



SHELLFISH AND BENTHOS COMMITTEE

by H. J. Thomas

1972

MOLLUSCA AND BENTHOS

Canada

(D. G. Wilder)

Ostrea edulis

A second shipment of cultured, disease-free oysters from Prince Edward Island was set in near-surface trays on 30 August 1972 in Conception Bay and St Mary's Bay, Newfoundland, at an initial mean length of 38 mm. Growth increments by 7 November 1972 were 7 and 14 mm respectively. The only mortality observed was due to breakage in handling.

Ostrea edulis and Crassostrea virginica

Growth, glycogen content and condition index data indicated that cod liver oil was a better lipid than corn oil for oyster feeding. Diets with 18% of either lipid resulted in greater meat production and earlier maturation than those with 5% lipid. Oysters on natural diets for 12 weeks grew 5-10 times as large as those on artificial diets.

The incidence of vibrio was consistently higher in Malpeque Bay than in Bras d'Or Lake, an area not affected by Malpeque disease. The possibility that vibrio organisms may weaken oysters before epidemics of Malpeque disease was studied. Oysters transferred from Bras d'Or Lake to Malpeque Bay suffered 90% mortality in two years. Diseased oysters generally exhibited poor condition, shell recession and yellow pustules.

Second generation European oysters reared in Prince Edward Island were transferred to the Dartmouth, Nova Scotia, Laboratory early in 1972 when threatened by unusually low salinities. The survivors which were returned to P.E.I. grew and survived well through 1972. Plantings in the spring of 1973 at selected sites in Nova Scotia will be monitored for growth, mortality, sexual maturation and spawning.

Placopecten magellanicus

A large bed of young scallops on Georges Bank was heavily exploited in 1971 and 1972. This led to an ICNAF agreement whereby the landing of small scallops was subject to restriction based on number of meats per pound and on shell diameter. In the inshore fishery off Nova Scotia, relative meat sizes were so variable that size restrictions based on meat counts appear not to be feasible.

Arctica islandica

Surveys to extend our knowledge of the distribution of ocean clams off southern Nova Scotia and to investigate the operation of various dredges were continued in 1972. Laboratory studies have confirmed that ocean clams grow slowly.

Mya arenaria

A survey of intertidal clam resources along the western and southwestern coasts of Newfoundland indicated total standing stocks of 50 000 kg (steamed meat weight) at Hawke Bay and 40 000 kg at Millville. Even in areas of moderate concentrations, most standing stocks ranged from 100 to 1000 kg.

Illex illecebrosus

After a moderate recovery to 1 600 metric tons in 1971, the Newfoundland squid fishery dropped to 16 metric tons in 1972. In a June-July survey off southern Newfoundland and Nova Scotia, mainly with otter trawl, squid were found in all areas. Best catches were on Western Bank, St Pierre Bank and Grand Bank. Sizes ranged from 11 to 22 cm and most specimens were immature.

Benthos

Benthic macrofauna invertebrates in St Margaret's Bay were not evenly distributed. Average macrofauna biomass at 7-10 metres and at 60-70 metres where sediments were consolidated was about 7 g/m². The biomass in deep water where sediments were soft and anaerobic was about 3 g/m². Average sedimentation in inshore and central bay areas was 3-5 g/m²/day and was not correlated with rainfall. Community metabolism (20-35 ml O₂/m²/day) was similar in shallow and deep water except where sediments were unconsolidated

and anaerobic. Over 80% of the carbon supply through photosynthesis was dissipated as carbon dioxide when mixing occurred to 20 m. The carbon released across the sediment-water interface was less than 10-20% of the carbon input at the surface. Highest bottom productivity tended to occur where mixing of a shallow-water column supplied freshly produced organic material to the sediment surface.

Denmark

(S. Munch Petersen)

Benthos

Meiofauna investigations were undertaken in the Sound north of Copenhagen.

Studies were undertaken of the invertebrate fauna in Ringkøbing Fjord, in particular in relation to their content of heavy metals. Levels of organic nitrogen in the deeper waters of the Kattegat were studied.

Federal Republic of Germany

(K. Tiews)

Oysters

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

These studies will be continued in 1973.

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.

These studies will be continued in 1973.

Cockles

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

These studies will be continued in 1973.

Benthos

The Biological Station, Helgoland, 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 macrobenthos in the southern North Sea with special emphasis on nematodes, fungi and bacteria.

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

The Institut für Meereskunde continued its studies on the availability of benthic food specimens in relation to its utilization by fish in the Kiel Bight. Twenty five bottom grab profiles at depths between 15-35 m were investigated. In an enclosed area a net, cages and other containers were placed 20 m deep to study the annual consumption of benthic organisms by fish and invertebrates directly, the production of benthos and the growth of fish food specimens. The feeding of cod, whiting, plaice and flounder was also studied.

The above benthos studies will be continued in 1973.

Finland

(J. Lassig)

Benthos

At the Institute of Marine Research the qualitative studies on the bottom fauna in the seas around Finland started in 1961 were continued at standard stations in June and July. A total of about 100 stations were investigated, including a number of reference stations in the Southern Baltic. In cooperation with Tvärminne Zoological Station, studies on

benthic macrofauna were continued at 5 standard stations in August in the archipelago of Tvärminne. The benthos of polluted Finnish coastal areas was studied at about 114 stations in August.

At the Tvärminne Zoological Station of the University of Helsinki studies on the tolerance of benthic invertebrates to different concentrations of ferrous sulphate were continued. Experimental studies on the uptake, elimination and toxicity of cadmium were carried out on Mytilus edulis. Studies were carried out on the activity of Pontoporeia affinis and P. femorata (Amphipoda) in relation to light. Ecological studies on Mesidotea entomon (Isopoda) were continued. The macrofauna was studied in the harbour of an iron mill in the vicinity of the station.

At the Archipelago Research Institute of the University of Turku the effects of organic pollution on soft-bottom macrobenthos off Turku were studied. Distribution patterns of soft-bottom macro- and meiofauna in polluted and healthy areas of the Archipelago Sea were analysed.

