

S h e l l f i s h a n d B e n t h o s C o m m i t t e e

By F.A. GIBSON

1969

MOLLUSCA AND BENTHOS

Belgium

(E. Leloup)

Ostrea edulis

1969: Observations sur l'élevage d'Ostrea edulis L. en panier japonais, dans le bassin de chasse d'Ostende.

1970: Continuation des observations sur ce sujet.

Canada

(D.G. Wilder)

Crassostrea virginica

The first commercial oyster hatchery in Canada successfully completed its first year of operation. The experimental federal hatchery is now concerned with selective breeding of oysters and other species and the controlled introduction of exotics.

Hatchery-bred and wild spat reared on suspended shell strings reached 2-2 1/2 inches in two seasons. They can be easily separated from the shells with negligible mortality, are of excellent shape and far superior in quality of meat to bottom-grown oysters.

Laboratory studies have shown that Stylochus ellipticus, a flatworm considered by some to be a serious predator of oysters, attacks oysters only when other foods are absent. It feeds principally on young soft-shell clams (Mya arenaria) and a wide variety of other bivalves.

Ostrea edulis

Breeding stock of Dutch origin, obtained through the U.S. Bureau of Commercial Fisheries, was held under quarantine and larvae were reared under quarantine to settlement. Spat from larvae released in late July and August reached 1 1/2 inches by the end of September when grown in the field on scallop-shell strings. Survival was excellent.

Placopecten magellanicus

Scuba studies revealed that 11% of all sizes of scallops in the path of a scallop drag were captured. Of those that escaped capture, 4% were lethally damaged. Mortalities due to deck exposure were only 3% in contrast to mortalities up to 100% in 1968. In an 84 square mile survey of a scallop bed with a camera attached to a scallop drag, about 9 000 photographs were taken in 29 tows that covered 120 miles. In general, scallops were scarce. In 7 dives at 20-60 fathoms from a submersible, lobsters were noted on boulder-strewn bottom at 20 fathoms, bar clams on sand and gravel ridges at 20-30 fathoms, and some scallops in coarse gravel below 30 fathoms. Annual landings of 4 500 metric tons of scallop meat have been maintained since 1965 by a great increase in fishing effort. The mean catch per hour fell 75% from 1961-1967.

Arctica islandica

Trial fishing in three areas indicated that ocean quahaugs were abundant. Monthly samples have been collected for studies of flavour problems. The prospects for a Canadian ocean quahaug fishery are improving.

Paralytic shellfish poisoning

Ocean quahaugs store less poison than blue or red mussels. A study of the serious paralytic shellfish poisoning epidemic that occurred in the St. Lawrence estuary in August 1969 is nearing completion.

Cephalopoda

The 1969 Newfoundland squid fishery was almost a complete failure. A survey of the continental shelf from Delaware to Florida between 9th February and 5th March failed to locate young juveniles or spawning concentrations of Illex.

Benthos

A study of the benthos in a typical Prince Edward Island estuary showed that most of the biomass was intertidal grass, Spartina alterniflora, and eelgrass, Zostera marina. Most of the fauna consisted of blue mussels, Mytilus edulis, soft-shell clams, Mya arenaria, and oysters Crassostrea virginica.

Over a 6-year period, the benthos showed few temporal changes. Longer-term data show that the estuary is filling with silt, a phenomenon contributing to the decline in oyster stocks. Great heterogeneity in benthos is not clearly related to physical parameters but appears to be more influenced by depth and distance from shore than by sediment type. Benthic populations in the intertidal zone are sparse because of winter freezing. Many of the crustacean and polychaete benthos leave the bottom at night and become available as food for pelagic fish.

Denmark

Finland

(S.G. Segerstråle)

Tvärminne Zoological Station (University of Helsinki)

Continuation of the work on the reproduction cycle of Mytilus edulis, Cardium lamarcki, Mya arenaria, and Macoma baltica.

Institute of Marine Research, Helsinki

Continuation of the quantitative study of the benthic macrofauna of the Baltic which was started in 1961 in accordance with the recommendation at the meeting in Moscow in 1960. (Standard stations).

Continuation of quantitative studies of the benthic macro- and meio-fauna in selected coastal areas influenced by pollution.

Quantitative sampling of the benthic macrofauna at the Tvärminne Zoological Station in co-operation with IBP-PM.

University of Turku

Studies on the bottom fauna in the polluted area off the town of Turku.

France

(L. Marteil)

Huîtres

Ostrea edulis. Les travaux ont porté sur les facteurs déterminant la reproduction et la croissance des huîtres plates et portugaises dans les divers centres français.

Du naissain de C. gigas a été importé de Colombie britannique et du Japon en 1969 pour être élevé sur les parcs français où la culture de l'huître portugaise est déjà autorisée. Le naissain était fixé sur des coquilles. Un contrôle sévère a été effectué, à chaque arrivage, pour éliminer parasites et compétiteurs avant reparcage. Les résultats obtenus varient suivant les régions d'élevage et le mode de culture. Ils ont été particulièrement satisfaisants lorsque le naissain était élevé en suspension ou en surélévation.

