarinbridge were continued. After the poor spat settlement reported for 1970, the Tralee Bay oyster stock resumed its normal pattern of high intensity natural settlement in 1971. The spat fall at Clarinbridge in 1971 was about average. Detailed examination of Tralee Bay in 1971 showed an extensive biomass of young oysters, the product of the highly successful spatfalls of 1967, 1968, 1969 (in particular) and 1971. The 1969 year class is so abundant that it will form the mainstay of the fishery during the 1970's.

The initial success experienced by private oyster farmers with O. edulis seed from Norway, was not maintained in 1971. Growth rates fell and mortalities rose steeply, being as much as 50% in some cases. This question is being investigated.

Italy

No report received.

Netherlands

(P. Korringa)

MOLLUSCA

Oysters: Though the population of native Zeeland oysters increased steadily, the oystermen had to introduce a fair quantity of oysters for relaying from Brittany. The oysters showed good growth and fattening with very limited mortality. The water of the Oosterschelde was remarkably clean in 1971 and of a very constant salinity. This is ascribed to cutting off the communication with the big rivers by the Volkerak Dam. A certain quantity of Portuguese oysters for relaying was imported directly from the Sado estuary. The oysters showed good growth and survival during the summer months, but early in autumn mortality stroke. On an average about 40% of these oysters died, presumably by the same infectious agency, which caused havoc in the oyster areas in south-western France. The remaining oysters were apparently of good quality, but lower water temperatures in the second part of the summer had prevented them to spawn, which influenced the flavour of these oysters unfavourably.

Mussels: Great activity was displayed by the experimental station for mussel farming at 't Horntje on the Isle of Texel. Laboratory investigations carried out in the well-equipped aquarium rooms went hand in hand with technical experiments in the outdoor installation. Various factors associated with cleansing and storage of mussels were studied in detail. Oxygen and ammonia appeared to be factors which influence greatly the physiological condition of the mussels kept in the installation. Many consignments of mussels treated in the installations of the experimental station were led to the usual channels leading to the market. It appeared that the market at home and abroad accepted these mussels without any difficulty. They appeared to be more free of sand and silt than those which had passed the usual natural cleansing plots at Yerseke. Moreover, the mussels thus treated retained the water between their valves sufficiently long to enable them to reach the market alive. On the basis of these experiences it would be possible to design the large installation required for treatment of all mussels grown in the Netherlands. It is necessary, however, to continue the studies of the experimental station to define the minimum requirements for all factors involved, in order to avoid investment of considerably more money than is really necessary in the construction of the definite installation.

The analyses of oysters and mussels serving as basis for the certificates of cleanliness were continued in 1971; the certificates could be issued without exception. Now and then plankton samples were taken in the coastal water to study the possible appearance of blooms and dinoflagellates, taking into consideration the 1961 experience that

mussels from the Dutch waters can occasionally be harmful for the consumer. Apparently the plankton samples were not taken frequently enough for immediately after the opening of the season on 1 July complaints were heard about gastro-intestinal afflictions. No paralytic symptoms were observed. The market was immediately closed by withdrawal of the certificates and not opened again before laboratory experiments with white rats had conclusively shown that the danger had disappeared. This was the case early in August. Plankton investigations in the month of July revealed unusually large numbers of dinoflagellates such as Dinophysis acuta and Prorocentrum redfieldi. No conclusive evidence could be deduced about the role these organisms played in this case of mussel poisoning, but it is assumed that there are at least two substances produced by dinoflagellates which can be blamed for it, one has heat resistant properties and one is thermolabile. Plankton samples will be taken with greater frequency in the years to come and a system of chemical determination of the mussel poisons will be worked out to replace the elaborate rat technique.

#### Norway

(K. Gundersen)

#### Chlamys islandica

In 1971 the two southernmost findings of C. islandica were recorded in Fauskangerpollen and Lindåspollen, two landlocked areas near Bergen.

#### Chlamys opercularis

In 1972, the western coast of Norway will be surveyed for possible beds of Queens.

#### Mytilus edulis

The experiments with cultivation of mussels with net bags were continued in 1971. Experiments were started with sorting of spat with the intention to increase mean length and decrease the time needed for growth to marketable size.

In the autumn 1971, the first commercially cultivated mussels were processed. Due to very good quality, high prices were obtained. Unusual cases of food poisoning occurred in Norway in the winter 1970-1971. The symptoms were vomiting and diarrhoea. During 1971 samples of seawater and mussels have been taken.

