D10

International Council for the
Exploration of the Sea

C.M. 1990/K:1
Report of Activities

SHELLFISH COMMITEE

by

C.C.E. Hopkins

1989

FOREWORD (C.C.E. Hopkins)

A total of 15 member countries of a total of 16 participating in the Shellfish Committee Activities. Survey activities of both crustaceans and molluscs continue to play the dominant role in the activities of member countries. Interest in implementing relatively little used techniques has otherwise grown greatly, and this has manifested itself in the two successful workshops held under the auspices of the ICES Shellfish Committee: a) Multivariate Analysis of Shellfish Stocks, b) Spatial Statistical Techniques. Reports of these were presented at the 1989 Statutory Meeting and modified versions will be published in due course in the Cooperative Research Report series. Further attention has been devoted to developing production, productivity and energetics approaches, including modelling. These supplement analyses of life history trends. All these developments will naturally be focussed in the 1990 ICES "Symposium on Shellfish Life Histories and Shellfishery Models".

CRUSTACEA

Belgium - Belgique

(F. Redant)

Crangon crangon

The investigations on the brown shrimp included current analyses of landing statistics and CPUE data, and a study on the relationship between the winter sea-water temperatures and the shrimp landings during the following summer and autumn.

Nephrops norvegicus

The market sampling programme on the Norway lobster (Belgian landings from the Botney Gut - Silver Pit stock) was continued to evaluate the impact of fishing on population structure and composition, and to establish a data-base for future analytical assessment studies.

Population studies, together with investigations on the development of the abdominal eggs, provided conclusive information on the reproduction cycle and on the onset of biennial spawning in Central North Sea Nephrops.

Epibenthic biota

On request of the Benthos Ecology Working Group a bibliographic review was compiled on the productivity of epi- and hyperbenthic species, including Crustaceans (Cumaceans, Decapods, Isdopods. and Mysids), Echinoderms (Asteroids, Echinoids and Ophiuroids), Molluscs (Bivalves and Gastropods) and small bottom-dwelling fish (mainly Gobiids). The P/B ratios of epi- and hyperbenthos were found to range between 0.1 and 9.3 year-1, and compare with those reported for the macro-endofauna.

Canada

Newfoundland Region and Scotia Fundy Region

(G. P. Ennis)

Homarus americanus

The 1988 and 1989 Canadian lobster landings from the open Atlantic coast of Nova Scotia and the northern Gulf of Maine waters remained above the long-term mean, but appear to have levelled off after seven years of unprecedented increase. Some areas experienced moderate declines from the highs of 1986 and 1987, but others continue to increase.

Offshore lobster landings declined for the third year and are at levels of the early 1980's. The role of the fishery in the decline is still unclear since natural fluctuations in distribution and catchability are not well understood in these highly migratory, deep-water lobsters. Size frequencies have remained relatively constant over the 17 year history of the fishery.

Published tagging studies along Nova Scotia's open Atlantic coast have confirmed that most lobster movement is local. The long distance movements seen occasionally in mature Bay of Fundy lobster have not been observed. Research continues on the population biology of all lobster life history stages, with emphasis being placed on reproductive ecology, juvenile distribution and habitat preferences and larval distribution in relation to physical state variables.

Long-term monitoring of the fishery continues with sea and port sampling, a compulsory offshore logbook system, and the introduction of a voluntary inshore logbook system to collect detailed catch and effort data.

Long-term monitoring of fishery characteristics including catch rates, catch, effort and exploitation rates and aspects of the population biology of lobster including annual growth, recruitment and standing stock was continued in three localized fishing areas around Newfoundland. Annual plankton sampling to study larval ecology continued in one of these areas.

Pandalus borealis

Fishermen's logbooks, observer data and a research trawl survey provided data on the northern shrimp fishery and status of the stocks off coastal Labrador in 1989. TAC's, totalling almost 26,000 t, were taken in most of the traditional fished stock areas and more effort was directed to some recently fished areas, especially Div. 0B and 2G. A research survey was conducted from July 6 to July 26 in Div. 3K to 0B inclusive and a biomass estimate was obtained for the Hawke Channel (Div. 2J).

The small inshore fishery which began in Fortune Bay on the south coast of Newfoundland in 1988 continued in 1989.

Chionoecetes opilio

In the Newfoundland fishery, at sea research sampling and sampling of commercial catches continued. Catch and CPUE data for the various management areas were analyzed. Landings are increasing in the southern zone offshore areas apparently because of increased recruitment since 1986. In 1982, there was a sharp reduction in the level of molting activity in the population that had persisted and appears to be related to lower bottom temperatures throughout the area over this period. CPUE remained stable in the deep-water bays along the coast, probably as a result of strict quotas that were first imposed in 1986. Landings and CPUE in the northern zone remained depressed despite drastic quota cuts. New areas of commercial abundance were identified in 1989 in the Labrador Sea and northeast of the Funk Islands on the northeast coast of Newfoundland.

Research aimed at fully documenting behavioural, ecological and biological aspects of a deep-to-shallow breeding migration of snow crab in Bonne Bay on the west coast of Newfoundland continued. Studies of various aspects of molting, mating and egg development continued. A spring bottom-trawl survey for snow crab in Conception Bay on the east coast of Newfoundland, was successfully carried out for the second consecutive year.

The overall status opf snow crab stocks in areas 2-6 of Cape Breton Island in 1989 appears to show a slight improvement over 1988, continuing the reversal of the collapsed state noted in previous years. A wave of males first detected as pre-recruits in 1985 continued recruiting into the commercial stocks prior to the 1989 fishing season and maintained fishable biomass over 1988 levels in all areas. A weaker marked demand for snow crab resulted in a slight decrease in estimated total fishing effort (trap hauls) but this was offset by a higher average catch rate and total landings were marginally higher than in 1988. Although 96 of a possible 111 vessels were active, only 34 logbooks were received covering 221.6 t of the total recorded catch (560.4 t). Nevertheless, the available logbooks and pattern of CPUE permitted estimates of exploitation rate for all inshore areas by Leslie analyses. Crude estimates of total available commercial biomass were made by multiplying the landings from sales slips by the reciprocal of the exploitation rate. Five vessels fished virgin grounds in the offshore of S.E. Cape Breton and landed 57 t. The commercial biomass could not be estimated but catch rates were high and it is probable that the fishery has yet to significantly impact on the resource. At-sea sampling showed that most of the males captured were relatively old-shelled and had attained morphometric maturity.

The minimal legal size was thought to confine exploitation to males that had been mature for 1-2 years. Hence, the full reproductive potential of the resource was believed to be protected. However, between 45.5% and 8.5% of the landed males sampled from the Cape Breton inshore areas in 1989 were morphometrically immature. Although th long-term biological implication of this situation remain unclear, virtually all of the mature females sampled through the 1989 fishing season carried eggs. Analyses of morphometric data also showed that large numbers of males had attained a terminal molt below

the legal minimum size. Research into reproductive physiology, morphology, and expressions of maturity in snow crab is continuing. In addition, tests are being conducted with radiochemical methodologies for aging snow crab carapaces.

Région du Québec et Region du Golfe du Saint-Laurent

(G. Y. Conan)

Pandalus borealis

Les pêcheries de crevettes dans le nord du golfe du Saint-Laurent ont de nouveau été suivies en 1989 mais cette espèce ne fera pas l'objet d'une évaluation de stock formelle pour l'émission des recommandations scientifiques pour la saison de pêche de 1990. Un relevé de recherche effectué à l'automne 1989 indique que l'abondance de la population de la zone de Sept Iles est en augmentation depuis 1987. Les taux de capture des flottes commerciales sont relativement stables depuis quelques annnées. Les statistiques préliminaires indiquent que les captures ont de nouveau augmenté en 1989 pour atteindre les plus hautes valeurs (plus de 15,000 t) jamais enregistrées depuis le début de l'exploitation en 1965.