L'étude de la "maladie des branchies" a été poursuivie. Les examens ont été étendus aux huîtres plates O. edulis et aux moules. Les altérations constatées occasionnellement sur les branchies ne sont pas toutes imputables à une maladie. D'autre part le protiste précédemment signalé chez C. angulata n'a pas été retrouvé dans les autres espèces françaises, non plus que chez C. gigas. En revanche, des structures présentant des analogies avec L. marina ont été retrouvées chez des mollusques de genres différents.

Pecten maximus

L'étude menée en 1968 a été poursuivie. Le stock comportait de nombreux individus des groupes 2 et 3.

Germany

(K. Tiews)

Mytilus edulis

Routine investigations on the growth and quality of wild and cultured mussels and on their infection rate with Mytilicola intestinalis have been continued at the 'Institut für Küsten- und Binnenfischerei'. Experiments on the vertical culture of mussels were initiated in the western Baltic (Flensburger Förde).

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 echo-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 'Institut für Küsten- und Binnenfischerei' continued benthos sampling in the southern Baltic during a research cruise of F.R.V. "Anton Dohrn" in April/May 1969.

The development of benthos communities was studied in a brackish water pond at the 'Institut für Küsten- und Binnenfischerei'. The distribution of benthic food specimens for flatfish were studied along the German North Sea coast.

Programme for 1970

Mytilus edulis. Routine investigations on the growth and quality of wild and cultured mussels and on their infection rate with Mytilicola intestinalis will be continued, also experiments on the vertical mussel culture in the Flensburg Fjord.

Ostrea edulis. Fattening experiments in the Wadden Sea around the Isle of Sylt might be continued.

Benthos. Research on the distribution of benthos animals along the German North Sea coast will be continued by the 'Institut für Küsten- und Binnenfischerei' in order to study the distribution of benthic food specimens for flatfish. Also the Biological Station of Heligoland and the 'Institut für Meeresforschung' in Bremerhaven will continue their benthos studies.

Iceland

(U. Skúladóttir)

Chlamys islandica

Beds of Iceland scallop located so far are already supporting a small commercial fishery which is expected to extend to other areas. An investigation has been started on the Iceland scallop regarding size distribution, maturity, spawning, age and growth.

Ireland
(F.A. Gibson)

Escallops

Pecten maximus. Investigations of scallop stocks around the Irish coast were resumed in November 1968, after an interval of some 10 years.

South-west coast: Samples of the commercial catches from Dunmanus Bay, Bantry Bay and Castletownbere Haven were examined for a comparative study of meat yield, maturity and growth-rate. A representative sample of gonads was selected and preserved for histological examination to determine the time of year that spawning takes place in the various local fisheries.

East coast: During February to May 1969, research boat surveys were carried out to locate stocks of scallops in the western Irish Sea. To date one stock of sufficient size to support a small commercial fishery was found between Bray and Greystones off the coast of Co. Wicklow. Escallops from this stock were examined and found to be typical of any unexploited stock having large numbers of old age-groups present.

Through catch and effort statistics and regular sampling, the effect of successful year-classes will be studied.

American hard shelled clam (*Mercenaria mercenaria*)

Through the courtesy of the MAFF, Fisheries Experiment Station at Conway, North Wales, approximately 4 000 seed clams were introduced to Irish locales in 1969 during April. They were divided into four roughly equal parts and placed within open wooden frames covered with 6 mm mesh plastic and partially buried in soft substrates at the following places:- Oyster Haven, Cork Harbour, (Co. Cork), Bannow Bay and Wexford Harbour (Co. Wexford). After this operation, a number of excess clams, all very small, were held back and eventually were placed in a heated water lagoon, associated with an Electricity Supply Board Power Station in the estuary of the river Shannon.

Growth and survival of these clams was noted at various times from April to November, 1969. At first planting, in April, the size range of the clams was from 8 to 16 mm, with a mean of 13 mm. By October and November the final growth and percentage survival were as follows:-

<u>Place</u>	<u>Initial size</u> mm	<u>Final size</u> mm	<u>% Survival</u>
Oysterhaven	13	22	60
Cork	13	25	70
Bannow	13	20	50
Wexford	13	25	80

Both Oysterhaven and Bannow proved to be less suitable for the clams, growth-rate being poor and survival lower than in the other areas. Cork Harbour proved to be reasonably good but some high mortalities were recorded which may have been due to the trays being set too high up on the shore. The best results were obtained in Wexford Harbour, where survival was high and approximately 15% of the clams exceeded 30 mm in length at the end of the growing period.

These experiments will be repeated in 1970 at Wexford and at Cork. A commercial concern will promote the experiment in the Cork area.

Ostrea edulis

Approximately 100 tons of mussel shell were laid on the Tralee Bay oyster beds. Due to the fine summer of 1969, water temperatures (maximum 22°C) were the highest recorded since 1965, and the spatfall was exceptionally heavy. It is estimated that the mussel shell caught an additional 150 million spat. Experiments were continued on the use of plastic sheets, made up into a pack form, and enclosed in mesh, for spat settlement. The results were encouraging and this work will be expanded. Routine observations on settlement, growth and survival of oyster spat in various parts of Tralee Bay were continued and a number of measurements of tidal movements were made.