Though the phytoplankton samples have not yet been examined in detail, it seems that the food poisoning is not due to blooms of toxic phytoplankton or sewage contamination. Tests with white rats have given no evidence upon the applicability of tests on the mussels in Norway. At present (1 March 1972), no explanation of the food poisoning can be given, but the group of haemolytical bacteria are under investigation. These bacteria have formerly been recorded in connection with food poisoning after consumption of mussels.



Ostrea edulis

In 1971, a production of 6 ton of one year old spat has not been sold and the producers are looking for new markets. In Norway, there are also interests for increased production of oysters for consumption.

CEPHALPODS

Todarodes sagittatus.

T. sagittatus is of commercial interest in Norway. Catches are very variable, from 10 000 tons a year to zero during short periods. The main habitats and spawning areas are unknown.

In September-November a few T. sagittatus were taken in the Faroe-Shetland area partly with bottom and pelagic trawls, partly with hook and line combined with light. Most of the individuals were immature with mantle lengths 19-36 cm. One female, mantle length 46 cm, had maturing eggs in the ovary. Males were in minority, constituting some 23 percent. In the same period, more than 300 metric tons of T. sagittatus were fished with squid hooks along the coast of north Norway. Representative samples from two localities were investigated. Mantle lengths varied from 23 cm to 35 cm, the average increasing from 28 cm in October to 30 cm in November. All individuals were immature, males constituting 10% in October and 5% in November. Fish usually dominated in the stomach contents, but were at times outnumbered by squid or krill. Other food items were polychaetes and amphipods. Species of fish identified from scales and otoliths were Trisopterus esmarki, Pollachius virens, Gadiculus thori, Maurollicus muelleri, Sebastes norvegicus and S. viviparus. T. sagittatus evidently turns to cannibalism when food is scarce.

Gonatus fabricii

Small specimens, mantle length 9-22 mm were taken in surface plankton hauls at st. M(66°N, 02°E) from January to June and in December. Beaks and a few specimens, mantle lengths 25-28 cm were taken from the stomachs of bottlenose whales, caught by Norwegian whalers near Labrador.

Loligo forbesi

A sample of 50 specimens, mantle lengths 19-50 cm; taken in bottom trawl off Western Ireland in March, was investigated.

In 1972 various species of squid will be sampled during the cruises of the research ships, especially north and west of the British Isles. Experimental fishing will be carried out from hired vessels in the Shetland areas during spring and along the coast of North Norway in October.

Poland

(L. Zmudziński)

We have carried out research work connected with benthos in the north-western Atlantic, south and middle Baltic and the Belt Sea. Our experiments were carried out at 150 biological stations.

Portugal

No report received

Spain

(H. Quiroga)

Oysters. Continuation of studies on the flat oyster (Ostrea edulis), the Portuguese oyster (Crassostrea angulata) and on the different settling substrata for oyster larvae; the growth and reproduction in several oyster beds along the Spanish coast. Culture experiments on oysters in the laboratory, using a recirculating system and in controlled environments have been effected.

Clams and cockles. Studies were made on the sedimentation and pollution effects on the mollusc beds in several localities on the north-west coast. The biology of clams, Venerupis decussata and V. pullastra has also been studied.

Mussels. The mussel culture is being studied in the delta of the Ebro river.

Cephalopoda. Studies were made on the biology and systematics of the different species from the Iberian coast.

Benthos

Studies were made on the different aspects of the repopulation of Gelidium sexquipedale beds from the north coast of Spain, with the object of industrial exploitation. The ecology of the weeds from the north-west coast of Spain were investigated as well as the specific diversity of different benthic ecosystems from the continental shelf.

Sweden

(B.I. Dybern)

An investigation has been carried out on the Mytilus edulis population density on soft bottoms, in a heavily polluted fjord, at the Swedish west coast.

Benthos

Soft bottom benthos is studied at 75-100 so-called "diagnostic stations" spread over big parts of the open Baltic and along the west coast. These stations will be investigated for several years in order to get indications on changes in the natural environment, e.g. by pollution. Hard bottom benthos is studied at some places on both the east and west coasts for similar purposes.

In about 10 areas benthos sampling is made in connection with investigations of the natural near-shore environment at places for present and future nuclear and other power plants, emitting warm water discharges.

United Kingdom

1. England and Wales

(P. R. Walne)

Cardium edule

During 1971 monitoring surveys of the three main cockle-producing areas - the Burry inlet (S. Wales), the Wash and the Thames estuary were continued. Spatfall in the Burry Inlet was poor, but the survival of the 1970 spat was excellent and large stocks of 2-ring cockles now form the basis of the 1972 fishery.