France

(L. Marteil)

Huitres

Les conditions climatiques défavorables de l'été 1972 ont perturbé la reproduction d'Ostrea edulis dont les fixations ont été tardives sur la côte atlantique; elles ont contrarié gravement celle des huitres du genre Crassostrea (C. angulata et C. gigas) dont les fixations ont été très faibles. En conséquence, de nouvelles importations de naissains de C. gigas ont eu lieu en provenance du Japon et du Canada.

La croissance de C. gigas est toujours satisfaisante et le taux de mortalité très bas. On prévoit que près de 100 000 tonnes d'huitres pourraient être commercialisées en 1974.

Des essais de captage d'O. edulis en Méditerranée ont donné des résultats satisfaisants, la croissance du naissain se poursuivant en octobre et novembre.

Les études sur la pathologie de l'huître plate et de l'huître portugaise ont été poursuivies. Les examens histologiques effectués périodiquement ont permis de déceler très vite l'infestation des huîtres plates dans un nouveau secteur. Chez C. angulata, la mortalité qui s'était arrêtée dans l'été 1971 a repris au début de 1972 pour s'arrêter à nouveau en juillet. Les causes de cette épizootie ne sont toujours pas connues.

Pecten maximus

Dans les courreaux de Belle-Ile, le stock continue à augmenter alors qu'il reste stable en rade de Brest. En baie de Saint-Brieuc (Manche ouest), les captures ont été importantes en raison de l'abondance des jeunes mollusques, groupe 2 et 3.

Les essais de reproduction contrôlée se poursuivent à l'université de Brest.

Programme 1973

Poursuite des travaux sur la reproduction et la croissance des mollusques comestibles, l'implantation de C. gigas et la pathologie des huîtres.

Iceland

(H. Eiríksson)

Chlamys islandica

Exploratory scallop surveys in 1972 showed rich new fishing grounds in Breiðafjörður, West Iceland and Vestfirðir, Northwest Iceland. In both areas an Isle of Man dredge was used. This type of dredge has now mostly replaced the Icelandic dredge formerly used in this fishery.

In 1972 licences and catch reports for scallop boats were introduced. This gave valuable information on catch per effort in the various areas fished.

Owing to the high intensity of fishing in Breiðafjörður a controlled catch-quota-per-area fishery was introduced in late 1972 which was fully operative in late 1972. This will probably be put into effect in other areas in 1973.

A record Iceland scallop catch of approximately 6 500 metric tons was caught in 1972 which was 80% up on the previous year. The majority, approximately 5 000 tons, came from the Breiðafjörður area.

Sampling was continued with main emphasis on size, sex, maturity, growth and age.

In 1973 at least 4 scallop surveys are planned. In addition a large tagging programme will be started.

Ireland

(F. A. Gibson)

Oyster (*Ostrea edulis*)

The monitoring of oyster spat settlement in Tralee Bay was continued during the summer of 1972. The weather conditions from mid-June to early July were the coldest on record and as a result water temperatures remained unusually low, being from 13° to 14°C. During this period larvae were released, but no settlement took place. Subsequently, water temperatures rose rapidly, reaching a peak on 19 July of 21.0°C, and a heavy settlement of spat took place during the following week. This was followed by another heavy settlement a fortnight later. Thereafter settlement continued throughout August, ceasing at the end of the month. This was one of the heaviest spatfalls recorded since records began in 1965. Because of low temperatures during the early summer, the normal settlement period was about three weeks later than usual. Consequently even if survival was as high as in normal years, the growth of these spat was the lowest recorded to date. At the end of August, the largest spat measured was 10 mm in diameter and the average size was from 3 to 5 mm, which is about one third the size recorded in previous years. Work was also carried out concerning the movements of tidal waters within Tralee Bay, using automatic self-anchoring drift buoys, which were developed for this purpose.

Studies of the oyster stock in Tralee Bay will be continued in order to extract the maximum benefit from this self-propagating population.

Mussels (*Mytilus edulis*)

Surveys of extensive areas of the south and south-west coasts were made to estimate both the present abundance of this species and the potential of these areas to support larger populations using standard farming techniques. During the course of these surveys, the stocks of other mollusca were studied, including the cockle (*Cerastoderma edule*), the palourde (*Venerupis decussata*) and the periwinkle (*Littorina littorea*).

This type of survey, with its associated farming possibilities, will be continued in 1973.

Scallops (*Pecten maximus*) from the east, south and south-west coasts were extensively examined for size, age, maturity and growth rates. Different areas were compared. Queen scallops (*Chlamys opercularis*) from the west coast were studied in a similar manner. A Queen scallop fishery, which was commenced on the east coast in 1970 and which yielded very high catches that year and in 1971, collapsed in 1972. Examination of the stock position revealed that, in this short period, there had been total overfishing in those areas fished. Even though it is probable that the 'queen' bearing area can be extended, this experience illustrates the sensitivity of this species to fishing rates, particularly where a size limit is not mandatory.

Italy

No report received

Netherlands
(P. Korringa)

Oysters

The Zeeland oyster farmers again imported considerable quantities of flat oysters from Brittany, for relaying. The native stock showed a further increase though spatfall was rather poor in 1972 owing to the unfavourable summer weather conditions. Again the water of the Oosterschelde was remarkably clean and of constant salinity. Growth of the oysters was good and mortalities very low. Fattening was excellent and the oysters produced found a ready market.