The first recorded starfish, a lone Asterias rubens, was found on Fenit Pier at the western extremity of the oyster bed.

Mytilus edulis

A heavy natural spatfall occurred at Cromane, Co. Kerry, (a centre of major mussel production), in 1968. The settled area being of little use for mussel culture, about 4 000 metric tons of this year-class was transplanted by power dredger in 1969. No natural spatfall of any consequence took place in 1969.

Similarly, at Wexford Harbour which is an emerging mussel fishery of importance, 500 metric tons of seed mussels were transplanted to good fattening areas.

Raft culture of mussels was undertaken at Wexford, Cork and Kinsale harbours in the summer of 1969. Success was recorded at Kinsale, but at both Cork and Wexford settlement did not take place. These experiments will continue.

Consideration was given to pollution in Wexford Harbour. This area is assuming some of the features of a large lagoon because dredging of the bar to the open sea has been discontinued since 1965. The area is therefore becoming more susceptible to the effects of pollution.

Italy

Netherlands

(P. Korringa)

Oysters

Again, the oyster industry in the Netherlands worked predominantly with imported oysters to populate the beds. Most of the oysters came from Brittany and some from the Sado-estuary in Portugal. An experimental consignment of oyster spat from Japan showed a remarkable growth. The number of native oysters is increasing, and especially those born in 1967 are quite numerous. High temperature in the summer season led to spawning of the Portuguese oysters relaid on shallow grounds, and hence to an excellent condition of these oysters later in the year.

No special research has been carried out on oysters in the year 1969 and no complaints have been heard about unusual mortality or gill defects.

Mussels

Continuing earlier investigations a survey has been made on the occurrence of Mytilicola intestinalis in certain parts of the Dutch Wadden Sea.

The new laboratory for mussel investigations on the southern tip of the Isle of Texel started its work early in 1969. Laboratory investigations on the biological cleansing of the mussels and on their condition after storage has been started, in which a great number of factors of possible influence on these processes has been followed.

Norway

(K.R. Gundersen)

Mytilus edulis

Experiments with raft culture were continued. Further experiments with transferring spat to net bags of different sizes were started. The growth-rate of spat transferred from spat collectors to net bags increased compared to the spat remaining on the collectors.

During 1969 a raft culture experiment on semi-commercial scale was initiated in the outer Oslo Fjord.

Laboratory experiments for studying adaptation and growth-rate in different salinities were initiated.

In the Trondheimsfjord, the period of spatfall has been observed.

Modiolus modiolus

The biology and growth-rate has been studied in the outer Oslo Fjord.

Poland

(L. Zmudziński)

Benthos

In 1969 sampling was restricted to a few collections taken in March, May-June and November from the deepest parts of the southern Baltic area, especially from the Bornholm and Gdańsk Deep.

Zoobenthos was investigated at 36 stations, of which 29 were investigated in the period from 27th May to 10th June.

Portugal

(H. Vilela)

Work done during 1969

Essays on improvement of oysters from the Tagus on several localities of the Portuguese coast.

Studies on gill-disease of oysters and mussels.

Investigation on infestation by parasites of oysters and mussels.

Programme for 1970

The same as for 1969.

Spain

(H.H. Quiroga Lorenzo)

Oysters

Mr. Robles, at the Vigo Laboratory of the 'Instituto Español de Oceanografía', made studies on larval settlement at the Cies Islands and at Ria de Arosa.

Mr. Dicenta, at the Baleares Laboratory of the 'Instituto Español de Oceanografía', continued his work on the acclimation of the Portuguese oyster, Crassostrea angulata, in Puerto Colom and Puerto Andraitx.

Mr. Andreu and co-workers, at the Barcelona Laboratory of the 'Instituto de Investigaciones Pesqueras', are working with the culture of the flat oyster, Ostrea edulis, at the Delta del Ebro, with special attention to the growth, mortality and adaptation.

Personnel from the Cadiz Laboratory of the 'Instituto de Investigaciones Pesqueras', are studying the distribution, sexual cycle and settlement of the Portuguese oyster, Crassostrea angulata, at the Guadalquivir estuary.

Mr. Figueras, of the Vigo Laboratory of the 'Instituto de Investigaciones Pesqueras', continued his work on the flat oyster, Ostrea edulis, in order to obtain a better larval settlement, trying different types of collectors, and the feeding of the oyster with phytoplankton cultures.

Mussels

Mr. Robles, at the Vigo Laboratory of the 'Instituto Español de Oceanografía', studied the growth of the mussel, Mytilus edulis, and the influence that the abundance of mussels exerts on growth and development.

Gill disease of oysters and mussels

Mr. Robles, from the Vigo Laboratory, and Mr. Quiroga, from La Coruña Laboratory, of the 'Instituto Español de Oceanografía', are doing periodical observations on the flat oyster, Ostrea edulis, noticing that the infection rate does not increase with the growth.

Mr. Cendrero, at the Santander Laboratory of the 'Instituto Español de Oceanografía', made periodical observations on the Portuguese oyster, Crassostrea angulata, from the experimental cultures at the Santander Bay, and he did not observe any case of infection.