In the Thames estuary studies have been mainly concerned with the effects of hydraulic dredging on both the fishable and undersized cockle stocks. Results indicate that while this method of fishing cockles is very efficient, it can result in a large mortality of spat which become disturbed and washed out of the substrate if the grounds are continually fished.

Studies on a large unexploited stock of cockles on the Buxey Sands in the Thames estuary were continued during 1971. It has been estimated that approximately 235 000 cwt (12 000 tonnes) are of commercial size. Investigations showed that about 50 percent of the stock died last year, mainly because of the high density. Cockle stocks in the Wash were surveyed during the spring and autumn. The spatfall in 1970 was good, but nearly one hundred percent of it had died by the spring of 1971. A further spatfall occurred in 1971; those cockles surviving until the autumn of 1972 will form the basis of the 1973 fishery.

Mytilus edulis

The monthly recording of spatfall in Morecambe Bay was continued, and showed that the annual cycle in 1971 was similar to previous years. The heavy winter spatfall grew to 20-25 mm by the autumn, by which time one bed of 250 acres was estimated to carry 12 000 tons of seed. A major effort is being made to explore the methods by which this seed can be moved to more sheltered areas. Spat caught on coir ropes and transferred to a raft in the Menai Straits have attained a mean length of 38-42 mm and a yield of 10-12 kg per metre within 7 months. Experimental plots at low water of spring tides have given disappointing yields, probably due to excessive predation.

Ostrea edulis

Observations have continued in the River Fal (Cornwall) and in the east coast fisheries to determine spatfall. During 1971 spatfall in the River Fal was moderately successful, but on most east coast oyster grounds it was generally poor. The annual September stock survey in the River Fal showed the number of ring-sized (67 mm diameter) oysters in the fishery to be approximately the same as in 1970, indicating another fairly poor season during 1971/72. However, an increase in the number of brood oysters was recorded and catches in this fishery are likely to improve in the near future.

Surveys have been made of a recently located stock of oysters in Stanswood Bay in the Solent (south coast). A population of at least 10 million oysters is estimated to be present in this area. Some 80 percent of this stock appears to have resulted from a heavy spatfall in 1970, most of the settlement occurring on Crepidula fornicata which is very abundant in this area. A light spatfall also occurred in 1971.

#### Crassostrea gigas

Experiments to assess the effects of varying degrees of tidal exposure on the growth of C. gigas spat were made in the River Roach (Essex) and Anglesey (N. Wales). In the early summer batches of 50 spat were planted in trays on the shore at approximately 80-100% immersion and 85-98 at the two sites respectively. 0.4 g spat were used in the River Roach and 1.5 and 4.0 g in Anglesey. The oysters were examined after 3 months in R. Roach and 8 months in Anglesey. At both sites there was a positive correlation between the time of immersion and shell growth but meat yield did not follow the same pattern as there was little difference in the final dry weight of meat in spat immersed for 90-100% of the time.

#### Pecten maximus and Chlamys opercularis

Surveys were made of stocks of Pecten in the eastern area of the English Channel early in 1971. One area was located where catches of up to 50 market size scallops were taken in dredge hauls of 30 minutes duration. Following this survey a Newhaven vessel exploited this stock with satisfactory results.

Exploratory surveys for Chlamys opercularis were carried out along the east coast of England in the Wash and off the Humber estuary. No stocks of commercial value were located in these areas.

#### Predator control

Experiments were started to test the effectiveness of "Sevin" insecticide (active ingredient 1 Naphtyl N nethyl carbonate) as a control agent for green crabs, Carcinus maenas. This was considered to be a possible method for protecting small clams (Mercenaria mercenaria and Venerupis decussata) which had been reared in hatcheries. The initial results suggest that very localised control of crabs can be obtained by the use of "Sevin". However, it was found that trays protected with the usual commercial mesh of 4 x 4 mm could become re-infected by crabs smaller than 4.5 mm carapace width. These small crabs entered the trays after the initial treatment and sometimes caused considerable mortalities before the next application of "Sevin".

2. Scotland

(H.J. Thomas)

Mytilus edulis

Observations on the settlement and growth of mussels cultivated on ropes were continued in several sea lochs on the Scottish west coast. Experiments were undertaken on the control of ascidians fouling mussel ropes. The occurrence of Mytilicola was further studied. Various shellfish were examined for bacterial and other contaminations.

Pecten maximus

Observations on the abundance and growth of Pecten maximus were continued.