Un modèle (Synthetic Age Population Analysis) à été développé afin d'inclure simultanément des données d'âge et de taille dans une analyse virtuelle de population. Ce modèle, développé d'abord pour les pétoncles, a été utilisé sur les données de crevettes de la zone de Sept Iles et les résultats préliminaires indiquent que la mortalité par la pêche a augmenté depuis les sept dernière années pour atteindre une valeur de 0,5 pour les femelles en 1988.

Les analyses des structures spatiales des crevettes du nord du golfe du Saint Laurent se sont poursuivies et ont fait ressortir que la biomasse observée au cours des relevés de recherche de 1982 & 1988 montre d'importantes fluctuations dans sa répartition spatiale.

Une analyse des crevettes provenant d'une collection d'échantillons récoltés au moyen d'un traineau supra-benthique a révélé l'existence d'un groupe d'individus de 1 an. La présence de cette cohorte à cette gamme de taille a été attribuée à la faible croissance des jeunes crevettes reliée à la température froide (0,5-2,0^{0}C) de leur habitat. Les mâles atteignent leur maturité complète à un âge de 30 & 37 mois. L'installation benthique des larves semble survenir à un âge de 4-5 mois.

Des expériences en laboratoire ont été menées sur les larves de Pandalus borealis afin de déterminer leur contenu lipidique et éventuellement mettre au point un facteur de condition pouvant expliquer la survie larvaire de cette epèce.

Pandalus montagui

Les résultats d'un projet de recherche dans l'Arctique canadien révèlent que les captures par chalut de fond des ces marines les plus communes de décapodes et de poissons correspondent à

gradient croissant de diversité et d'abondance dont les plus fortes valeurs sont obtenues vers l'est, du détroit d'Hudson vers le détroit de Davis et la mer du Labrador. La crevette rose (P. borealis) domine dans le détroit de Davis et la mer du Labrador alors que la crevette rayée (P. montagui) domine dans l'est du détroit d'Hudson. Les captures annuelles de P. montagui sont très variables et sont possiblement reliées à l'intensité du mélange dans la partie est du détroit d'Hudson.

Homarus americanus

Un programme de recherche s'est poursuivi sur la population de homards de l'île d'Anticosti (golfe du Saint-Laurent). La fréquence de mue en fonction de la taille des individus a été évaluée et un programme de marquage entrepris en 1989 devrait permettre de vérifier la relation qui existe entre la fréquence et l'accroissement à la mue et la taille des individus. En outre, ce marquage permettra d'évaluer à nouveau l'abondance et le taux d'exploitation de cette population afin de les comparer avec les résultats obtenus en 1986.

Les échanges larvaires entre différentes régions ont été modélisés en tenant compte d'un mécanisme par lequel le climat et les facteurs hydrographiques (gyres, remontées côtières d'eau profonde) pourraient avoir un impact direct sur l'advection et la survie des larves planctoniques de crustacés. Le modèle a éte testé sur les larves de homards et suggère que l'exploitation de larves de la côte nord du golfe du Saint-Laurent et l'île d'Anticosti pourrait expliquer la stabilité des débarquements de la côte ouest de Terre-Neuve.

Chionoecetes opilio

Une méthode simple et peu coûteuse pour déterminer l'âge des carapaces de crabes des neiges a été mise au point et sera validée sur le terrain par des expériences de marquage en 1990 et 1991.

Une étude de la population de crabes des neiges du fjord du Saguenay a été commencée en 1989. La population est inexploité et dominé par des gros mâles en apparence très vieux. La détermination de l'âge et le suivi annuel de la population permettront de calculer des taux de mortalité naturelle et de les comparer aux taux de mortalité par la pèche subis par les mêmes classes d'âge dans des populations exploitées. Des annalyses phénotypiques (caractère méristiques et morphométrie) et génotypes (electrophorèse des protéines) sont en cours afin de préciser les relations entre les populations du Saguenay, de l'estuaire (Cap Colombier) et du golfe (baie Sainte-Marguerite) du Saint-Laurent.

Le mouvement ascensionnel d'une partie importante de la population de crabes des neiges de la baie Sainte- Marguerite, mis en évidence par un échouage massif de crabes sur la plage de la Baie en 1988, semble être un phénomène annuel puisqu'il a été à nouveau observé en 1989. Les crabes, surtout mâles, se déplacent jusque dans l'infralittoral (3 à 5 m de profondeur) de la Baie au mois de mars, pour y muer et/ou s'y reproduire. Le suivi de cette population se fera maintenant sur une base

annuelle car il est possible d'observer directement son comportement de reproduction et de mue.

L'évaluation annuelle de l'état des stocks de crabes des neiges de l'estuaire et du golfe du Saint-Laurent a été effectuée après la saison de pêche de 1989. Divers projets sur la dynamique de population de ce crustacé se sont poursuivis ou ont débuté en 1989. Ils portent en outre sur la croissance estivale des crabes dans l'estuaire du Saint- Laurent, l'évaluation de la fécondité et la distribution des juvéniles sur la côte nord du Golfe.

L'état de la ressource dans le sud-ouest du Golf a été étudiée à partir des statistiques de débarquement et des journaux de bord fournis par les pêcheurs. L'incidence des crabes récemment mués dans les débarquements et la chute de la capture par l'unité d'effort, observées durant les échantillonnages à bord des navires commerciaux, ont suscité une fermeture prématurée de la saison de pêche. Les résultats d'une campagne d'échantillonnage à l'aide des casiers ont confirmé cet état de fait après la fermeture. L'estimation de la biomasse disponible effectuée par la technique géostatistique du krigeage, et basée sur la campagne de l'année 1988 a démontré une bonne concordance avec la capture commerciale de la saison 1989. Une campagne de chalutage expérimentale à l'aide d'un chalut à langoustine a permis d'évaluer, pour la première fois, l'abondance des crabes de bonne qualité commerciale et également les crabes qui vont muer pendant la saison suivante. Une nouvelle approche de la gestion de stock du crabe a été mise en place en se basant sur les résultats de cette campagne afin de protéger et de reconstituer le stock.

L'histoire naturelle de l'espèce en relation avec la présence d'une mue terminale est étudiée en bassin thermocontrolé à l'aquarium de Shippagan et in situ en plongée sous-marine dans le Fjord de Bonne Bay. Les résultats de ces études ont permis de suivre le cycle et le méchanisme du recrutement du crabe en mue terminale dans le milieu naturel.

Cancer irroratus

Des travaux ont été entrepris en 1989 afin d'acquérir des données sur la biologie du crabe common dans la baie des Chaleurs. Les travaux ont porté sur la détermination du cycle de mue dans le milieu naturel afin de déterminer la fréquence annuelle de mue de différentes classes de taille et d'examiner l'évolution saisonnière de la proportion de crabes en post-mue récente (crabes mous) dans la pêche.

D'autres travaux ont également porté sur l'évaluation de la sélectivité de différents engins de pêche de façon à déterminer le type d'engin qui permet de minimiser les captures accessoires de homards.

Amphipodes lysianassoïdés (principalement Anonyx et Orchomenella)

Divers travaux sur l'agrégation et la dispersion des amphipodes lysianassoïdés autour d'un appât ont été réalisés en 1989. Ces travaux visent à déterminer l'impact trophique des lysianassoïdés sur les communautés benthiques des fonds meubles.

L'importance relative des lysianassoïdés en tant que destructeurs d'appâts a été déterminée par une série d'expériences de terrain. L'analyse des données préliminaries suggère que, sur certains fonds, les lysianassoïdés peuvent réduire à néant la capturabilité d'espèces convoitées par des pêcheurs, parce qu'ils accaparent en consomment l'appât rapidement.

Une expérience de gestion expérimentale du homard ayant débuté en 1987 s'est poursuivie sur la côte ouest de l'île du Cap-Breton. La longeur minimale de carapace sera augmentée de 63,5 mm à 69,9 mm dans une période de 4 ans. Plus de 5,000 homards ont été marqués à l'intérieur de la zone expérimentale en 1988. Vingt pourcent (20 %) de ces homards ont été recapturés en 1989, leur mouvement s'est restreint à l'intérieur de la zone. L'effet de l'augmentation de la taille minimale sur la croissance et la fécondité est présentement étudiée.