Mussels

The Mussel Experimental Station on the Isle of Texel continued its activities both in the laboratory, where physiological research was carried out to study the effect of various factors on the mussel's well-being, and in the large outdoor installation. It was demonstrated that eliminating sand and silt, introduced into the shell during fishing operations offered no problems. The following phase, the storage of mussels for several days without loss of vitality, is more difficult. The French and Belgium market requires living mussels in shell. For this the shells should remain tightly closed so that the intervalvar liquid is retained. Investigations demonstrated that rough treatment during fishing and passage through the production-line for grading and separation results in a physiological shock. When byssus threads have been torn out by force, after some time, mussels usually die. Better knowledge of the factors affecting the well-being of mussels, during fishing operations, storage, grading, and separation, and studies on the factors operating during transport, will be used to devise improved treatment between fishing and consumption. Whilst cleansing and storage is certainly possible, in a well-designed plant, it is necessary to study other

factors, in addition to those of a biological and technical nature, before decisions can be taken regarding the construction of a large plant for cleansing and storing all the mussels produced in the Waddenzee after enclosure of the Oosterschelde. Specialists in various fields, including mussel farmers and mussel dealers, are being consulted by the Ministry of Agriculture and Fisheries with a view to an early decision on size and location of the plant.

Growth and fattening of mussels was excellent in 1972 on the plots in both Zeeland and the Waddenzee. The latter is the more remarkable in view of the growing worries concerning pollution of the Waddenzee by the water discharged from the river Rhine making its way northwards along the Dutch coast. Although cockles and periwinkles are now scarce in the Waddenzee, it is not certain that pollution caused this reduction. Experience with oyster farming all over the world shows that microscopic parasites may considerably reduce dense populations of shellfish in monoculture. Greater losses by parasites and diseases may result in shellfish in a weaker physiological condition than would have occurred amongst shellfish in perfect condition before the attack.

As reported to the Fisheries Improvement Committee sanitary conditions resulting from dinoflagellate blooms did not cause anxiety in 1972.

Norway

(K. R. Gundersen, B. Bøhle)

Mytilus edulis

Experiments with cultivation of mussels by the net bag method were continued. Attempts were made to decrease the time needed for growth to marketable size by sorting the spat before transplanting to the net bags. Up till now this has not been successful.

The time needed for adaptation to lowered salinities were studied in the laboratory.

Laboratory experiments were started to investigate growth at different temperatures and amounts of available food and to get information on the amounts of particulate material in the sea in the fjords and along the coast by analysing water samples by micro bomb-calorimeter.

In 1973, cultivation experiments will start in Northern Norway.

No "unusual food poisoning" from consumption of mussels was recorded in 1972 and no investigations were undertaken.

Loligo forbesi

About 100 squid were taken with bottom trawl north of Shetland at the beginning of February. Mantle lengths were in groups: 10-14 cm, 16-24 cm and 28-35 cm, with peaks at 11 and 19 cm.

Todarodes sagittatus

Material collected during 1971 was worked up and a report published. The Norwegian fishery for T. sagittatus failed completely during 1972, probably because no immigration took place. Experimental fishing during a cruise off north west Norway in October-November was also unsuccessful. Two females of T. sagittatus, mantle lengths 33 and 36 cm, were caught by bottom trawl north of Shetland in January. Another specimen, mantle length 42 cm, was obtained in a decayed state in a fjord in N Norway in November.

Gonatus fabricii

Three specimens, mantle lengths 3.5, 4.0, and 4.0 cm, were taken near Spitzbergen in September.

Poland

(L. Żmudziński)

Macrozoobenthos investigations, based on materials collected by means of Van Veen or Petersen bottom samplers, were undertaken at 184 stations in the Southern part of the Baltic Sea.

Macrozoobenthos investigations were undertaken, in the general pollution programme, in the Southern and Central Parts of the Baltic and in the Belt Sea.

Portugal

(J. E. E. Cabido de Ataíde, M. J. Figueiredo)

Oysters

The Instituto de Biologia Maritima continued the study of the gill disease in the Portuguese oyster Crassostrea angulata. Experiments have been initiated on the improvement of quality in the oysters of the Sado river. Observations have been made on oysters transferred from the estuaries of the Sado and Tejo to the north of the country (Ria de Aveiro) and to the south (Algarve province).

Spain

(H. H. Quiroga Lorenzo)

Ostrea edulis

Work concerning oyster farming in Galicia and the Ebro' delta was continued and improvements made in the techniques for tank production of larvae.

Crassostrea angulata

Biology and farming studies were continued in Cadiz and Santander harbours. New types of collectors, not previously used, were tried out in Santander harbour.

Venerupis decussatas and V. pullastra

The development of these species was studied on conditioned soils (Santander and Galicia). An experimental hatchery was installed and growth and fattening of V. pullastra larvae succeeded.

Other molluscs

Studies of the ecology of beaches and the population dynamics of natural beds were undertaken with a view to a more rational and profitable exploitation of mollusc farming.

Benthos

A study and evaluation of fields of Gelidium sesquipedale and of associated species were carried out off the North coast of Spain. Studies were made of gastropods and lamellibranchs collected from the Jandia, Concepción, Dacia and Savage Islands benches during the Norcanarias Campaign I.

Sweden

(B. I. Dybern)

Mytilus edulis

Distribution and size composition of Mytilus edulis were studied in a polluted fjord on the west coast.

(The first large-scale mussel cultivation undertaking in Sweden has been started by private persons with some success).

Benthos

Investigations of the benthic fauna of the Baltic were continued. The investigations were of two kinds: (1) off-shore long-term investigations at a large number of stations, (2) local coastal studies of the benthic fauna at sites where there are or expected to be pollution problems.

These studies will be continued in 1973.

United Kingdom

1. England and Wales

(P. R. Walne)

Ostrea edulis

Assessments of spatfalls and stock levels in the main English oyster fisheries have been continued. Spatfall was negligible in all areas during 1972 but the availability of oysters for relaying purposes has been more than adequate owing to the exploitation of the recently found natural stocks in the Solent area. The level of stocks in several of the traditional fisheries is now the highest for the past ten years.

Crassostrea gigas

Batches of small hatchery-produced seed (0.06g mean weight) were grown in stacks of trays held on rafts at five different sites around England and Wales. The growth and survival of the oysters from the raft held at Menai Straits (north Wales) was significantly less than from the

four rafts at Helford (Cornwall), Poole (mouth coast) and Paglesham and Walton (east coast), which had similar growth and survival rates. Experiments to determine the effects of exposure on growth and meat yields were continued, and the results compared with similar trials in 1971, and at all sites there was a positive correlation between the time of immersion and the shell growth.