Mr. Quiroga, at La Coruña Laboratory of the 'Instituto Español de Oceanografía', studied some samples of mussels from La Coruna Bay, not finding any case of infection.

Sweden

(B. I. Dybern)

Benthos

An exhaustive programme for physical and biological investigations in the polluted Baltic areas was started in 1969. Amongst these studies is a rather extensive investigation of the bottom fauna in different parts of the Baltic proper; the Bothnian Sea and the Bothnian Gulf. Most of these investigations are made by means of bottom samplers.

In connection with investigation of pollution problems, benthic animals are used in many projects.

A series of benthic and fishery biological surveys in areas where nuclear power stations are being built or planned, together with similar investigations at Idefjorden (west coast) and the Västervik area (in the Baltic) may be mentioned.

United Kingdom

1. England and Wales

(A.C. Simpson)

Cardium edule

The continuing assessment of the cockle stocks in the Burry Inlet (S. Wales) has shown that the 1968 and 1969 year-classes have been poor and the fishery is now largely dependent on the 1967 year-class. Landings in 1970 are expected to be down on recent years. Oystercatcher numbers are again very high, with around 15 000 birds feeding in the Burry Inlet in September, October and November 1969, the highest figures ever recorded for these months. A change in the roosting behaviour of the birds has made catching them for marking much more difficult and none have so far been marked during the 1969/70 winter.

An observed inverse relationship between the cockle stock in May and the logarithm of the number of spat the following May and November is being studied. Further observations have been made on the seasonal changes in meat yield.

Following detailed surveys of stocks of cockles in the Wash in 1968, the changes in availability of cockles there has been kept under review. The catches are still predominantly of the 1963 year-class but these will not last much longer. There was a heavy and widespread spatfall during the year but much of this and older cockles were smothered by an exceptionally heavy settlement of mussels.

In the Thames area, 6 hydraulic cockle dredges are now operating. The cockle stocks in the estuary have been resurveyed and an investigation is being made of the effects of these dredges on the catch and stock of cockles in the area.

Chlamys opercularis

A start has been made on a study of the availability of stocks of queen scallops and samples are being obtained from several areas, to determine size composition, growth-rates and meat yields.

Crassostrea angulata

Studies of the gill disease of Portuguese oysters have continued at the Portsmouth College of Technology and at Burnham-on-Crouch.

Seed oysters, imported from the Tagus in March 1969, showed only 2% with damaged gills but within a few weeks the majority of those relaid, both in Essex and in Cornwall, were dying or dead. Comparable oysters from the Sado were less affected and their survival was much better.

Observations on the active disease have shown what appears to be a progression from the gills to the mantle and adductor muscle. Work on the identification of the causative organism has continued.

Mytilus edulis

The investigation of the settlement, growth and survival of mussels in Morecambe Bay has continued. Spatfall occurred all the year but gave peaks in December to February and June to July. In June, spat settled on one "hair-lock" pad at a density equivalent to one and a half million per square meter. Each winter a dense carpet of spat covers about 40 hectares at Roosebeck, the mussels grow rapidly to yield in late summer a potential crop for relaying of 2 000 to 4 000 tons of 3 cm mussels. By the autumn, the mussels are raised on their own mud, become unstable and nearly all are destroyed by scour and autumn gales.

Ostrea edulis

In spite of high water temperatures, spatfall in the Essex and Cornish oyster grounds was again poor. However, the growth of seed and larger oysters was good. Experiments on the growing of small Norwegian spat in trays have continued and shown the importance of avoiding overcrowding, periodic removal of silt and keeping the trays at a low spring tide level to achieve maximum growth.

Following observations that shore crabs (Carcinus maenas) appeared to be damaging oysters in trays, laboratory experiments showed that shore crabs of 5-6 cm carapace width would eat an average of approximately one 3 cm oyster per day.

During the summer, the starfish Asterias rubens was reported to be consuming oysters in the Helford River, Cornwall. They were found to have been at densities of up to 60 per 100 square meter on some oyster grounds and it is probable that they had been the cause of a considerable mortality. Various methods of controlling the starfish were tried and dredging, the Dutch starfish dredge, and the use of burnt (anhydrous) lime were found to be fairly successful.

Pecten maximus

Experiments were carried out off Plymouth to determine the absolute density of the scallops there and to establish the efficiency of the Baird scallop dredge. Repeated hauls were made with a Baird dredge on a ground seeded with tagged scallops, and the Delury and Peterson methods were used for the calculations. These methods gave 33% and 24% respectively for the efficiency of the gear, and a density of scallops of 0.16 per m².

Monthly samples of scallops from Brixham and Plymouth were examined to continue the study of seasonal changes in gonad condition and meat yield.

Venerupis decussata

A survey has been made of a stock of V. decussata adjacent to a power station outfall in Poole Harbour and a detailed study of their growth and reproduction is being undertaken.

2. Scotland

(H.J. Thomas)

Ostrea edulis

Field trials, by the Scottish Marine Biological Association, have been made in the Hebrides on the growth of oysters in suspended culture and on the use of an artificial sea-water pond for oyster breeding.