Chlamys opercularis

Catch effort and composition data were obtained for the commercially exploited stocks. Studies were pursued on the settlement and growth of queens. Comparative fishing experiments were undertaken to test the efficiencies of a variety of gears in the capture of scallops and queens.

Loligo forbesii

Data on the commercial landings and catch composition of squid were maintained.

BENTHOS

Food Chain Studies

Long term studies of prey-predator relationships on a flatfish nursery ground have continued. These involve regular assessments of the available fish food, and of the structure of the flatfish populations. This work is leading to the formation of hypothesis about the mechanisms which control flatfish recruitment.

Studies are being carried out at the same time on the food chain of a nearby muddy ground at a depth of 30 m. Particular attention was paid in 1971 to the fall out onto the bottom as a result of primary production and the grazing of planctonic herbivores.

Coastal survey

A final evaluation has been made of surveys of 22 sandy beaches. Their potential as plaice nursery grounds has been assessed and the range of biomass determined.

U.S.S.R.

(A.S. Bogdanov)

In 1971 investigations on the biology and distribution of cuttlefish were carried out off the coast of north-west Africa. The benthos survey of the Barents Sea was made (500 stations).

CRUSTACEA

Belgium

(R. De Clerck)

Analyses of consumption shrimp landings were carried out and catch per unit data were collected.

A special study has been started on the length composition of shrimps by means of research vessel catches. An attempt was made to shrimp-forecasting on the Belgian coast.

Regular shrimp surveys along the Belgian coast were also continued.

Canada

(D.G. Wilder)

Homarus americanus

In the seaweed zone of St Margaret's Bay, Nova Scotia, the seaweed production is an order of magnitude greater than the food consumption by herbivores (sea urchins) and the herbivore production is an order of magnitude greater than their consumption by lobsters. In many areas dense populations of sea urchins have eliminated large seaweeds. This imbalance which leads to a loss in primary productivity, may be a consequence of reducing the lobster population below a critical density.

The artificial induction of the bactericidin in lobster hemolymph confers no protection against Gaffkya homari the causative agent of blood disease. The most effective antibiotic tested in vivo is vancomycin, given in small doses prior to infection.

The complexity of the hormonal central mechanism of moulting in lobsters is illustrated by the fact that treatment with ecdysterone induces apparently normal preparation for ecdysis but most animals die near or during the attempt.

Study of the so-called Y-organ of Homarus indicates that this is actually the mandibular organ - a recently described structure of unknown function. Preliminary results indicate a role in the female sexual cycle but do not rule out a secondary role in moult control.

A previously undescribed ciliate parasite has been discovered in the blood of lobsters. Incidence of infection among stored animals was associated with shell disease but the parasite can be cultured in healthy lobsters and has been transferred to the crab Hyas araneus.

Experiments in pens, hatchery and restricted sea basins demonstrated that Atlantic lobsters survived, grew and reproduced in Pacific waters but failed to establish a brood stock, principally because seedlings were too small and larvae were dispersed by flushing. The prime requirement for success is an adequate brood stock in an area where the larvae will remain and be recruited to the parent stock.

The effects that raking for Irish moss has upon lobsters in the Prince Edward Island area differ regionally in relation to underwater topography. Where the bottom is mostly flat bedrock, damage to lobsters is negligible. Where moss beds are predominately on boulder bottom, moss rakes may kill up to 5% of the lobsters in their path.

In 1965, an artificial reef was constructed of quarry rock for lobsters in Northumberland Strait. The standing stock of lobsters in 1971 was 25 kg per hectare - about 20% higher than that on best natural lobster grounds in the area.

Sediments and fauna from Chedabucto Bay show little diminution in Bunker C oil content in the 12 months following the wreck of the Tanker "Arrow". Some carnivorous species are assimilating and partially metabolising Bunker C oil.

Satiated male and female hard-shelled lobsters are moderately attracted to water in which newly moulted lobsters of either sex are held. Of the 16 amino acids in lobster urine only proline and glutamic acid elicit walking responses at low concentrations. Lobster antennules have one type of receptor that responds to L-hydroxy proline and another that responds to L-glutamic acid. Another type in the male antennule responds to urine from moulted females but not to amino acids or ecdysterone. Lobsters do not respond to water from tanks containing live starfish, sea urchins, blue mussels, clams or crabs nor to sea water extracts of crushed starfish or sea urchins. Sea water extracts from mussels, clams and crabs were highly stimulating.