Shellfish pests and diseases

Observations have been made on the distribution and abundance of Urosalpinx cinerea in Kent and Essex. Some evidence has been obtained that this predator has slightly increased its distribution to the north and east. A brine-dip treatment has been developed for killing Crepidula fornicata on oysters before transferring oyster consignments to areas which are not infested with this pest. Investigations have been made to determine the cause of mortality of Portuguese oysters (Crassostrea angulata) landed on the east coast of England in 1972. Physical microbiological and chemical examinations were carried out without identifying a causative agent. The only physical symptoms were extensive shell blisters, containing a clear gelatinous fluid, on the inside of the shells.

Mytilus edulis

The monthly recording of spatfall in Morecambe Bay was continued and showed that in 1972 the spatfall was a failure. The growth and yield of the 1971 spat cultured on vertical coir ropes suspended from a raft in the Menai Straits have been encouraging, but the strong currents make the ropes difficult to handle and this programme has now been concluded. Experimental plots on the coast of Anglesey showed an 80% mortality in 12 months. Trial plots in cages strongly suggested that this was due to predation by shore crabs.

Pecten maximus and Chlamys opercularis

An exploratory fishing survey was made off Newhaven in the eastern Channel but no stocks of commercial potential were located. Important fisheries for Chlamys have recently developed in west and north Wales and off south Devon. The development of these fisheries has been monitored and size composition data collected. Chlamys is now also exploited on new grounds located near the Channel Islands.

Cerastoderma edule

Routine stock surveys to monitor the main fisheries of the Wash, Thames estuary and in south Wales were carried out in 1972. In addition studies in the Wash have included observations on the possible effects of a fishing method which uses a boat's propeller to wash cockles out of the sand (ploughing-out). The implications of a proposed water storage scheme in the Wash which involves the construction of barrages have also been examined in the light of the distribution of cockle stocks. In the Thames estuary, research has been concentrated on monitoring the effect of hydraulic dredges on the previously unexploited Buxey and Foulness Sands. In south Wales the rapid spread of Spartina townsendii on the cockle beds at Llanrhidian Sands is being mapped since this could be a threat to cockle production from this area. The population of oyster catchers is also being monitored during the winter period.

2. Scotland

(H. J. Thomas)

Mytilus edulis

Experimental cultivation of mussels was continued in two sea lochs in the north west of Scotland. Settlement, growth and flesh condition were studied. Experiments were undertaken in the transferrance of seed mussels in tubes of plastic into areas of poor settlement.

Other mussel cultivation experiments were undertaken by the Scottish Marine Biological Association into the commercial possibility of growing mussels on suspended ropes at 8 sites in 6 Scottish west coast sea lochs. The main settlement of spat generally occurred in May or June, but in some areas there were years when this was delayed until late in the year, or failed to occur at all. As the density of young mussels was usually very high, the best method would probably be to use the ropes as collectors for seed mussels, followed by the netting bag technique of Böhle (1970).

Although the flesh yield was generally satisfactory, the growth rate was not sufficient to ensure a commercial yield at the end of the second season, and if left for a third season the mussels suffered damage by gales and fouling.

Pecten maximus

Catch/effort and composition data were obtained for the commercially exploited stocks. An assessment was made of the abundance of small prerecruit scallops. Further experiments were undertaken on the growth of settled spat of which a heavy spat fall was obtained on collectors.

Chlamys opercularis

Catch/effort and composition data were obtained for the commercially exploited stocks. Assessments were undertaken of the abundance of pre-recruits and experiments involving 2 000 spat were undertaken on their growth in cages.

Loligo forbesi

Data were obtained for commercial landings on catch/effort and the seasonal variation in size, sex composition and maturity.

Benthos

Long term food chain studies of prey-predator relationship on a flatfish nursery ground in Loch Ewe are nearing completion. In 1972 surveys of flatfish and their most important prey organisms were limited to the minimum required for an adequate assessment of the populations. More

effort was devoted to the larger components of this ecosystem, particularly the decapods and echinoderms, which were studied by diving. An accurate estimate of the density and fluctuations of these organisms is almost complete. In 1972 this work was extended to the Clyde estuary where a detailed examination of the benthos and its relationship to fish stocks was begun. This involves the whole estuary, but special attention is focussed on one flatfish nursery ground on the Ayrshire coast. Comparable studies of the food chain on a muddy ground in Loch Ewe have continued, and an attempt is being made to produce a carbon budget for the area.

In 1973 the food chain work in the Clyde sea area is being extended and benthos surveys of fish food in selected areas are planned.

U.S.S.R.

(B. Ivanov)

Cephalopods

Biology and distribution of main commercial squids, octopuses and cuttlefishes off West and Equatorial Africa were studied in 1972. Data on distribution of oceanic squids (Ommastrephes pteropus, O. bartrami) were analysed. Data on age-length composition were collected. Squids were most numerous in the Benguella Stream. The distribution of the octopus (Octopus vulgaris) and the cuttlefish (Sepia officinalis), off the Spanish Sahara and Mauritania was studied. Maximum concentrations of octopus, migrating for spawning in November-March were observed at the depth of 15-175 m off Cape Blane. It was noted that octopus stay in areas with good food conditions. Stable concentrations of Loligo vulgaris were found in the area of 23-24°.

Studies of cephalopods of the Gulf of Guinea are planned for 1973.

Benthos

PINRO drew up maps of the distribution of the biomass of the main groups of animals and determined limits of the biocenosis based on materials of the benthos surveys made during several years in the Barents Sea (1968, 1969, and 1970). These data were compared with results from 1921-31. The

CRUSTACEA

Belgium

(R. De Clerck)

Shrimps

Analyses of landings of commercial shrimps were carried out and catch per unit effort data were collected. A special study on biometric observations of the Crangon crangon population along the Belgian coast was undertaken.