Une étude de l'effet de la pêche de Chondrus crispus et Furcellaria par rateau sur les stocks de homard a été menée en conjonction avec une firme de consultation sur la côte nord de l'île-du-Prince-Edouard. Des effets visibles mineurs ont été enregistrés sur les homards lors de cette étude.

Le recrutement et le cycle de mue sont étudiés en détails dans la Baie Malpeque, à l'île-du-Prince-Edouard. Il semble y avoir une grande proportion de crabes qui muent plus tôt dans la baie. Les pêcherus considèrent que la région est hautement productive et devrait être protégée.

Des études de fécondité et d'abondance de l'ensemble des stades benthiques ont été initiées dans plusieurs endroits du Golfe afin d'essayer de prédire le recrutement annuel.

Denmark - Danemark

Pandalus (S. Munk-Petersen)

Data for the assessment of Pandalus stocks in ICES Divisions IIIa and IV have been collected from commercial catches.

Nephrops norvegicus (A. Nicolajsen, Faroe Islands)

Landings from the commercial creel fishery were regularly sampled for size measurements and determination of maturity stages.

The monthly survey started in January 1988 to investigate biometric parameters and maturity ended in January this year.

France

(D. Latrouite)

Cancer pagurus

La collecte des données d'apports, et d'effort de pêche des

flottilles françaises attachées aux ports de Manche ouest a été réalisée à partir des livres de bord européens (logbooks) pour les bateaux travaillant au large et par quelques enquêtes auprès des pêcheurs et mareyeurs pour les unités côtières. L'analyse pour aboutir à des CPUE par rectangle statistique est en cours.

Des mortalités imputées au dinoflagellé parasite Hematodinium sp. ont été notées en période hivernale, plus particulièrement sur les tourteaux provenant des zones côtières.

Homarus gammarus

L'étude du taux de recapture et de survie de homards produits en &closerie s'est poursuivie par l'échantillonnage des captures de la pêche commerciale et la recherche des individus porteurs d'une marque magnétique. Une vingtaine de recaptures a été obtenue. L'analyse des données en regard du taux d'échantillonnage et de la composition des captures par secteur est en cours.

Maja squinado

L'analyse des donnéees sur la biologie de l'espèce et sur l'exploitation du stock en Manche occidentale s'est poursuivie et devrait faire l'objet d'une synthèse courant 1990.

Une campagne d'estimation directe du recrutement pour la saison de pêche 1989/1990 a effectuée par dragage pendant l'éte 1989. Des indices fiables du niveau de capture de ces cohortes par la pêche commerciale sont recherchés pour aboutir à un établissement de prévisions de pêche.

Nephrops norvegicus

L'échantillonnage des débarquements de langoustines a été poursuivi comme chaque année pour la pêcherie du Golfe de Gascogne et celle de Mer Celtique. Le nombre de langoustines mesurées a été de 13 746 pour le Golfe de Gascogne et 5 859 pour la Mer Celtique.

De nouvelles recherches sur la croissance ont été entreprises par radiomètrie: les premièeres mesures d'activité du 228Ra et 228 Th effectuées sur des carapace d'âge connu confirment la validité de la méthode pour déterminer la durée du stade d'intermue. Elles seront complétées par des mesures d'accroissement à la mue.

La cartographie des zones de pêche commencée en 1989 sur la base d'enquêtes a été étendue à toute la partie nord de la pêcherie du Golfe de Gascogne.

Etude de l'âge des carapaces par radiomètrie

Les travaux consacrés en 1989 à l'étude du rapport d'activité 228 Th/228Ra ont porté essentiellement sur les aspects techniques de la méthode. La préparation des échantillons a été simplifiée et les performances des compteurs ont été accrues. Des tests effectués sur de nouvelles espèces ont donné des résultats concluants.

French sampling data for Nephrops in 1989.

Area	Season (quart)	No. of samples Research	Market	No. of specimens Measured
7G1+7G2+ 7G3+7GH	1		7	1123
	2		10	1623
	3		11	1475
	4		10	1638
8A	1		103	3717
	2		80	3493
	3		80	3511
	4	1231 measured	63	3025
8B	1		6	388
	2		4	459
	3		5	593
	4		5	473

Federal Republic of Germany
République Fédérale d'Allemagne

(R. Meixner)

Crangon crangon

Evidence provided by a new analysis of by-catches (25 species) in the fishery of brown shrimp gave no indication for concern regarding this fishery for the years 1982 - 1988. By-catch collection, which began in 1954, resulted in 378 samples (2,900 kg) for 1989 (Bundesforschungsanstalt für Fischerei, Hamburg).

As part of the Joint Demersal Young Fish Survey (FRG, Netherlands and Belgium) the coastal waters off Niedersachsen Niedersachsen and Schleswig-Holstein including the Elbe estuary, were again surveyed to study young fish and brown shrimp populations. A total of 248 samples (1989) were analysed and showed a stable situation for almost all species compared with the previous years (Bundesforschungsanstalt für Fischerei, Hamburg).

Carcinus maenas

A mass mortality of green crabs near Sylt island in the summer of 1988 was possibly caused by very high prevalences of larval trematodes. About 1,000-10,000 parasites (Microphallus claviformis, Maritrema subdolum) were found per crab. Various birds are known to be the final host of these parasite species. Some birds have increased dramatically in the Wadden Sea since the 1970's. The findings are considered with regard to a decreasing trend in the green crab population in some parts of the Wadden Sea (Biologische Anstalt Helgoland, List/Sylt).

Iceland - Islande

(U. Skúladóttir & H. Eiriksson)

Nephrops norvegicus

An annual research vessel survey was carried out in May covering all major Nephrops grounds. Most importantly, the survey included regular sampling of various biological parameters used in a yearly stock analysis. The nominal catch of Nephrops amounted to 1 900 tonnes compared to over 2 250 tonnes in 1988. Cpue which had remained high during the years 1980-1987, ranging from 46-61 kg per trawling hour, remained low in 1988, i.e. at 36 kg. This is attributed to a combination of unfavourable weather conditions during the season as well as decreasing recruitment.

Pandalus borealis

Landings in the offshore areas declined to about 22 600 tonnes in 1989, following the effective TAC of 22-23 000 tonnes (the Marine Research Institute advised 20 000 tonnes), as compared to a nominal catch of about 26 000 tonnes in 1988. Cpue was about 67 kg for the north-west areas in 1989 (66 in 1988). This cpue is an index taken from a regression of cpue on gear size where the cpue of a 1 200 mesh trawl is calculated every year. The cpue for the north-east area increased from 85 kg in 1988 to 10 kg in 1989.

Bi-annual research vessel surveys (fixed stations) were carried out as usual for assessment of stock size (area swept) in the fjords. At the same time, sampling of P. borealis was carried out as well as evaluations of by-catch of young gadoids. After the uptake of square mesh in the fjords, the number of young gadoids per tonne of shrimp is not likely to exceed the permitted limit (built on survival of 0-2 year olds and price ratio between Pandalus and gadoids. The offshore areas were surveyed once, taking the same stations as in 1988. Stock did not seem to have declined to any great extent since 1988.

The L_{50} of female maturity length has been calculated for many shrimp areas in Icelandic waters in the 1988/1989 spawning season. In 1989 the estimation of age of the commercial samples of shrimp in the western Isafjardardjup for the years 1977 through to 1989 was completed. The samples were first compiled by months. The VPA (Lowestoft package) with tuning, separable VPA and traditional VPA were carried out for the winters 1979/80 - 1988/89 and then compared to the biomass estimates from the surveys. The result was good.

Collection of young shrimp in a small meshed (6 mm) bag attached to the cod end was continued. The distribution of young shrimp in offshore areas can be studied from these collections.