Mytilus edulis

The experimental cultivation of mussels on ropes has been continued including studies on the predation by eider duck. Results continue to be promising. Further trials were carried out by the Scottish Marine Biological Association at several sites on the Scottish west coast.

Paralytic shellfish poisoning again occurred on the east coast of Scotland but at a much lower level than in 1968.

Further sampling of mussels for infestation by Mytilicola was undertaken.

Cardium edule

Cockles removed from the settlement area high on the shore at Barra and relaid low on the shore have continued to survive and grow well. Preliminary observations suggest a good spatfall in 1968.

Pecten maximus

Catch-effort data have been collected from selected boats and samplings undertaken of the commercial catch from the Clyde, the west coast and Shetland. Further research vessel explorations for unexploited scallop beds have been undertaken. Further studies have been made of the early life-history of the scallop.

Chlamys opercularis

Further studies have been made on the distribution and collection of catch-effort data initiated.

Cephalopoda

Data on the commercial landings of squid have been maintained.

Benthos

Food chain studies

In 1969 assessments of benthos in a muddy area in Loch Ewe were made in connection with a study of food chains leading to fish. This project is noted in more detail in the report to the Fisheries Improvement Committee.

Coastal survey

As part of a long-term survey of benthos on commercially important grounds round the Scottish coast, a survey was made on the cockle beach at Barra in the outer Hebrides. The beach, which is on the sheltered side of the island, was found to support a rich and varied population of invertebrates besides cockles and, for comparison, sampling was also done on a nearby very exposed beach on the Atlantic shore. On this beach lamellibranchs were absent, and only the isopod Eurydice, a few amphipods (mainly Bathyporeia) and an occasional polychaete (Nephtys) were found. These data help to build up a picture of the natural level of biomass on unpolluted sandy grounds.

U.S.S.R.

CRUSTACEA

Belgium

(R. De Clerck)

Crangon crangon

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

Regular shrimp surveys along the Belgian coast are carried out.

Laboratory experiments on shrimp growth were started.

Canada

(D.G. Wilder)

Homarus americanus

Growth and mortality of immature lobsters held for more than a year at 5, 15 and 20°C varied directly with temperature.

Lobsters exposed to mud suspensions polluted with effluent containing yellow phosphorus died after several days. Death appeared to be due to asphyxiation.

In nature, lobsters feed mainly on sea urchins, crabs, mussels, tunicates, starfish, polychaetes, shrimp, amphipods, barnacles and small fish. Most food is taken alive but there is little evidence of cannibalism. There appears to be little competition between rock crabs (Cancer irroratus) and lobsters.

The lobster population on an artificial reef built in 1965 has probably reached its maximum. Tiles attract lobsters but are not durable enough for use in shallow water.

Effluent from a bleached kraft pulp mill had no obvious effects on the abundance or distribution of lobsters. In the laboratory, lobsters did not avoid concentrations of effluent up to 20%.

The feeding behaviour of lobsters was stimulated more by sea-water extracts of cod, shrimp and lobster than by amino acids tested alone or in various combinations.

During 3 months' winter storage, the mortality rate among weak or injured lobsters was 3 times as high as among vigorous lobsters. Lobsters provided with drainage tiles for cover during summer storage survived appreciably better and had much less algal growth than those without cover.

Lobster serum protein concentrations throughout the year are being related to reproductive, moulting and environmental cycles.

Growth data derived from lobsters tagged with ferromagnetic and sphyrion tags are being processed for publication.

The nocturnal behaviour of lobsters from May to November was studied by scuba divers.

Plankton tows confirmed that wild lobsters conceive, that embryos develop and larvae hatch in Pacific waters. More than 75% of the hatching occurred between late May and early June. By October, about 60% of trapped females were berried, mostly attributable to Pacific matings. The survival of juveniles (to 3rd and 4th year) is 20% among groups at large in pens and almost 100% in individual cages. Radioisotopes have been used for mass marking and sonic tags for tracking and behavioural studies.

Using ecdysterone and inokosterone, lobsters were forced into late pre-moult condition but did not moult. Material showing insect hormone activity isolated from lobster blood is probably inokosterone, ecdysterone or both.

Death of lobsters from gaffkemia is due to depletion of hepato-pancreatic glycogen, blood non-protein nitrogen, lactic acid and carbohydrates.

Chionoecetes opilio

In the new fishery for snow (queen) crabs, commercial landings rose from 5 000 metric tons in 1968 to 8 400 tons in 1969. The growth per moult of male and female immature crabs did not differ appreciably, averaging 35% in carapace width and 105% in weight. Apparently 9-10 moults from the first crabstage are required to reach maturity. Fifty percent of the males and females are mature at 57 mm and 50 mm respectively, considerably below marketable size. Tag returns indicate that snow crabs are heavily exploited in some areas. Few tagged crabs moved more than 5 miles. Up to 70% of non-marketable crabs can escape from traps with 1 1/2" wide spaces. One dive in a submersible at 50 fathoms showed that most crabs approached bait up-current and preferred herring over shrimp or crushed scallops.

Surveys indicated good stocks of snow crabs in bays along the south and east coasts of Newfoundland but yielded poor catches in Labrador. Of 2 400 tagged crabs released in Trinity Bay, only 100 have been returned to date.