Monthly shrimp surveys on 15 fixed stations were also carried out and the attempt at shrimp-forecasting on the Belgian coast was continued.

The behaviour of shrimps in a dumping area was studied.

Canada

(D. G. Wilder)

Homarus americanus

During its first year of operation, the Canadian offshore lobster fleet of six boats landed about 450 metric tons of lobsters, partly from newly discovered grounds. Inexperience and inadequate storage facilities on some vessels resulted in heavy seasonal mortalities. High catches per unit effort depend in part on the supply of large lobsters and are necessary to offset the high cost of fishing in deep offshore waters.

Six thousand lobsters were stored in a tidal pound for 2 months at rates of 5 and 10 kg per m² with and without drainage tiles for cover. Lobsters provided with tiles survived better and developed less algal growth, and fewer females resorbed eggs. Storage density had little effect on mortality, 70% of which occurred in the first 10 days.

In some areas, the raking of Irish moss causes significant damage to lobster stocks. Control of raking to minimize damage to lobsters and optimize profits from moss and the development of less damaging moss harvesting methods were recommended.

The moulting frequency of lobsters can be accelerated through surgical removal of the eyestalks, with good survival, excellent growth and normal physical appearance maintained through at least two moults.

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The development of lobster larvae was delayed and their survival reduced by exposure to sublethal concentrations of emulsified Venezuelan crude oil in sea water for 30 days or longer. Experiments were conducted to determine whether larval feeding was influenced by oiled sea water and whether oiled sediments affected the growth, feeding and burrowing of stages 5 to 8.

Satiated lobsters responded to tank water from other lobsters except intermoult females. Satiated males responded to dilute urine from moulted males or females. These observations indicate a social communication system among lobsters. Certain chemical fractions of tank water, urine, lobster tissue and cod muscle extracts retained partial activity but the compounds that stimulate social and feeding responses have not been identified. Social responses by satiated lobsters were blocked by cod and lobster extracts.

Pre-treatment of healthy lobsters with vancomycin prevented the development of gaffkaemia for 15 days. The bactericidin which can be induced in the lobster's hemolymph by the use of vaccines is a product of hamocyte:plasma interaction but does not confer protection against Gaffkya homari. Live and formalized vaccines prepared from avirulent strains of G. homari showed no induced bactericidal activity when the avirulent strains were used as test organisms but did show increased activity against Pseudomonas perolens. In vivo tests showed a limited enhancement of the host's resistance.

In general, lobsters that responded to treatment with the insect moulting hormone ecdysterone died in attempting to moult. In special cases, where lobsters survived the moult, the effect of the treatment was too slight to be considered useful. These results and the low responsiveness of lobsters to physiological manipulation suggest that the currently accepted crustacean moult inhibition mechanism is not valid for lobsters. A hypothetical new mode of moult inhibition will be tested. The significance to lobsters of a major hormone group, the prostaglandins, is also being investigated. These hormones which have been shown to have important, multiple effects in mammals have recently been isolated from Gorgonia and may be important to all animals.

Lobsters on diets where corn oil was the only source of lipid had a high mortality rate immediately after moulting. Those where cod liver oil was the sole lipid source survived and grew well. Casein or fish protein concentrate was a satisfactory protein source and there was no difference between glucose and corn starch as a carbohydrate source. Control diets for maintenance and growth promotion are now available.

Plankton sampling in Newfoundland coastal areas in July and August showed that when winds were offshore larvae were very scarce close to shore. With inshore winds larvae were concentrated within 60 m of shore. There was some indication of a shore avoidance reaction. Larvae of several species of decapods are being reared to complete a reference collection of lobster faunal associates in Newfoundland waters. The commercial fishery in selected areas is being monitored for catch and effort statistics, size composition and tag returns.

Homarus gammarus

Work done at the Marine Biological Station, Port Erin, showed an endogenously controlled hatching rhythm in this species. Responses of different stage larvae to changes in hydrostatic pressure and light were also studied.

Chionoecetes opilio

Exploratory fishing in nearshore Newfoundland waters showed that at the optimum combination of temperature and depth (<0°C and 180-290 m) only 24% of the traps hauled caught more than 20 commercial-sized crabs. Clearly other factors also influence crab catches.

Pandalus borealis

Landings declined from 1 650 metric tons in 1971 to 1 250 metric tons in 1972, mainly because of a diversion of boats on the north west coast of Newfoundland to a more lucrative fishery on a virgin stock of Iceland scallops. In a trawl survey of Esquiman Channel deeper than 180 m, best catches were made in the northern part where catches ranged up to 70 kg per half hour tow. Size distributions and shell conditions were monitored monthly.

Denmark (Greenland)

(E. Smidt)

Chionoectes opilio

The experiments with various crab traps, initiated in 1971, were continued.

During 1973 experiments will be continued in the inshore waters of the Godthab district.

Pandalus borealis

Investigations, on a small scale, were continued in the offshore waters of west Greenland.

During 1973 similar investigations will be undertaken, in both inshore and offshore waters, mainly in the Umanak and Julianehab districts.

Federal Republic of Germany

(K. Tiews)

Crangon crangon

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 450 samples (= 2 273 kg) of unsorted catch of the shrimp fishery were collected in Büsum, Cuxhaven, Neuharlingersiel, Dornumersiel, and analysed as to their species and length composition. Experimental work at the Institut für Küsten- und Binnenfischerei with Crangon crangon has been started to find out whether or not this shrimp changes its sex.

In 1973 work on catch assessment and the composition of shrimp catches by species and length will be continued.

Pandalus spp.

Samples of deep sea prawn catches made on the occasion of a research cruise of RS "Friedrich Heincke" in the Farn Deep area and on the Fladen Ground were analysed as to their species and length composition at the Institut für Küsten- und Binnenfischerei. A study on the stomach contents of Pandalus was started at the Institut für Hydrobiologie und Fischereiwissenschaft of the University of Hamburg.

Research on the composition of Pandalus catches made by RS "Friedrich Heincke" in the North Sea, as well as food investigations, will be continued in 1973.