Swordfish fishermen displaced because of mercury in swordfish flesh were permitted to fish lobsters with traps more than 50 miles from shore on a one-year trial basis. Five Canadian vessels landed over 110 000 kg in five months' fishing from the continental slope in the vicinity of Lydonia and Hydrographer Canyons. Offshore trap-caught lobsters range in weight from 0.1 to 11.0 kg and average 1.4 to 2.3 kg.

#### Chionoecetes opilio

The snow (queen) crab fishery which started in the mid-sixties expanded rapidly to peak landings of 8 300 metric tons in 1969; landings declined to 6 600 tons in 1971. The densities of crabs in Placentia Bay and Conception Bay, Newfoundland, as indicated by bottom photography were 0.35 and 0.45 crabs/100m<sup>2</sup> respectively. About 6% of the crabs photographed in Placentia Bay were of commercial size.

#### Denmark

(E. Smidt)

#### Home waters

Pandalus borealis. Research work was undertaken in the North Sea, especially on the Fladen Ground, in March-April.

Crangon crangon. Preliminary investigations were made on by catch of young flatfish in the Crangon fishery in the Danish Waddensea.

### Greenland waters

Pandalus borealis. Offshore investigations at West Greenland were continued by echo soundings and trawling experiments. Off Umanak district a new prawn field was found (length ca 60 miles, width ca. 10 miles, depth 580 - 600 m) which is hitherto the greatest known at Greenland. Soundings and trawling experiments were also made west of Store Hellefiske Bank and off Frederikshåb, but with poor results.

Chionoecetes opilio. Preliminary experiments with crab traps in in-shore waters at Godthåb were initiated in 1971.

### Programme for 1972

Offshore Pandalus borealis investigations in the Davis Strait will be continued, and more systematic inshore fishing experiments with crab traps for Chionoecetes opilio are planned.

### France

(L. Marteil)

L'étude des stocks de crustacés peuplant les cantonnements et les secteurs non protégés des côtes françaises a été poursuivie en 1971. La croissance, la reproduction, les déplacements de Homarus vulgaris, Maia squinado et Leander serratus ont été observés.

Des recherches ont été effectuées sur les maladies affectant Homarus vulgaris, Homarus americanus et Cancer pagurus.

### Germany

(K. Tiews)

Crangon crangon. 1) Investigations of the Institut für Küsten- und Binnenfischerei to assess the shares of undersized protected fish in the catch of the German shrimp fishery and the fluctuations in the abundance of fish species found on the shrimp fishing ground were continued. A total of 245 samples (= 2 225 kg) of unsorted catch of the shrimp fishery were collected in Büsum, Cuxhaven, Neuharlingersiel, Dornumersiel and analysed as to their species and length composition.

2) Investigations on the distribution of shrimp larvae along the German coast were continued. Samples were taken also during the winter months at a large scale.

Lobster. Rearing and crossing experiments with lobsters of different origin were continued by the Biological Station of Heligoland as well as stock assessment work on the lobster population of Heligoland.

Pandalus sp. Samples of deep-sea prawn catches made by a commercial fishing boat and on the occasion of a research cruise of RV "Friedrich Heincke" in Farn Deep's area and on the Fladen Ground were analysed as to their species and length composition at the Institut für Küsten- und Binnenfischerei.



Programme for Shellfish- and Benthos Research in 1972

Crangon crangon. Catch assessment work to determine the composition of shrimp catches by species and length will be continued at the Institut für Küsten- und Binnenfischerei.

Pandalus sp. Research on the composition of Pandalus catches made by RV "Friedrich Heincke" in the North Sea will be continued.

Cockles. Survey work on the size of the cockle population along the German North Sea coast will be continued.

Iceland

(H. Eiríksson)

Nephrops norvegicus. Routine data on Norway lobster landings, catch/effort and catch composition were maintained. 2 832 Nephrops were tagged in September at south-west Iceland.

In 1972/73 research will be carried out along similar lines as before. However, increased emphasis will be laid on tagging Norway lobster and to the problem of undersized whitefish in the catch, especially haddock.

Pandalus borealis. Sampling and collecting of catch/effort data was carried out in the same manner as before.

February, May and November surveys revealed new Pandalus grounds in Beruffjördur, east Iceland, in Djúpáll off the north-west coast and in Jökuldjúp, west Iceland. In the first area exceptionally big catches were obtained, or up to 3 300 kg per 20 minutes tow. The area is however, not expected to support a large fishery due to its limited size. In Djúpáll and Jökuldjúp catches of respectively up to 320 and 600 kg/hour were obtained.