Electrophoretic studies of Chionoecetes from the Gulf of St. Lawrence and the Sea of Japan show them to be the same species. This indicates that the species is almost circum-polar and suggests that the resource may be extensive.

Denmark (Home Waters)
(E.M. Poulsen)

Pandalus borealis

A cruise was made with the R.V. "Dana" from 1st-16th July 1969, in the western Skagerrak and in the northern North Sea (east of Fladen, Fladen and the area northwards to east of the Shetland Islands). A total of 34 x 1/2 hours hauls were made in daylight with the trawl commonly used by Danish fishermen when fishing for deep-sea prawns, (mesh size knot to knot in cod-end 14 mm, belly 16-18 mm, arms 20-30 mm, length of head rope of approximately 33.5 m). The catch in each haul was sorted, counted and weighed by species, both prawns and fish catch. Samples of prawns (and fish) were sexed and measured.

Crangon crangon

During recent years a few (3-5) vessels have been permitted to conduct an experimental fishery with beam trawl (length of beam 7.5 m, mesh size in cod-end 9 mm from knot to knot) in the Wadden Sea around the southern part of Rønø (close to the German border). This experimental fishery has been supervised. Samples of the catches have been examined in various seasons, and experts have occasionally been aboard the vessels fishing and sampled the catch. Data have been collected as to amounts caught per haul of shrimps and of by-catch (smaller fish); measurements of shrimps (and fish), countings and weighings have been carried out both of the amounts retained (for marketing) by the sorting machine and of the undersized shrimps and other animals discarded.

Greenland
(E. Smidt)

Pandalus borealis

Trawling experiments were continued in inshore waters (mainly in Godthåb district) and in the Davis Strait (north of Store Hellefiske Bank, in the Sukkertoppen Deep and in the Godthåb Deep). Good catches of big sized prawns were made on the offshore grounds, however the commercial fishery is almost entirely carried out in the inshore waters, where bottom and weather conditions are more comfortable.

Finland
(S.G. Segerstråle)

Archipelago Research Institute at Seili: Continuation of the work on the biology of Crangon crangon.

France
(L. Marteil)

Homard

Les expériences de repeuplement des côtes du Finistère ont été poursuivies. Dans la région de l'île d'Yeu, on a constaté ~~une~~ augmentation régulière du poids unitaire d'une année à l'autre, une élévation du rendement numérique, un accroissement du rendement pondéral.

Des essais d'élevage de homard ont été tentés.

Langouste

L'acclimatation de la langouste du Cap, Jasus lalandei, se poursuit. 1 891 langoustes, mâles et femelles, ont été immergées en 1969.

Nephrops norvegicus

En avril 1969, l'Institut des Pêches a procédé, à bord du "Roselys", aux essais d'un chalut sélectif destiné à la pêche de la langoustine. Dans ce chalut, une nappe de sélectivité sépare deux poches superposées: la poche inférieure (mailles de 25 mm de côté) est destinée à recueillir les langoustines; dans la poche supérieure se concentrent les poissons que leur comportement amène à nager vers le dos du filet. Un maillage adéquat permet aux plus jeunes et notamment aux merluchons de s'échapper, alors que les individus atteignant la taille légale sont retenus.

Par ailleurs la "Pelagia" a effectué du 11 avril au 2 mai une prospection des vasières du Golfe de Gascogne car elles constituent les principaux fonds à Nephrops dans cette région. La composition en taille des captures et la faune associée ont été étudiées. Les langoustines représentent, pour l'ensemble, 5,5% des captures et les merluchons 41%. Il convient également de remarquer que sur les fonds situés à proximité des centres de pêche les plus importants, la proportion de Nephrops mesurant moins de 10 cm de longueur totale peut atteindre 78%.

Enfin la sélectivité des filets en polyamide dans la pêche de la langoustine a fait l'objet d'une étude dont les résultats ont été présentés à la dernière réunion statutaire du Conseil.

Germany
(K. Tiews)

Crangon crangon

The 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 grounds were continued. A total of 440 samples (= 2 178 kg) of unsorted catch of the shrimp fishery were collected in Büsum, Cuxhaven, Neuharlingersiel, Dornumersiel, and analysed as to their species and length composition.

The 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.

Investigations on the infection of Crangon crangon with the so-called spot disease were continued at the 'Institut für Küsten- und Binnenfischerei'.

Pandalus sp.

Numerous samples of deep-sea prawn catches made on the occasion of two research cruises of R.S. "Friedrich Heincke" in Farne Deep area and on the Fladen Ground were taken and analysed as to their species and length composition at the 'Institut für Küsten- und Binnenfischerei'.

Homarus gammarus

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.

Crustacean programme for 1970

Crangon crangon

Catch assessment work to determine the composition of shrimp catches by species and length and work on the larvae distribution on the German coast, on the infection of Crangon with the spot disease shall be continued at the 'Institut für Küsten- und Binnenfischerei'. Rearing experiments shall be carried out.

Pandalus sp.