France

(L. Marteil)

Homarus vulgaris

Après cinq ans d'interdiction de pêche, les mesures prises sur les cantonnements commencent, semble-t-il, à donner des résultats bénéfiques, même en dehors des zones réservées. On capture un nombre de plus en plus grand de jeunes crustacés, âgés de 5 à 6 ans, ayant atteint la taille marchande ou la dépassant légèrement.

Le développement des cantonnements est désormais assuré par immersion de post-larves, aux stades 4, 5 et même 6, produites en écloséries. Près de 50 000 individus ont été ainsi immergés en 1972 en divers points de la côte. Plusieurs Sociétés participent à cette opération ainsi que l'Institut des Pêches qui poursuit ses mises au point de techniques destinées à éviter le cannibalisme et à augmenter ainsi le rendement des écloséries.

Jasus lalandei

De nouvelles captures dont l'une a eu lieu près de Belle-Ile témoignent des possibilités de déplacement de cette langouste.

Maia squinado

Ce crustacé fait l'objet d'études portant sur ses déplacements, son régime alimentaire et sa reproduction sous contrôle.

Pollicipes cornucopiae

Une étude sur les populations de Pouce-pieds a été entreprise.

Pathologie des crustacés

Les recherches sur Gaffkya homari ont été intensifiées en suivant la méthode décrite par J. Stewart. En milieu naturel, des homards ont été reconnus infestés; ils ont été réimmergés et certains ont été recapturés plusieurs mois après. Dans quelques cas, l'animal n'était plus parasité.

La présence du cilié trouvé chez Cancer pagurus a été recherchée chez des crabes morts ou mourants stockés en viviers. 14% des individus étaient parasités.

1973 Programme

Poursuite des études sur la reproduction des homards en éclosion et sur les maladies des crustacés.

Iceland

(H. Eiríksson)

Nephrops norvegicus

Routine collection of data on Norway lobster landings, catch/effort and catch composition of all major fishing areas were maintained. In 1972-73 research vessel surveys were carried out where work included the tagging of 3 700 Nephrops at south and south-east Iceland.

In 1973 research will be carried out along similar lines. Selection experiments are planned to investigate the possible increase of mesh size in Nephrops trawls.

Pandalus borealis

Sampling and collection of catch/effort data was carried out as in previous years. Pandalus surveys were undertaken off the northwest, north and southeast coasts. Noteworthy Pandalus catches were obtained in Berufjarðaráll (south-east Iceland) and Reykjafjarðaráll (north Iceland) of up to 165 kg and 80 kg/hour in each area respectively. 3 000 prawns were tagged on the prawn grounds at south-west Iceland. Regular surveys were

made on the main Pandalus fishing grounds. These led to the closing of the southwest prawn fishery for a great part of the year owing to the large numbers of young haddock. Areas at northwest Iceland were also closed periodically owing to the large numbers of young prawns.

In 1973 a similar research programme will be continued. Preparations are already under way to make compulsory the use of prawn sorting machines at sea. These sorting machines have shown very promising results in protecting young prawns as high proportions are returned to sea alive.

Ireland

(F. G. Gibson)

Lobster (Homarus gammarus)

Work was continued as in previous years on the assembly of catch and effort data in the lobster fisheries. Studies were made of lobster impoundment and a leaflet produced with the aim of optimising conditions under which this animal is stored prior to sale or export.

It is proposed that in 1973 further physiological studies will be made of lobsters in captivity. Extensive storage pond and port sampling will be undertaken.

Crawfish (Palinurus elephas)

Biometric observations of crawfish stocks in Irish waters continued at a reduced level during 1972. This work was combined with routine measurements of total serum protein level at various times of the year. It is hoped that this technique will provide a non-destructive indication of crawfish quality and condition.

Observations were made of the development of a tangle-net fishery off the south-east and south-west coasts. Experimental tangle netting trials were made off the south-west but these met with only limited success.

Crawfish tagging was undertaken off the south-west. Approximately 700 specimens were tagged. Two types of tag were used; (a) a dart or arrow tag, and (b) a toggle tag. The programme was designed to provide data concerned with growth rates and stock densities. The rate of recapture of crawfish has been low but it is not yet known whether this is due to the abundance of the stocks - a marked long distance migratory habit - or poor tagging technique.

Preliminary work on the collection of catch/effort statistics in detail, from observations on board fishing vessels, has been aimed at determining the factors responsible for short term fluctuations of catch, eg the immediate effects of weather, time of year and physiological conditions pertaining in the stocks.

Laboratory investigations of the storage conditions required by crawfish were resumed in the Autumn of 1972 and will be continued in 1973 on an expanded scale. It is proposed to monitor the effect of size, sex, and physiological condition on the oxygen condition of stored animals. The important effects of the main physical parameters, oxygen tension, temperature, etc, are also being studied.

Crab (Cancer pagurus)

Work with crabs during 1972 was devoted to the tagging and liberation of 1 250 specimens, of which 500 were released at Schull, County Cork, and 750 were released near Malin Head, County Donegal. All tags were of the suture type. It is expected that this work will provide estimates of the growth rates of crab.

Recapture rates by the end of the year were above 10% for the Cork releases, but below 2% from Donegal. This difference is presumed to reflect the differing rates of exploitation in the two areas. It is hoped that valuable information will be forthcoming from this experiment in 1973.

Nephrops

Sampling of commercial catches was on a reduced scale and confined to the main (summer) season of the fishery.

Observations of the growth of juveniles and adults in captivity were maintained during the year.

Consideration has been given to the possibility of undertaking a tagging experiment on a discrete population of Nephrops.