Experiments with mainly two types of selective trawls were continued to find a way of minimizing the by-catch of young cod and haddock in the prawn fisheries.

Experiments were carried out at sea on an Icelandic designed prawn sorting machine. Sorting of small prawns seemed to be effective and a high proportion of these were returned to sea alive.

Large scale tagging was initiated by tagging 8 000 prawns at north-west Iceland. The tag used was the plastic disc - silver wire type described by Tiews.

In 1972/73 research will be continued along similar lines as in 1971 with increased emphasis on tagging and probably deep-water surveys.

In addition to further trials with selective trawls, experiments are planned with mid-water trawl for catching prawns.

Also increased hydrographic observations are planned on the north-west prawn grounds.

Ireland  
(F.A. Gibson)

Lobster (Homarus gammarus). Information concerning catch and effort in the lobster fishery continued to be collected. Initial work on the requirements of lobsters in storage showed that rates of water flow are critically important and also that very rapid accumulations of ammonia in re-circulation conditions occur.

A thesis on gonadal development in lobsters was completed in 1971 and a version of this will be published in the Irish Fishery Investigation series.

Crawfish (Palinurus elephas). Full scale work on this species was resumed in 1971, beginning with a study of the winter trap fishery off the south-east coast. Of the specimens examined, 87% were females and of these 94% carried bright orange ova with no sign of eye.

An extensive research vessel cruise off the south coast in June failed to reveal phyllosoma larvae.

Routine adult crawfish measurements were made at various ports and storage pounds along the south and west coasts. During late May and early June, over a wide area of the south-west and west coasts, a very heavy fishing produced unprecedentedly large number of soft shelled crawfish. These were easily damaged in transport and in storage pounds, leading to heavy losses. At first the losses had been attributed to crawfish shell disease, but examination proved that the massive concentrated moult was responsible. Samples of diseased crawfish sent for examination to the Portsmouth Polytechnic, provided inconclusive results. Bacterial infections may have been of secondary nature following damage to soft shells. The occurrence of the "Disease" was noted to dwindle during the summer and by the autumn of 1971, its symptoms were very rarely seen.

In December 1971, experiments were commenced to monitor the oxygen requirements of crawfish of a large range of sizes under varying conditions of temperature in storage pound conditions and this work will continue in 1972. A large scale tagging programme will be undertaken in 1972 following successful trials with a plastic arrow tag inserted between the second and third abdominal segments. Toggle tags were also used and it is possible that these may be more successful with small crawfish than when inserted into the suture.

Crabs (Cancer pagurus). Crabs were tagged and released off the north-west coast, but only one was reported to have been recaptured by the end of 1971.

Dublin Bay Prawns (Nephrops norvegicus). Studies were continued in 1971, including commercial sampling, research vessel surveys, townet larval surveys, laboratory rearing of larvae and sub-aqua diving to study Nephrops in its natural environment.

Work was commenced on estimations of age based on nodes. The variance in each possible year class is so great that ageing is proving very difficult.

Larval surveys carried out in April, May and June showed that larvae appeared to be scarcer in 1971 than in 1970.

In the laboratory, three females held in aquaria, hatched and from them 50 larvae survived, many of them deformed, but a few were healthy and one of these survived the fourth post-larval stage. This has been rarely achieved in captivity before.

Juvenile and adult Nephrops were maintained in captivity to observe moult and growth rates. Five specimens of possible ages from 1 1/2 to 2 1/2 years at time of capture, survived for more than a year, providing valuable information of growth rates and its seasonal variation.

Using Scuba Divers, populations of Nephrops in the Irish Sea were studied. Prawns were counted by injecting purple stained formalin into burrows, thus allowing prawns to be clearly observed and associated with particular burrows.

#### Italy

No report received.

#### Netherlands

(P. Korringa)

Brown shrimp. The Dutch shrimp landings were greatly affected by the presence of unusually large schools of cod. Therefore the interrelation between cod and brown shrimp was studied in detail in the year 1971. It appeared that the very strong year classes of cod produced in 1969 and 1970 had drastically reduced the shrimp stocks in the Dutch coastal water in the winters of 1969-1970 and 1970-1971. The catches per day fishing were extremely low in the spring of 1971, and plankton investigations revealed that an unusually small number of shrimp larvae was produced in the period January-April 1971. This is evidently related to predation by cod upon the parent stock. There appeared to be a correlation between the numbers of cod of given dimensions and the losses suffered by the brown shrimp in its various developmental stages. A paper was presented on this matter during the Council Meeting held in Helsinki.