Research on the composition of Pandalus catches made by R.S. "Friedrich Heincke" in the North Sea shall be continued. Special emphasis shall be given on the distribution of Pandalus between the Fladen Ground and the Norwegian channel.

Homarus gammarus

Rearing and crossing experiments with lobsters of different origin shall be continued at the Biological Station Heligoland as well as stock assessment work on the lobster population of Heligoland.

Iceland

(U. Skúladóttir)

Pandalus borealis

Four exploratory surveys were carried out around Iceland, and three of these yielded positive results. During the year the prawn grounds in Briðafjörður were taken into continuous use. Here a new problem arose, i.e. the catch in the prawn trawl contained a large by-catch of fish. The trawling experiments in Seyðisfjörður by an experienced prawn captain had negative results. In an offshore exploratory survey a selective trawl of the French type was tried. The trawl has two cod-ends, one is designed to catch prawn, the other Norway lobster or fish. This proved successful.

The stomach contents of Pandalus borealis and P. montagui were examined.

Research has been carried out in the same manner as before concerning samples and collecting of catch and effort data.

Nephrops norvegicus

A number of out of season Norway lobster surveys have been carried out to investigate various aspects of stock composition. These supplemented the routine sampling during the fishing season (15th May - 30th September). Material on ovary and external egg development, presently being worked up, indicates a two years' breeding cycle. Catch-composition data and an increased catch/effort suggest a high recruitment to the catchable stock in 1969 in most areas.

Ireland

(F.A. Gibson)

Homarus gammarus

The census of trap and boat participation in the Irish lobster fishery, which was commenced in 1968, was continued in 1969.

The diary system for determination of catch and effort in the lobster fishery, continued in 1969, but disappointingly, the number of fishermen who contributed to the scheme voluntarily, was not appreciably more than in 1968. Nonetheless, this information is of great value and will continue to be collected in coming years.

The catch of lobsters was sampled at two centres. At one of these, the catch by all the fleet was examined throughout the period from June to the end of August, 1969. At the other centre, some 7 000 lobsters or about 14% of the total Irish catch were examined, which came from many parts of the coast.

The research work on the development of the lobster ovary was brought to an advanced stage in 1969 and will continue in 1970, when a completed report may be expected for presentation to this Committee.

Nephrops norvegicus

Commercial samples were examined during the main Nephrops fishing season (April-October) and to a small extent outside it. Samples consisted of three parts; the whole catch, rejected whole small Nephrops, and rejected front ends of marketable Nephrops, of which 'tails' only are sold.

A research vessel cruise to study distribution of density, size, sex ratio etc., was undertaken in September, and another to study diurnal variations in the catch at different depths, in November 1969.

Larvae were sampled by tin-townet from April to July 1969, to further the study of growth during the larval phases and any larval movements.

About 40 larvae were taken alive and held in captivity, to obtain data on stage duration, and carapace length and growth-rate in post larvae. Five post larvae survived this experiment of which two subsequently moulted.

Palinurus elephas

Because of other more pressing staff commitments, it was not possible to continue work on this species in 1969. The work will be resumed as soon as possible.

A single species of crayfish, Astacus pallipes, is found in freshwaters in Ireland. Apart from casual observations no studies have been made on the Irish populations. Beginning in 1967 an investigation has been made of the stocks in White Lake, a 30 hectare limestone lake in the midlands. The first report of this work will be published shortly in Irish Fisheries Investigations.

It was found that in male specimens from 55 mm to 105 mm total length, measurement of the full length of the carapace (from tip of rostrum to mid-point of hind margin) gave the best relationship to the weight and this measurement will be made in future work on the species. The crayfish were least active in the month of March and activity was at its greatest from July to October. Mating took place in September, eggs were laid in November and the young had left their mothers by the end of June. A particularly interesting point was that large specimens (carapace length greater than 46 mm) virtually disappeared from the catches from mid-September until June. Using a mark- and recapture technique it was estimated that the population of the lake was 37 000 individuals of the size range captured (30 mm to 54 mm carapace length; 72 mm to 102 mm full length). White Lake is believed to have an exceptionally large stock of crayfish. Observations to date suggest that the species is very scarce in the larger lakes in the country though plentiful in certain rivers.

Italy

Netherlands

(P. Korringa)

Crangon crangon

The Netherlands' shrimp research was in 1969 mainly focussed on actual difficulties experienced in the Dutch shrimp fishery. The main cause of the problems appeared to be overfishing. Two types of overfishing should be distinguished: over-exploitation and irrational exploitation. The latter point has been the major subject of Dutch shrimp research for ten years. To stop the irrational exploitation of the shrimp stock and to save the lives of countless undersized flatfish the replacement of the obsolete shaking sieve by the new developed rotating sieve for shrimp sorting on board was strongly stimulated by the Government. The new rotating sieve has been improved in 1969.

At present, only 1 out of 10 shrimps killed by the Dutch shrimp fishery is a consumption shrimp of commercially acceptable size. Rational exploitation of the Dutch shrimp stock involves ending the over-exploitation if the fishing intensity remains constant at the present level.

During the year 1969 a regular shrimp larvae survey has been carried out in the coastal waters of the Netherlands and shrimp investigations have been made in the western Wadden Sea and in the Zeeland estuaries.