Ireland - Irlande

(J.P. Hillis)

Nephrops

Commercial sampling of catch landings and discards in Division VIIa continued, with a sample interview survey to establish detailed distribution of effort in the area during July and August. Sampling of the Porcupine Bank fishery (Divisions VIIc,k) also took place. Numbers sampled in both areas appear in the table below.

A sampling cruise in June and July was carried out in the same area of Division VIIa as in 1988 but with greater sampling density (53 stations as opposed to 39), with sediment samples taken from stations where this had not been previously done. Some male length frequency distributions from this source proved amenable to ageing by application of a normal curve separation program to modes in the length frequency distribution. A further separator trawl experiment (to separate whiting from Nephrops) carried out late in the year is more fully reported to the Fish Capture Committee.

Table 1 Irish sampling data for Nephrops 1989.

Div.	Quart.	No. of samples	Sex	Catch	Landings	Disc.	Total
VII	1	8	Male	620	921	716	2257
			Female	444	257	635	1336
			Unsexed	...	1327	...	1327
			Total	1064	2505	1351	4920
	2	7	Male	1426	170	199	1795
			Female	1798	148	206	2152
			Unsexed	...	2182	...	2182
			Total	3224	2500	405	6129
	3	21	Male	3490	1954	2866	8310
			Female	3648	1851	2779	8278
			Unsexed	...	4151	...	4151
			Total	7138	7956	5645	20739
	4	11	Male	2631	1090	139	3860
			Female	1639	241	173	2053
			Unsexed	...	1080	...	1080
			Total	4270	2411	312	6993
Total		47	Male	8167	4135	3920	16222
			Female	7529	2497	3793	13819
			Unsexed	...	8740	...	8740
			Total	15696	15372	7713	38781
VIIc-k	2	12	Male	-	1614	-	1614
			Female	-	914	-	914
			Unsexed	-	...	-	...
			Total	-	2528	-	2528
	3	23	Male	549	3699	-	4248
			Female	689	1824	-	2513
			Unsexed	...	...	-	-
			Total	1238	5523	-	6761
Total		35	Male	549	5313	-	5862
			Female	689	2738	-	3427
			Unsexed	...	...	-	...
			Total	1238	8051	-	9289
Overall		82	Male	8716	9448	3920	22084
			Female	8218	5235	3793	17246
			Unsexed	...	8740	...	8740
			Total	16934	23423	7713	48070

The Netherlands - Les Pays Bas

(R. Boddeke)

Crangon crangon.

Surveys

The international young flatfish and brown shrimp survey in co-operation with Belgium, FRG and UK was carried out as in earlier years in October. The results showed a considerable decrease of the stock of shrimps > 50 mm in comparison with the favourable year 1987, due to the extremely mild winter 1988-1989.

Netherlands sampling data for Crangon. No.'s/1000/m^2

Year	INSHORE AREAS		
	Westerscheldt	Easterscheldt	Waddensea
1987	1034	929	4358
1989	725	411	1286
Year	COASTAL ZONE		
	Zealand	Holland	Wadden isles
1987	2204	618	3069
1989	2045	186	983

In March, May and August cruises were made at the Easterscheldt to follow possible environment changes due to construction of the sluice work in the mouth of this sea arm. In the eastern part of the Easterscheldt, berried females were observed that were smaller than ever found before in Netherlands waters and comparable to those in the western Baltic.

Sampling.

The sampling of commercial landings in the six most important shrimp harbours continued in the usual way. During the last ten the average size of the landed shrimps has decreased in particularly in the northern harbours. This seems to be related to lesser problems in getting the shrimps peeled.

Norway - Norvège

(C.C.E. Hopkins and S. Tveite)

Pandalus borealis

The CPUE decreased in both the Skagerrak area and in the Norwegian Deeps, due to a combination of poor recruitment in 1986 and 1987 combined with heavy exploitation. However, from research cruises, the 1988 year class seems to be slightly above average and the 1989 yearclass seems to be a rich one.

Abundance estimates (number and biomass) of deep-water prawn by age class were continued by the Institute of Marine Research (Bergen) in the Barents Sea and the West Spitsbergen shelf in 1989. By-catches of fish (species, year class and stomach content) were also recorded. Annual research using a prawn trawl were continued in April-May in the Barents Sea (Div. I) and in July-August in the Spitsbergen area (Div. IIb). Biomass estimates in the Barents Sea showed an increase of about 12% compared with observations in the spring of 1988. In the Spitsbergen area an increase of about 56% was observed.

In the East Greenland area, the Institute of Marine Research (Bergen) had an inspector on a prawn trawler in March-April. Biological samples were taken and by-catch and discard were measured. In September the annual scientific demersal trawl survey was conducted off East Greenland, in order to measure prawn abundance and distribution.

Population density, demography, maturity stages, fecundity, and growth and mortality studies in selected north Norwegian and Spitsbergen fjords were continued in 1989 by the Norwegian College of Fishery Science/University of Tromsø. Factor analyses were used to study inter- and intra- population relationships in these areas, as well as to describe the inter-relationships between P. borealis, cod (Gadus morhua) and fish assemblages in several regions of the Barents Sea.

Comparisons of the population parameters and life-histories of P. borealis from different regions of its geographical distribution were initiated by the Norwegian College of Fishery Science/University of Tromsø. Work continued on the development of a flexible, dynamic population production model, which hopefully should allow production and productivity characteristics of this species to be analysed and quantified across its whole geographical range.

Homarus gammarus

The monitoring program for CPUE and length measurements of commercial catches at five different localities in the Skagerrak area was continued in 1989.

Yearlings of lobster raised in warm water were released at different localities along the Norwegian coast. It has been noticed that the released ones have two pincer claws and a more elongated appearance than the native ones; the fishermen call them "foreigners". This type contributed about 50 % of the lobsters of < 25 cm total length at the release sites.

A project examining release of one year old reared lobsters in the sea, is continuing at Austevoll Aquaculture Station. The goal is to find out if this is a way to replenish depleted lobster stocks. None of the lobsters released in 1988 were caught in 1989, as expected after the short time from release. Various behavioural studies involving juvenile lobsters and their physical and biotic habitat have been initiated.

Sclerocrangon boreas

Research on temperature related hatching and larvae development of this arctic prawn in the laboratory is is continuing.

Samples of crustaceans analysed by Norway during 1989

SPECIES	AREA	SEASON Quart	NO. OF SAMPLES RESEARCH	MARKET	NO. OF INDIVIDS MEASURED	AGED*
Pandalus	I	1989	123	20	41200	35700
	IIb	1989	62		22000	19000
	IIIa	1	12	4	5550	5550
	IIIa	2	11	2	3889	3889
	IIIa	3		2	461	461
	IIIa	4	39	2	10356	10356
	IVa	1	3		710	710
	IVa	2	3		567	567
	IVa	4	25		5895	5895
	XIV	1		16	3344	
	XIV	2		5	1048	
	XIV	3	48		8879	
Homarus	IIIa	4		5	1514	

* aged by normality separation mehod.

Poland - Pologne

(NO REPORT ON CRUSTACEA)

Portugal

(M.J. Figueiredo)

Nephrops norvegicus

New Nephrops grounds have been traced and explored off the Portuguese south coast in depths ranging from 400 to 750 m where some other deep water crustacean species (e.g., Plesiopenaeus edwardsianus, Aristeus antennatus, Aristaeomorpha foliacea and Geryon longipes) have been found. Studies on stocks assessment were continued.

Parapenaeus longirostris

Two surveys have been carried out, in June and September, on distribution areas and abundance. Biological sampling has been conducted at the fishing harbour of Vila Real de Santo Antònio (south coast), once a week.

Aristeus antennatus

Biological sampling has been conducted at Vila Real de Santo Antònio (south coast), once a week. Studies on distribution areas

have been made during a research survey carried out in September.