The introduction of the rotating sieve for sorting the catch on board the shrimpers continued steadily and now about 50% of the shrimp fleet is equipped with this machine. The so-called sieve-net, a French invention which was introduced in the Netherlands in 1964, but was then not readily accepted by the Dutch shrimp fishers, gained suddenly a spectacular popularity among the shrimpers in 1971. When correctly rigged, this net with its horizontal separation has evidently considerable advantages over the traditional shrimp net. Undersized shrimps were not landed at all in 1971.

Deep sea prawn. In 1971 Dutch shrimpers fished on a rather large scale for the deep sea prawn Pandalus borealis on the Fladen Ground and in the Farne Deep. Samples of the landings were analysed and scientific advice was given to the fishermen.

Norway

(K. Gundersen)

Homarus gammarus. Tagging experiments on lobster in the field were continued. Fifty-three tagged lobsters were liberated in January and 118 at the end of June in Busepollen south of Bergen.

At the end of March, 53 tagged lobsters were liberated in Kvernhusosen north of Bergen.

In addition, at the above mentioned localities, fishing experiments with different types of gear were carried out in June-July and October and November.

Catches of tagged lobsters from previous years were controlled for moulting, etc., and if in fine condition, they were liberated in other areas.

From this year, the burning marking method was used in combination with the toggle tag on all liberations of tagged lobsters.

Commercial catches of lobsters were investigated at the lobster pond at Glesvær in order to get information of the composition of the lobster stock along the west coast of Norway.

Cancer pagurus. The feeding experiments on crabs in basins which started in 1969 were continued in 1971. In addition to the feeding in basins, floating wooden boxes were also used.

Also different methods of setting the crabs' claws out of function were tried.

Poland

Nothing to report.

Portugal

No report received.

Spain

(H. Quiroga)

Studies on the prawn and shrimp populations from the Canary Islands, Balearic Islands and the Spanish Sahara coast. An important Homarus population from the Sahara coast has been studied.

Studies on the breeding of the prawn Penaeus korathurus.

Parasites of the crab, Carcinus maenas.

Sweden

(B. I. Dybern)

Pandalus borealis. Continued information from about 20 commercial trawlers as to their daily catches in different fishing areas was obtained. The catches which declined strongly from 1962 to 1966 now seem to have a slight upward trend again, but only half of the catches of 1962 (about 5 000 tons) are obtained. The increasing trend is mainly due to the decreased number of trawlers and subsequently less fishing pressure on the stocks (about 70% of the trawlers as compared with 1962 are now in action).

The modusa Tina bairdi caused only very slight trouble to the deep-sea prawn fishery.

During 1972 experimental trawlings will be carried out to collect material for age determination and assessment of Pandalus stocks.

Cancer pagurus. The studies of the biology and behaviour of the crab have been continued along the same lines as before. The results of tagging experiments have further stressed the capability of the crabs to travel long distances. The average distance travelled by a crab exceeds that of a lobster by at least 10 times.

The main part of the crab programme is now finished and the results are expected to be published during 1972.

The fishery legislation of Sweden is being under consideration and in connection with this it has been discussed to protect the crab stock (which tends to decrease) through introduction of a close season during summer. It is also being discussed to introduce a ban on capturing crabs and lobsters by diving.

Homarus vulgaris. The tagging programme in the Skagorak area has been finished after 5 years of tagging. It has partly been replaced by a similar programme for the Kattegat area which will be continued during 1972.

The decrease in commercial catches of lobsters continued also during 1971 but is somewhat less pronounced than before.

Nephrops norvegicus. Reporting of the daily catches from about 40-50 trawlers has been continued. There are no signs of a decrease in the stock of Norway lobsters, although the mean size of the individuals in some places seems to decrease somewhat. The reporting will continue during 1972, but will be replaced by reporting by a lesser number of boats in the coming years,

Experimental trawlings in the Bohuslän archipelago show that a proportionately big number of Norway lobsters are obtained there than outside the island region. This is probably due to the higher fishing pressure in the last-mentioned area.

United Kingdom

1. England and Wales

(P. R. Walne)

Cancer pagurus. The investigation of the crab stocks in the south-west of England has been continued. The main aim of this study, which began in 1968, is to check on the value of the existing minimum size limit of 114 mm and to determine what effect any change in this size would have on the yield from this fishery.