Norway

(K.R. Gundersen)

Homarus gammarus

Tagging experiments on lobster in the field were continued in an attempt to determine the most economical minimum size. The material consisted of lobsters up to 24 cm total length. (The minimum legal size in Norway to-day is 22 cm total length).

Lobsters for tagging were taken from commercial catches at a lobster pond south of Bergen. 219 of the tagged animals were liberated in Busepollen south of Bergen and 309 in Kvernhusosen north of Bergen.

At the same localities fishing experiments were carried out with different types of gear in October and November.

To obtain information about the composition of the lobster stock along the west coast of Norway, commercial catches received at a lobster pond were controlled. The following data, total and carapace length, weight, sex and females carrying eggs were recorded. This work was carried out during the fishing season in spring and autumn.

Cancer pagurus

Tagging experiments on Cancer pagurus were continued mostly in the same way as in 1968 in the Hjeltefjord area.

In addition, the suture tagging method of van Engel was used for comparison with the Norwegian method. 311 and 664 tagged crabs by the two methods respectively were released.

Because of the very variable quality of crabs sold alive, the demand for crabs of guaranteed quality has constantly increased.

In order to investigate the possibilities of producing high quality crabs by feeding an experiment on crabs in basins was carried out from the last days of July to the beginning of November.

Poland

(L. Zmudziński)

The biology of common shrimp, Crangon crangon and prawn, Palaemon adspersus, was investigated in Gdańsk Bay.

Portugal

(H. Vilela)

Sampling of catches of shrimps from north-west African coast and the Portuguese south coast.

Studies on sexual maturity of Penaeus keraturus from the Portuguese south coast.

Programme for 1970

Studies on cultures of shrimps and Nephrops.

Cancer pagurus

The study of the crab stocks on the south coast of England is

Routine observations on the size composition of crabs on the Yorkshire and Norfolk coasts have been continued.

Crangon crangon

A survey of the area in and adjacent to the Thames estuary showed that in June brown shrimps were widely present but only in commercial densities on grounds close inshore.

Regular sampling in the River Crouch indicates that few shrimps are carrying eggs in the winter and that the main period for egg carrying is between March and July. A similar pattern occurred in the Wash.

Homarus vulgaris

Fishing trials with a number of traps, which varied only in eye size (between 3 1/2 and 6 inches, 9 and 15 cm), in the Menai Strait (North Wales), showed that maximum catches were made with traps with 4 inches (10 cm) and 4 1/2 inches (11 1/2 cm) eyes. The size composition of the catches also varied with the size of the eye.

Nephrops norvegicus

The population of Nephrops south of the Farne Islands was re-surveyed in October.

A study of the occurrence of the trematode gut parasite Stichocotyle nephropis was completed during the year and showed that this parasite was much commoner off the west coast of Scotland than round England and Wales, being absent from Nephrops in the Irish Sea and south of the Farne Islands.

Experiments with a trawl to separate Nephrops from commercial sized whiting and undersized whiting gave encouraging results. The whole of the upper side of the net and cod-end was of 70 mm mesh, while the underside of the net and cod-end was of 50 mm mesh. The cod-end was divided horizontally by a septum of 50 mm mesh, the leading edge of which was held in position in the mouth of the cod-end by being attached to a horizontal bar across the long axis of an oval hoop sewn into the net.

Palinurus vulgaris

A further 100 crawfish were tagged with arrow tags and released off the coast off Cornwall during 1969, bringing the total released since 1966 to 915. Of these, a total of 67 have now been recaptured, including 2 that have been in the sea for 3 years. If tagging mortality is low, as believed, the rate of exploitation is seen to be low. No recaptured crawfish had moved more than a few miles.

A survey of possible offshore crawfish grounds, north of Land's End, resulted in only small numbers of crawfish being caught. They were of the same large size as crawfish caught further inshore.

Pandalus montagui

This species, which had become scarce since 1960, has again become abundant in the Wash and off the Essex coast. Samples of Wash material have shown that there are large numbers of juveniles present, which indicates good fishing in 1970. Most of P. montagui have become females by the time they have reached 14.5 mm carapace length, but this year some transitional males were found up to 15.3 mm carapace length.

2. Scotland

(H.J. Thomas)

Crangon sp., Pandalus sp.

Collection of catch-effort data for the brown shrimp fishery off the south-west of Scotland has been maintained. Research vessel cruises have investigated the distribution, abundance and catch composition of pink shrimps.

Nephrops norvegicus

The monthly sampling on board commercial Nephrops trawlers on the Firth of Forth grounds was continued. Creel fishing for Norway lobsters was undertaken by F.R.V. "Goldseeker". Experiments on feeding and growth of small Norway lobsters were continued in the aquarium. Behaviour studies, using diving techniques, have been continued.

Cancer pagurus

Sampling of the catch of edible crabs and collection of catch-effort data from selected boats have been maintained from the main fisheries.

Homarus vulgaris

Catch-effort and catch-composition data have been maintained for all the main lobster fisheries. Monthly sampling of the commercial catches was undertaken at Orkney and elsewhere, annually.

U.S.S.R.