Spain - Espagne

(A. Celso Fariña)

Nephrops norvegicus

The monitoring of commercial landings and fishing effort of Porcupine Bank, Galician and Cantabrian fisheries was continued. Commercial landings were sampled monthly to provide information on sex ratio and size composition. Data regarding sampling in these areas are shownin the following Table. Additional data on distribution, abundance and size composition were obtained by groundfish surveys in the Galician and Cantabrian Seas (ICES divisions IXa and VIIIc).

Spanish sampling data for Nephrops norvegicus in 1989.

Area	Season	Research vessels	Market samples	No. measured
VII	1		12	2343
	2		11	2626
	3		11	3805
	4		14	3416
VIIIc	1		15	1461
	2		31	5928
	3	29	31	5274
	4	43	15	1774
IXa	1		6	1040
	2		6	908
	3	19	6	1304
	4		10	2043

Sweden - Suède

(H. Hallbäck)

Homarus vulgaris

Commercial catches increased during 1989. A small area has been totally restricted for the commercial fishery. Different investigations, such as logging, test fishing, and diving studies, have started in this area.

Cancer pagurus

Catches are still good. Collection of catch data continued.

Nephrops norvegicus

The fishery for Nephrops is still very intensive with trawls and creels. The stocks in the southern Kattegat are still very poor due to low oxygen content during the last autumns. More than

4,000 Nephrops have been tagged. Besides the ordinary research programme, an underwater vehicle was also used to study behaviour bottom conditions, effects of trawling etc.

Pandalus borealis

Collection of catch data and analysis of commercial catches have continued. During two weeks in May experiments with 35, 40 and 45 mm meshes in the cod-end have been carried out in the Skagerrak by two shrimp trawlers.

United Kingdom - Royaume Uni

1) England and Wales
(R.C.A. Bannister)

Port Sampling

Collection of landings, effort and size composition data by the Sea Fisheries Inspectorate for Cancer, Homarus and Nephrops continued, but achievement of targets was poor, necessitating continuation of the collection of log book and size composition data on an opportunistic basis by scientific staff.

Cancer pagurus

The horizontal and vertical distribution of edible crab larvae was surveyed by research vessel in the English Channel in June along a grid running from North Foreland and Cap Gris Nez (VIId) out to La Chapelle bank (VIIh) and around to Trevose (VIIf). Observations were also made of temperature, salinity, illumination and chlorophyll, whilst an Argos buoy was deployed at La Chapelle bank. Results will be available in mid-summer 1990 and will be used to identify spawning areas for stock management purposes, as well as the importance of the eastern Channel where spawners are at risk from gravel dredging activity.

Studies continued on biological examination of Channel crab samples for morphometrics/maturity (N=1410) and fecundity (n=50).

On the English coast winter water temperatures were again above average. Winter crab catches were higher, but spring 1990 crab catches were again poor, especially in Northumberland.

Two new fisheries have now developed. One, approximately 15 miles off the Norfolk coast, catches much larger animals than is customary in the coastal waters of Norfolk. The second, 50 miles off the Humber, involves catches of large females in the vicinity of a known area of larval production. Crabbers from Devon are developing this fishery.

Minimum landing size was increased to 125 mm carapace width on parts of the east coast; to 130 mm on parts of the west coast, whilst the present western Channel area sizes of 140 mm (female) and 160 mm (males) were extended to the Scilly Isles.

Fishing effort continues at a high level in the Channel crab fishery, for which stock assessment investigations continue.

Crangon crangon

On the east coast fishing effort has been maintained in the Wash (IVc) and has occasionally spilled over into the Humber (IVb). Periodic monitoring of catch, effort and size composition has been instituted at a processing plant at King's Lynn. In the last year landings have declined from the recent 1988 high point.

Homarus gammarus

Long term studies continued in the east coast study area at Bridlington in Yorkshire (IVb) using chartered commercial vessels to study the seasonal abundance and size composition of trap caught lobsters; the effect on these of using escape gaps in traps; and also to assess the lobster by-catch by trawlers fishing in the area.

Also at Bridlington work continued to sample undersized and legal sized lobsters for the presence of microtagged hatchery reared stock released between 1983 and 1988 as part of the Ministry of Agriculture, Fisheries and Food stock enhancement experiment. Nearly 13,300 lobsters were tested, yielding 110 recaptures from the 1983, 1984 and 1985 release cohorts, of which about a third were above the legal size limit of 85 mm carapace length.

Recaptures were clustered around know release positions and give important information on growth. Related experimental studies on burrowing and feeding activities by juveniles continue at the Fisheries Laboratory at Conwy. Comparable field studies on the recapture rate of microtagged stock continue at the Scottish sites of Ardtoe and Scapa Flow (Sea Fish Industry Authority) and the Welsh site at Aberystwyth (North Western and North Wales Sea Fisheries Committee).

Fishing effort on lobster stocks remain high and is rising in some areas, especially South Yorkshire. Informal discussions are in progress on the question of pot limitation and licensing.

Biological studies continued on the east and south coast with the collection of 1 500 animals for maturity studies, and 40 animals for fecundity estimation. An increase in the number of sub-legal berried females appears to have occurred in Yorkshire.

2) Scotland
(C.J. Chapman)

Nephrops norvegicus

Commercial landings of trawl and creel caught Nephrops from the main fishing areas in regions IVa, IVb and VIa were sampled regularly at major fishing ports. A research vessel suvey was conducted on stocks in the north of region VIa (North Minch).

A programme of sampling discarded Nephrops from commercial Nephrops trawl vessels was initiated, and quarterly sampling from

each of the main fishing areas undertaken.

Further recaptures of tagged Nephrops were made in Loch Torridon to complete experiments on the effectiveness of cuticle implant tags and to show that eye damage has little influence on growth, survival and reproduction. Studies on the influence of eye damage on Nephrops behaviour were initiated using acoustic tracking methods.

Pandalus borealis

Commercial landings from fisheries in areas IVa (Fladen) and IVb (Farn Deeps) were monitored and samples of the catches obtained for length frequency analysis.

Homarus gammarus

Monitoring and sampling of lobsters continued in all main areas. The number of fishermen/observers has been increased and a new cpue logbook has been introduced.

Lobster tagging at the Summer Isles site on the west coast has ceased and results are now being processed.

Acoustic tracking studies were again carried out. Five lobsters were continuously monitored for a period of 21 days. Movement and activity was limited, generally being restricted to the hours of darkness. Periods of inactivity frequently exceeded 24 hours.

The artificial reef off Dunbar was again surveyed using underwater TV, as part of a joint monitoring project with the Gatty Marine Laboratory, St. Andrews. Preliminary results for 1989 indicate an increase in the lobster population on the reef.

Routine monitoring for gaffkemia continued. No incidence of the infection has been found in Scotland.

Cancer pagurus

Sampling of commercial catches and collection of cpue data has continued. An assessment of the east and west Coast crab stocks is being prepared in relation to Minimum Legal Size (MLS) legislation. The use of artificial collectors to monitor juvenile crab settlement continued. Settlement of Cancer (as well as Liocarcinus and Carcinus) in 1989 was lower than in the previous two years.

Liocarcinus puber

Sampling of commercial catches and collection of cpue data has continued in all the main areas. A minimum landing size of 65 mm carapace width (excluding spines) was introduced. Growth studies are continuing.

Carcinus maenas

A small fishery is developing for this crab species. Sampling of commercial catches and collection of cpue data has begun on a limited scale.

Scottish crustacean quarterly sampling data, 1989.
C = Commercial samples, R = Research samples.