A further 3 297 crabs were tagged by the suture method during 1971 to collect information on growth rate and migrations. A total of 9 466 tagged crabs have been released in this study; of those released before September 1971, 1 117 (16%) were returned by the end of 1971, of which 214 (18%) had moulted. Sufficient data is now available on the moult increment and frequency of moulting to make an estimate of annual growth of each sex. In general, migrations have been relatively limited, with most crabs being recaptured within 10 miles (16 km) of their positions of release, although some movement occurs between the main fishing areas of Devon and Cornwall, with migrations of up to 70 miles (112 km) being recorded.

During 1971, it was possible to consolidate the data required to make an assessment of the crab stocks in the south-west, and a yield assessment of this fishery will be made in the near future.

Homarus vulgaris. Trials testing the persistence of tags have continued. The sphyron tag is continuing to prove very satisfactory. Eighteen lobsters have moulted successfully with this tag and without tag loss.

In cooperation with the NERC Fisheries Biochemical Unit, Aberdeen, a series of bait trials have been conducted in large outside concrete tanks. It was found that pots baited with squid, plaice and mackerel were equally attractive under these semi-natural conditions, but empty pots and an artificial bait compounded from squid extract bound with agar were not attractive.

Palinurus vulgaris. An intensive search of the Cornish coast for small crawfish was made by a diving party during the summer, but none were found. Returns from the 1970 tagging experiment suggested that off St Ives 20-30% were being caught annually. A further 163 tagged crawfish were released in that area in 1971. Preliminary returns do not confirm the previous high rate of exploitation.

Crangon crangon. Samples of Crangon have been collected from the commercial fisheries in the Wash and the Thames estuary to study the stock composition and to record the occurrence of ovigerous females. On the west coast, the Morecambe Bay (Lancashire) stock was examined. Low landings of brown shrimps in this area in late 1970 and early 1971 caused considerable concern regarding the future of this important fishery, but catches began to improve in September 1971 and stocks during the early winter were adequate for local needs. From the information available, it appears that the decline in the fishery, which mainly depends upon a single year class, was due to poor recruitment in 1970. This situation also applied to other brown shrimp fisheries in NW Europe. Improved recruitment in 1971 has helped to stabilise this fishery.

Pandalus borealis. The population of P. borealis in the Farne Deep area, 30 km off the coast of north-east England, has been surveyed annually since 1966. Data is now available on the relative abundance of this species, the size and weight distribution of the stock and the sex ratio. In December 1971, the stocks were again surveyed and catch rates were similar to those in previous years, with quantities suitable for commercial exploitation. However, no British vessels have yet fished this stock which is exploited by German and Danish trawlers. The survey also provided further information on the distribution of P. borealis in relation to water depth and the nature of the sea bed.

Pandalus montagui. The only remaining commercial fishery for P. montagui occurs in the Wash. Landings in 1971 were good and the fishery was mainly based on the brood from 1970. Monthly visits were made to this fishery during 1971, and regular samples were taken to determine length and the sex ratio in order to monitor changes in the population. The oil content of large and small whole shrimps as well as the digestive gland (the main storage organ) has been determined during 1970 and 1971. The oil content shows seasonal variability which appears to be related to the timing of oviposition in the female.

Regular monitoring of the Thames stocks has continued, but the population density remains at a low level. Only "0" group individuals have been found in any number and older specimens are rare.

Nephrops norvegicus. The major effort on Nephrops during 1971 has been directed towards the preparation for publication of the considerable amount of accumulated information relating to the North Sea fishery and the Irish Sea stocks.

Regular sampling of the Northumberland fishery has continued and observations have been collected on the size distribution, sex ratio and breeding cycle of Nephrops. One of the main problems of this fishery is the presence of large numbers of small Nephrops in the commercial catches despite the use of 70/75 mm mesh nets. This has caused some concern among local fishermen and merchants. However, after all the available evidence was examined, it was concluded that reduction in size was mainly due to changes in the pattern of fishing. At the present time the small change in average size does not appear to justify further measures to conserve these stocks. Preliminary investigations have been made into the northern Irish Sea fishery off Cumberland, where a relatively new fishery exploited both by British and Irish vessels for this species has developed.

## 2. Scotland

(H.J. Thomas)

Pandalus spp. Studies of the catch composition of Pandalus borealis and on the distribution and biology of P. bonnierii were undertaken.

Cancer pagurus. Routine sampling of the catch and the collection of catch/effort data were maintained.

Homarus vulgaris. Population studies were pursued. An investigation was made of ovary development. The fishing efficiencies of various traps in the capture of lobsters and crabs were studied.

Nephrops norvegicus. Population studies were continued including an investigation of recruitment and growth. A variant of the standard trap was tested.

U.S.S.R.

Nothing to report.