Italy

No report received

Netherlands
(P. Korringa)

Crangon crangon

The production of shrimp larvae in Dutch coastal waters during 1972 has been closely studied. Plankton surveys revealed that the numbers of shrimp larvae are related to the size of the adult shrimp stock in particular to the number of berried females. It is insufficient to estimate the percentage of shrimps of length over 45 mm the eggs of which will hatch during the season. Quantitative data on the fluctuations in the shrimp stock, based on the catch per unit of effort throughout the year, are also essential. The number of boats equipped with the mechanical shrimp sorting machine rose steadily. Over 60% of the Dutch shrimpers now use this machine which was improved by the development of an automatic transporter. This device, which leads the catch in a steady stream to the sorting machine, is not solely labour-saving it also protects the by-catch which, during the operation, is kept in sea water and so avoids desiccation.

Norway

(K. R. Gundersen, B. Bøhle)

Homarus gammarus

The lobster investigations were carried out mainly in the same way as in previous years. Commercial catches of lobster were investigated at the lobster pound at Glesvaer south of Bergen in order to get information on size, sex and proportion of berried females in the lobster stock along the west coast of Norway. Also along the south-east coast commercial catches were investigated to obtain information on the stock.

Recaptured lobsters from earlier tagging experiments were inspected, and if in fine condition with the tag perfectly fixed, liberated for further experiment. Lobsters of this kind and also some tagged for the first time were liberated at Busepollen south of Bergen in March, June

and July, totalling 79, 15 and 36 respectively, and at Kvernhusosen north of Bergen in May, July, October and December totalling 40, 16, 37 and 55.

Fishing experiments with different types of gear were carried out in May, June, July and October-November in the tagging area in Busepollen and Kvernhusosen. A Norwegian type pot, the "Måløyteine", seemed to be most effective in areas with dense seaweed.

Some preliminary experiments in lobster rearing were carried out in the laboratory using new equipment designed by John T. Hughes, USA. The result, however, was not so good as expected. Mortality caused by cannibalism seemed to give heavy losses in lobster rearing.

At the Biological Station in Flødevigen, small scale experiments on growth in warmed sea water (16-17°C) were initiated in 1969. The animals, which are hatched and reared in the laboratory, seem to reach 22 cm (minimum legal size) at an age of 2-3½ years.

Cancer pagurus

The tagging experiments on Cancer pagurus were continued in the Hjeltefjord area mostly as in the year before. At Frøya, in Trøndelag, crab investigations were started in September 1972. In this area a very valuable crab fishery takes place mainly in the period September-November. The crab fishery in Norway is not regulated by closed seasons, but in this area there is an agreement between the fishermen and the fishery does not start before samples of crabs, taken from the middle of August onwards, show that the quality is excellent. The catch in this area is sorted. Ripe females are mostly exported, giving a high price to the fisherman. The rest, males and secondary females, are used in canneries. This fishery usually stops at the end of November when soft crabs start to dominate in the catches. Investigations in this area are a combination of tagging experiments, and an analysis of the stock composition, maturity and catch per unit effort.

Pandalus borealis

Because of the great amount of O-group fish which are destroyed by prawn fishing, the Institute has worked further in making a prawn sorting trawl, which catches mainly prawns and allows fish to escape. It was found difficult to construct a sorting device in the large Norwegian prawn trawls ("Sputnik" trawl). This trawl has much in common with the pelagic herring trawl which is ordinarily used in the North Sea countries. Experiments with this sorting net principle were undertaken using the Canadian type of prawn trawl, ("Kodiak" trawl) and an old Norwegian prawn trawl ("Vingetrål"). Further experiments will be carried out with these two last types to improve the sorting efficiency

Portugal

(J. E. E. Cabido de Atáide, M. J. Figueiredo)

Nephrops

A programme of sampling of Norway lobsters (Nephrops norvegicus), captured by trawlers and by inshore boats, and studies on the length composition of the populations, were started at the Instituto de Biologia Maritima.

Culture

A programme of field work was initiated in the south of the country (Ria de Faro-Olhão) to obtain information on water quality, in respect of both the biology and the chemistry, to assess the suitability for the culture of crustacea (and fish). In the Instituto laboratory experiments were undertaken on the development and artificial culture of the Norway lobster (Nephrops norvegicus) and the shrimp (Penaeus kerathurus) from the egg. In addition studies on the culture of marine organisms (Palaemonetes varians and Tisbe spp.) as food for the larval and post-larval stages were pursued.

Spain

(H. Quiroga)

Palinurus regius

A study was undertaken on the green lobster of the Spanish Sahara coast. 700 specimens were measured. Their growth, migration, sexual reproduction and fishery was studied.

Maia squinado

In the same area a similar study was made on the spider crab of which 200 specimens were examined.

Calappa granulata L.

The biology and fishery of this decapod, captured during the Norcanarias Campaign I, were studied.

Culture

Studies on the farming of the prawns Penaeus kerathurus and Palaemon urratus were continued.

Sweden

(B. I. Dybern)

Homarus gammarus

Collection of lobster stomachs was carried out.

An in situ investigation of the time individual lobsters stay in their hollows is planned for 1973.

Cancer pagurus

Studies of the ecology and behaviour of the crab were continued on a smaller scale as compared with previous years. The final publishing of the results from the last 5-year period has unfortunately been delayed.

Nephrops norvegicus

Continued reports were obtained from about 40-50 trawlers on their daily catches of Norway lobsters and fish. This reporting has lasted for more than 5 years.

It is intended to make a final compilation during 1973. In coming years the reports will be restricted to fewer boats.

Pandalus borealis

Continued reports were obtained from about 20 commercial trawlers of their daily catches of shrimps and fish. Analyses were made of age and sex composition in samples from scientific trawlings. Calculations were made for simple models on exploitation of Pandalus populations in Skagerak and adjacent waters.

For 1973 analyses of size, weight and sex composition, reproductive stages and seasonal variation in samples brought in by commercial fishermen from different areas are planned. Studies will be undertaken of the selectivity of trawls using different mesh sizes. A data-machine treatment of Pandalus material collected during previous years will be started.