Species		IVa		IVb		VIa		VIb		
		C	R	C	R	C	R	C	R	C
Nephrops	1	2550		307		1638				
	2	4396		2897		16424				
	3	4066	27	6482		9196				
	4			1950		10921	9830			
Lobster	1									
	2	813		582		48				
	3	1815		297		1014				
	4			1174		202				
Crabs	1									
	2	2506		728		2297				
	3	2826		702		2191				
	4									
Pandalus	1	1801								
	2			703						
	3									
	4						1350			

USA - Etats Unis

(C.H. Peterson & S.A. Murawski)

CRUSTACEA

The Northeast Fisheries Center conducted spring and autumn bottom trawl surveys which provided abundance and size composition for a variety of megabenthic and pelagic crustaceans. State and NEFC personnel conducted a separate bottom trawl survey for northern shrimp (**Pandalus borealis**). A considerable quantity of research was completed on the occurrence and prevalence of shell diseases in a variety of offshore and inshore crustacea including American lobster, **Cancer** crabs, deep-sea (**Geryon**) crabs, and blue crabs (**Callinectes**). In particular, some of these studies focused on the potential for linkage between crustacean shell diseases and the offshore disposal os sewage sludge.

Northern Shrimp (**Pandalus borealis**)

NEFC researchers conducted a variety of population biology and associated modeling studies, focusing on the change of reproductive parameters with increasing population size, and various other vital statistics. Growth was evaluated using several length-based methods. Research on fishing gear intended to minimize the catch of juvenile groundfish in shrimp trawl fisheries was continued by researchers in Maine.

American Lobster (**Homarus americanus**)

A number of state agencies and university researchers continued population biological studies of lobster, primarily focusing on near-shore habitats. Movement patterns in relation to lobster size were evaluated by researchers from the Maine Lobster Institute. Vital population and fishery statistics data were collected in ongoing studies being conducted in Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York and New Jersey. Larval distribution and dispersion were investigated in New Hampshire and Maine. Improved egg production and fishery yield models for lobster were constructed by NEFC researchers. Several studies evaluating the effects of minimum size increases focused on biological responses of the populations and economic impacts. A revised assessment of offshore lobster populations was initiated by NEFC researchers.

Rock, Jonah Crabs (**Cancer spp.**)

Studies of the distribution, relative abundance, and biological characteristics of rock and Jonah crab populations in offshore waters were completed by NEFC researchers. These studies were based on time-series data from bottom trawl, sea scallop and hydraulic clam dredge surveys conducted from 1963-1988.

Blue Crab (**Callinectes sapidus**)

Researchers at the University of Maryland and the Virginia

Institute of Marine Science ,continued a study of the population dynamics of blue crab in the Chesapeake Bay. This study is intended to evaluate fishing and natural mortality, growth, and recruitment of the species, and to evaluate the constituents of fishing mortality attributable to various fisheries operating throughout the year. Studies completed in Virginia focused on the effects of hypoxia on the survival of blue crab.

USSR - URSS

(G.I. Luka)

Pandalus borealis

Investigations of deep-water prawn stocks, biological characteristics and distribution in the Barents Sea were continued in 1989. Investigations of prawns were conducted in April-July. 215 prawn samples were collected and processed.

The results of the investigations indicated an increase in the prawn stocks in the Barents Sea and within the Spitsbergen area, due to the 1986 strong year-class entering the commercial stock and also the decrease in predation pressure.

MOLLUSCA

Belgium - Belgique

(NO REPORT ON MOLLUSCA)

Canada

Newfoundland Region and Scotia Fundy Region

(G. P. Ennis)

Illex illecebrosus

Abundance of squid at Newfoundland was low during 1989, for the eighth consecutive year. No pre-season abundance survey was executed in 1989 and no biological studies were pursued in inshore areas. Some samples were collected from the commercial fishery at one inshore locality.

Placopecten magellanicus

Landings for NAFO SA 4, the Bay of Fundy and Scotian Shelf were approximately 44,600 t round weight for 1989, a substantial increase from previous years. In the Bay of Fundy, the Digby beds have experienced a strong recruitment pulse, which has led to record landings. Commercial catch rates have been over 15 kg/hm for the most productive areas. The most recent stock survey indicates, however, that the abundance of pre-recruits is coming down.

An experimental fishery in the Browns Bank area has allowed the Scotian Shelf landings to rebound in 1989. Catches from the Western Bank - Sable Island area on the eastern shelf have also been quite high, while catch rates maintain average values.

The Georges Bank catches (NAFO SA5) represent an average 85 % of the total annual offshore catches. A management plan using enterprise allocations has been approved for the long term. Under this plan, a heavy targeting of effort was seen on age 5 animals Research surveys show poor survivorship above this age. The TAC for 1989 was set at 39,010 t round weight. Landings reached the TAC level. In addition, a roe fishery landed less than 50 t. Catch rates improved slightly (10 %) from last year. Research data confirmed this by indicating that recent year classes have not been as strong as the 1982 year class.

Stock surveys were carried out on the eastern Scotian Shelf scallop beds inthe Bay of Fundy and on Georges Bank. Research activities are continuing on growth rates and variability in meat yields. Studies on the juvenile ecology have been initiated.

A survey was conducted on St. Pierre Bank to determine spatial distribution and abundance of sea scallops. Nominal catch from NAFO Div. 3Ps was 300 t (meats), down from 1,027 t in 1988. The fishery was based primarily on the residual 1982 year class. There is no evidence of significant new recruitment.

Spisula polynyma

The fishery on Banquereau Bank has stabilized, it can, however, supply more than the present market demand. One of the three Canadian vessels that fished last year has been tied up indefinitely. Landings of 7,772 t for 1989 were double that of 1988, but nowhere near the 30,000 t TAC. With the exception of a small inshore fishery landing 15 t, there has been little fishing on the rest of the Scotian Shelf. Exploratory fishing for this species on the eastern Grand Banks (NAFO Div. 3L) began in 1988. Neither standing stock nor production are known. A pre-emptive TAC of 20,000 t round weight is in place for 1989. Commercial fisheries data will be used to assess the fishery.

Région du Québec et Région du Golfe du Saint-Laurent

(G. Y. Conan)

Placopecten magellanicus

Les études sur le pétoncle géant en milieu aquicole débutées en 1988, ont été poursuivies avec la collaboration d'aqueculteurs de la côte ouest de Terre Neuve. La croissance du pétoncle des paniers japonais ("pearl nets") a été étudiée en utilisant 25, 50 et 100 pétoncles par panier. Il existe une nette corrélation entre le taux de croissance et le nombre de pétoncles par panier, la croissance la plus rapide étant observée dans les paniers ayant 25 pétoncles. Cependant, en considérant les paramètres économiques, 50 pétoncles par panier seraient le nombre permettant de maximiser la production en chair de pétoncle tout en étant économiquement acceptable. D'autres travaux en cours portent sur: l'étude du cycle larvaire, la période de déposition des larves de pétoncles, la capture de jeunes pétoncles en utilisant des collecteurs artificiels et l'effet des facteurs environnementaux surla productivité du pétoncle. Ces travaux seront poursuivi pour trois années consécutives.

Un relevé expérimental et l'analyse des données de l'exploitation commerciale ont permis d'évaluer l'état des stocks de pétoncles des Iles-de-la-Madeleine, de la Gaspésic et de la Basse Côte Nord (golfe du Saint-Laurent). L'effort de pêche et les débarquements ont augmenté sensiblement en 1989.

Les expériences de photographie sous-marine visant à mesurer l'efficacité de la drague Digby ont été complétées en 1989. Le projet sur le recrutement du pétoncle aux Iles-de-la-Madeleine s'est poursuivie pour une cinquième année consécutive. Des collectcurs ont été immergés au printemps et relevés à l'automne afin d'évaluer la fixation du naissain. En 1989, le nombre moyen de naissains, environ 1000 par collecteur, était à son plus haut niveau depuis le début du projet.

Une analyse de la structure génétique des populations de pétoncles du golfe du Saint-Laurent est en cours. Les résultats préliminaires donnent à penser que populations de la Gaspésie et des Iles-de-la-Madeleine seraient distinctes. Les effectifs des échantillons seront prochainement grossis par la prise en compte individus de taille extrême.

Chlamys islandica

Les données obtenues de l'exploitation commerciale ont permis d'évaluer l'état des stocks de la côte nord du golfe du Saint-Laurent. Une augmentation importante des captures a été notée en 1989 dans le secteur de la Moyenne Côte-Nord, elle est causée principalement par une forte augmentation de l'effort de pêche. Un relevé de recherche a permis d'augmenter les connaissances sur la distribution et la structure démographique d'une partie de la population de la Moyenne Côte Nord.

La pêche exploratoire au pétoncle d'Islande s'est poursuivie dans le détroit d'Hudson au cours du mois d'août 1989. Le secteur d'étude couvrait la côte entre le village de Quaqtoq ($69^0$30'O, 61^0O'N) et Salluit ($75^0$00'O). Des concentrations de pétoncles ont été découvertes dans la baie de Diana et aux abords de Wakeham Bay, entre autres. Des évaluations des taux de capture et de la structure de taille et d'âge des principaux secteurs sont en préparation. L'exploration devrait se poursuivre vers l'ouest en couvrant la partie ouest de la baie d'Hudson en 1990.

Mytilus edulis

The Gulf Region has been studying the limiting environmental factors influencing growth, survival and productivity of mussel (Mytilus edulis) population in the form of long term (3 year and ongoing) research to examine the productivity of cultured mussel in relation to natural food supply. This growth, production and environmental information was used to develop a productive simulation model of cultured mussel growth and production, in cooperation with researchers from Acadia University. An extension of the model, which incorporates both physiological and environmental components, is the potential delineation of the controlling factors for aquaculture site selection which would be of benefit to the development of the industry. Publications are in preparation.

Les travaux sur la répartition spatiale optimale des structures d'élevage en suspension de la moule sont terminés. Les résultats indiquent que les conditions prévalantes au moment des observations permettraient de rapprocher les différentes zones d'élevage sans qu'il n'y ait d'effet négatif sur la croissance individuelle. Les travaux sur la modélisation de la répartition spatiale du phytoplancton au-dessus d'un banc de moules naturel sont également terminés tandis que ceux sur le comportement alimentaire de la moule en présence du dinoflagellé Alexandrium excavatum se poursuivent toujours.

Buccinum undatum

Les expériences sur l'aire d'attraction des casiers à buccins ont débuté en 1988 et se sont poursuivies en 1989. Le comportement d'agrégation du buccin autour d'un appât, sur des fonds variés soumis à des régimes de courants très différents, a été enregistré in situ par photographie. La modélisation du processus d'agrégation, en relation avec la courantologie, l'éclairement, la présence de compétiteurs et la mobilité de l'espèce, est en cours.

La capturabilité du buccin selon la taille et le type d'appât a été déterminée au cours d'une série d'expériences de terrain. La de tailles et le nombre d'individus attirés - donc le rendement - peuvent varier grandement selon le type d'appât utilisé et son accessibilité.

Par ailleurs, les travaux sur l'âge et la taille à maturité sexuelle se sont également poursuivis afin de recommander une taille minimale de capture qui permettrait de protéger le potentiel reproducteur de la population.

Général

Un modèle de la relation entre la densité et la biomasse des mollusques qui tient compte des relations dépendantes de la densité a été mis sur pied. Ce modèle permet de déterminer le facteur (espace ou nourriture) responsable des effets dépendants de la densité. Lorsque la nourriture est le facteur limitant, il permet d'indexer la qualité des sites aquicoles. De plus, il peut donner des indications quant à la densité optimale de semis en aquaculture des mollusques. Une expérience visant déterminer le potentiel pratique de ce modèle pour la gestion aquicole a été effectuée.

Crassostrea virginica

Gulf Region reestablished its commitment in oyster (Crassostrea virginica) research by conducting quantitative stock assessments of the two principal public fishing grounds in the region: Caraquet Bay, N.B. and Dunk River of Bedeque Bay, P.E.I. This resulted in a critical evaluation and concise summary of the historical data, documenting the long term changes in population structure, distribution and abundance. An extension of this work was the selection of one area, Caraquet Bay, to examine the self sustaining mechanisms of that public fishing ground in light of the environmental perturbations. An intensive field project was conducted, in collaboration with physical oceanographers, to

examine the larval development, dispersion and distribution of oyster larvae during the 5 week larval period in 1988. Results from the physical and biological data analysis are being examined to elucidate the larval export and retention mechanisms of the Bay as well as the optimal locations for the collection of spat (seed) collection for local enhancement projects.

AUTRES TAXONS

Ascophyllum nodosum

Les travaux visant à déterminer la stratégie de coupe (hauteur et fréquence) permettant de maximiser la récolte d'Ascophyllum nodosum se sont poursuivis en 1989 sur la rive sud de l'estuaire du fleuve Saint-Laurent.

Pathobiologie des bivalves

Un nouveau parasite du pétoncle de baie a été découvert dans le golfe du Saint-Laurent. Ce parasite n'est pas connu chez les autres espèces de bivalves du Golfe.

L'évaluation des effets des parasites de bivalves sur les autres espèces natives se poursuit. Il n'a pas été trouvé à ce jour de parasites ayant un effet dévastateur sur les populations naturelles.

Des travaux ont débuté sur la maladie de Malpeque afin de déterminer si cette maladie est toujours infectieuse pour les huitres du golfe du Saint-Laurent.

Une étude a été terminée sur les stades parasitaires (glochidia) des moules d'eau douce et leurs effets sur les saumoneaux durant l'hiver. Un effet néfaste a été observé sur les saumoneaux portant plus de 200 larves de moules, mais les mortalités ne se manifestent qu'après que les parasites se libèrent au printemps.

Denmark - Danemark

Mussels (Sten Much-Petersen)

The investigations by the Danish Institttue for Fishery and Marine Research on the mussel stocks in the Danish Wadden Sea were continued in 1989.

A two-year project in collaboration with the Mussel Industry Association of the Limfjord was begun in 1989 with the aim to:

1) investigate the feasibility of mussel culture in the Limfjord;

2) investigate the benefits of transplantation of undersized mussels from localities with poor growth to localities with fast growth.

Chlamys opecularis (A. Nicolajsen - Faroe Islands)

Samples for size measurements were taken regularly from commercial catches on known banks.

On newly discovered banks samples were taken from commercial catches to obtain data on abundance, size and growth.

France

(D. Latrouite)

Venus verrucosa

La production a continué de diminuer en 1989 (1300 tonnes) malgré une augmentation de l'effort de pêche en baie de St-Brieuc. Les échantillonnages ne révèlent aucun indice de redressement prévisible à court terme.

Tapes rhomboïdes, Spisula ovalis, Glycymeris glycymeris

Manche-Ouest

Dans le golfe normand-breton, des compléments d'évaluation directe ont été réalisés sur les zones prometteuses. La population de T. rhomboïdes apparaît relativement stable. Les gisements de S. ovalis de la partie est du Golfe sont toujours dominés par la classe d'âge 1985 bien qu'en net recul en terme de biomasse. Le prérecrutement 88 et 89 apparaît non négligeable localement.

L'exploitation s'est développée en baie de St-Brieuc où la production de T. rhomboïdes est passée de 500 & 1200 tonnes (celle de S. ovalis est stable autour de 200 tonnes), en baie de St-Malo où elle atteint quelques centaines de tonnes pour S. ovalis et dans le secteur de Granville où elle dépasse les 600 tonnes pour S. ovalis.

En Iroise, la campagne d'évaluation directe n'a mis en évidence aucun prérecrutement notable en S. ovalis. L'exploitation est résiduelle et la seule perspective concerne un gisement de 2500 tonnes (cohorte 1986).

Golfe de Gascogne

En sud-Bretagne, aucun prérecrutement en S. ovalis n'a été observé. L'exploitation est faible et se développe sur le reliquat des cohortes 81 et 86 qui ont connu une forte mortalité en 1989.

En Vendée, le gisement de S. ovalis de Jard-sur-mer connaît une forte regression des classes exploitables: 7000 tonnes en 89 contre 1500 tonnes en 88. Un fort recrutement (cohorte 88) est observé sur l'ensemble du site.