United Kingdom

1. England and Wales

(P. R. Walne)

Homarus gammarus

Lobster catches in certain parts of England and Wales have declined in recent years. Investigations into this species were, therefore, expanded in 1972 to include observations in all the major lobster fishing areas along the coasts of Northumberland, Yorkshire, Sussex, Cornwall and Wales, to determine the state of the stocks. In 1972 some 25 000 lobsters were examined for carapace length, sex ratio, proportion carrying eggs and size at 'maturity'. Records of trap contents, including the proportion of the catch below legal size, were obtained by accompanying commercial fishing vessels to sea from the major lobster ports in the country. Observations were made on the carapace length/total length relationship and on the length/weight relationship. Data on catch-per-unit of effort have also been collected from the main fishing areas.

Palinurus elephas

Two sets of catch measurements in 1972 did not indicate any change in size composition. Of 155 tagged crawfish released in July 1971, 7.7% have been returned.

Cancer pagurus

The main research programme in south-west England to determine the effectiveness of the existing conservation measures has been completed. Studies during 1972 were mainly concerned with the collection of catch-per-unit of effort data and observations on the population structure including studies on moulting and growth. During 1972 a programme of offshore tagging was begun in the English Channel to add to the information available on migrations and stock relationships. A total of 1 129 suture-tagged crabs, mainly females, were released 20-50 miles off the Devon coast in August and October 1972.

The programme to monitor changes in the catch, effort and population structure has been continued on the east coast of England as a follow-up to the intensive research programme during 1959-1966. An experiment to determine the effect of limb loss and regeneration on the body growth and the timing of ecdysis was successfully completed in the laboratory.

Nephrops

Routine monitoring of the populations in the Irish Sea and North Sea have been continued. Trials have been made with various types of gear to try to reduce the catches of undersized whitefish. Tests with a modified Gulf of Mexico shrimp net, which has no wings, have been promising and will be continued in 1973.

Crangon crangon

Sorting trials were conducted in the Thames estuary and the Wash with a Dutch rotary shrimp sieve. The sorting and conservation functions of the sieve were first tested on Crangon and found to be entirely satisfactory. Tests on Pandalus montagui, not fished by the Dutch, suggested that both pink and brown shrimps could be sorted efficiently by this rotary sieve but the survival of P. montagui was less than that of C. crangon.

Pandalus borealis

A survey of the stocks in the Farn Deep was completed in the autumn. The fishable stocks are based almost entirely on 2- and 3- year old prawns; as a result of this short life-cycle fluctuations in abundance occur, and the catch-per-unit of effort was lower in 1972 than in earlier surveys. The stock is still, however, being exploited by Danish, German and Scottish vessels.

Pandalus montagui

The study of a commercially-exploited stock in the Wash included observations on the changes in annual and seasonal shrimp abundance and on the general biology of the population. Changes in the density and oil content of P. montagui have been studied. It is believed that these affect the catches of shrimps taken in a fishery where bottom trawling is exclusively used, particularly during the summer when shrimps have been observed to be present at mid-water levels and are not caught.

2. Scotland

(H. J. Thomas)

Homarus gammarus

Population studies involving data on landings, catch-effort and catch composition were undertaken in all main areas of exploitation. Further studies were made on the rates of ovary and external egg development. Further aquarium experiments were undertaken on lobster growth. An experiment on lobster environment improvement was initiated in which broken concrete slabs were used to provide crevices on otherwise smooth bottom.

Cancer pagurus

Routine sampling of the catch of crabs and the collection of catch/effort data from selected boats were continued in the main fishing areas.

A tagging programme was carried out and the fishing efficiencies of parlour and east coast traps were compared.

Norway lobsters

Population studies involving landings, catch/effort data and catch composition were continued and a comparison made between adjacent grounds. Further comparative trap fishing experiments were undertaken. In conjunction with this a survey was undertaken of the occurrence of squat lobsters (Munida bamffica).

Crangon crangon

The collection of catch and fishing effort data was continued.

Pandalus spp.

Landings and catch composition data were obtained for the Scottish Pandalus fisheries on the Fladen and in the Farn Deep. By-catch studies were undertaken in both areas. Investigations on the distribution and biology of Pandalus bonnierii were continued.

U.S.S.R.

(B. Ivanov)

Shrimps and prawns

In 1972 the Atlantic Institute of Fisheries and Oceanography (AtlantNIRO) collected material in a study of the biology and distribution of pink shrimp (Penaeus duorarum) off West Africa. Material was collected during the whole year, and delivered to the laboratory in the first quarter of 1973. In 1972, 1 223 stomachs of pink shrimp were examined to study variability in feeding by season, time of the day and according to size. Migrations of shrimp seem to be connected with changes in feeding. Regular collections of material of deep-water shrimp Parapenaeus longirostris, started in 1968, were continued. In 1972 about 20 samples (3 000 shrimps) from the four areas off the West and Equatorial Africa (in the main, the Gulf of Guinea) were examined. The season of reproduction and peculiarities of depth distribution were elucidated. Shrimps seem to spawn in a rainy period, rising for this purpose on to the shelf. In dry seasons shrimps move from coastal to deep water and there form commercial concentrations.

In the Barents Sea the Polar Research Institute (PINRO) conducted investigations on the distribution and biology of the deep-water prawn Pandalus borealis. The collection of materials were made from the research ship "Atlantida". Results of 420 trawls in the Barents Sea, 48 in the Norwegian and the North Seas, 11 off Scotland, 13 off the Faroes and 52 off Iceland were analysed. Two hundred samples were collected. Four areas with relatively high concentrations were found and the possible catch in these areas was estimated. Two types of concentrations were found; seasonal concentrations, disposed on open and relatively level parts of seabed in the spring and summer; and persistent concentrations with stable densities which do not perform sizeable seasonal migrations, in underwater channels of the continental shelf. Shrimps off Bear Island live 6 years. Shrimps change their sex at the 5th year of life, spawn in August-September and hatch in May. Shrimp maturation off the Island of Hope and the Western Channel occurs one year later as compared with shrimps off Bear Island. Concentrations in these areas are temporary. It is recommended to close the fishery for the period of mass hatching.

In 1973, investigations on the biology and distribution of Parapenaeus longirostris and Pandalus borealis are planned.