Le gisement S. ovalis de l'Ile d'Yeu a connu une forte mortalité liée aux étoiles de mer. Il subsiste 2200 tonnes de S. ovalis de la classe 86. Aucune exploitation n'est envisagée.

Manche-est

Une prospection a été menée en baie de Seine pour évaluer les potentialités d'exploitation. S. ovalis est présent en faibles densités dansles zones sableuses des parties ouest et est de la baie.

T. rhomboïdes a une aire de répartition plus vaste. Bien que d'une façon globale les densités soient peu élvées, il existe néanmoins des zones de plus forte concentration pouvant éventuellement justifier une exploitation. Un complément de prospection sera toutefois nécessaire pour vérifier ce premier jugement.

G. glycymeris est quasi-absente de la baie de Seine.

Mytilus edulis

L'étude des moulières en eau profonde de l'est Contentin (secteur 7d), entamée en 1981, s'est poursuivie en 1989 avec une prospec-prospection printanière par dragage sur les principaux gisements: Barfleur, Réville, Ravenoville.

Les observations faites au cours de cette prospection ont mis en évidence une faiblesse des fixations de naissain en 1987 et 1988 sur les gidements de Barfleur et Réville. De plus, suite à des défauts multiples de recrutement, le gisement de Ravenoville, très prospére en 1983, peut être considéré comme éteint. Ouvertes de juin à octobre, ces moulières ont permis une production de 2400 tonnes en 1989.

Pecten maximus

Les principaux stocks de coquille St-Jacques du littoral Atlantique et de la Manche restent à un niveau d'exploitation très élevé malgré des ressources à un très faible niveau. La production nationale est de l'ordre de 6500-7000 tonnes.

Pour les deux principaux gisements, des campagnes sont réalisées par les navires de recherche IFREMER au cours des trois mois précédant l'ouverture de la pêche. Les données permettent de proposer des scénarios d'exploitation (quota global, effort de pêche total et rythme, tailles).

Baie de Saint-Brieuc

La campagne 88-89 s'est ouverte avec une biomasse équivalente à celle de l'année 86-87 où le quota avait été limité à 3000 tonnes. Cet ordre de grandeur avait d'ailleurs été retenu comme quota provisoire de début de saison. L'essentiel des captures a porté sur des coquilles de 3 ans dont la taille commerciale est proche de 11 cm. Des bons rendements ont été obtenus sur les zones où le naissain 1985 s'est fixé, en particulier sur le cantonnement du Petit Léjon ouvert & la pêche en octobre après une année d'interdiction. La classe d'âge 1986 s'est révélée très pauvre.

La campagne s'est déroulée en conformité aux prévisions, avec des rendements faibles en fin de campagne qui, avec la pêche prudente de deux jours par semaine et deux heures de pêche, s'est clôturée en fin mars à 2600 tonnes pour 13 500 heures de pêche.

Le cantonnement du Petit Léjon a contribué de manière importante aux captures de début de saison, moins cependant que ce qu'il en était escompté.

Il n'y a pas eu de mortalité importante en fin d'hiver à la différence des trois années précédentes. Cette observation, jointe à la poursuite des travaux sur les infestations de Rickettsies sur les branchies de Pecten maximus, permet de conforter la hypothèse de la nécessité d'une association de plusieurs facteurs pour provoquer des mortalités notables (et non la seule présence de cette pseudo-bactérie).

La campagne de prospection de juin 1989 révèle une faiblesse particulière du recrutement et du prérecrutement (classes d'âge 1987 et 1988). Par contre le captage de naissains est beaucoup plus important que les années passées et indique une classe d'âge 1989 abondante.

Manche-Est

La saison 1988-1989 a été marqu&e par un redressement des captures (3600 tonnes) essentiellement dû à une augmentation de la production en baie de Seine (1630 tonnes), secteur où les mesures de gestion (quota, taille de capture) retenues pour la saison 1987-1988 ont conduit à une augmentation de la biomasse exploitable. Les captures sont relativement stables sur les autres zones qui commencent à donner tous les signes d'une trop forte exploitation (diminution de la taille moyenne des captures) mal compensée ces dernières années par une série de mauvais recrutements.

La campagne de prospection réalis&e en 1989 a montré de bons indices de prérecrutement pour l'ensemble des gisements de la Manche orientale.

Aquaculture extensive

Les travaux sur la production de juvéniles en aquaculture et le semis sur des zones réservées interdites à la pêche se sont poursuivis en rade de Brest et en baie de Saint-Brieuc. Plus de deux millions d'animaux de 30 mm ont été produits en 1989.

L'exploitation des premiers semis indiquent des recaptures par la pêche commerciales de 22 & 33 % en rade de Brest après cinq ans de développement sur parc (36 tonnes débarqués).

Federal Republic of Germany - République Fédérale d'Allemagne

(R. Meixner)

Mytilus edulis

Mussel stocks in the German Wadden Sea showed a slight increasein abundance, and harvests of mussels rose over the past decades. There are indications of better condition (meat yields). This might be caused by a combination of eutrophication and improvements in the cultivation of mussels (Bundesforschungsanstalt für Fischerei, Hamburg).

A co-operative German-Irish enzyme electrophoretic study provided evidence of biochemical-genetic differentiation among mussels in

the Baltic proper compared to mussels in the more saline Western Whether this difference is at the specific or subspecific level of classification requires further consider- ation (Biologische Anstalt Helgoland, Hamburg; Regional Technical College, and University College, Galway).

Iceland - Islande

(U. Skúladóttir & H. Eiriksson)

Chlamys islandica

An annual stock abundance dredge survey was carried out in March in the Breidafjördur area, W. Iceland. A slight increase was observed in stock abundance index based on over 100 stadardized tows. However, a slight decrease in cpue continued somewhat as in previous years. Nominal catch remained low as in 1988 at just on 10 000 tonnes.

A small scale Icelanbd scallop culture project that started in 1988 in Breidafjördur, W. Iceland, was continued.

Ireland - Irlande

(J.P. Hillis)

Ostrea edulis

Bonamiasis work was continued at University College Cork. Population genetic studies took place at Galway Regional Technical College.

Crassostrea gigas

Population genetics were investigated at Galway Regional Technical College.

Mytilus spp.

Genetics of exposed shore mussels, systematic relationships within the genus Mytilus and population genetics in M. edulis were studied at Galway Regional Technical College.

Pecten maximus

Larval distribution and settlement in south-western Ireland were investigated at University College Cork, and population genetics at Galway Regional Technical College.

Chlamys varia

Population genetics were investigated at Galway Regional Technical College.

Intertidal mollusca

Crow (Corvus corone) predation studies continued at University College Cork.

The Netherlands - Pays-Bas

(R. Dijkema)

Production figures:

With the exception of Mytilus landings, all data are provisional estimates:

Mytilus edulis cultivation:	99 688 t
Ostrea edulis cultivation and fishery : (est.)	766 t
Crassostrea gigas cultivation and fishery :	625 t
Verastoderma edule fishery:	66 500 t

Oyster culture

Monitoring of spatfall and concentrations of larvae of the flat oyster Ostrea edulis in Lake Greveingen and the Oosterschelde was continued. Due to the early and warm summer of 1989 a concentration of 0.2 larvae per liter was recorded as early as June 12. The highest concentration found was 26.4 larvae per liter, which was lower than in earlier years. The long reproduction season, however, made the total spatfall in 1989 abundant. Survival of the settled spat in the spring of 1990 appeared, however, rather poor. Concentrations of larvae of Crassostrea gigas in the Oosterschelde rose to the unprecedented level of 75.8 larvae per liter on August 7. Expectations for the oyster stock in the lake are, however, bleak after the outbreak of the oyster disease bonamiasis in 1988. Increased amounts of mussel shells will be seeded to improve settlement results. Additionally, a project has been started with the aim of finding alternative culture methods which can increase growth and reduce mortality. The basic idea of the project is to reduce seeding and handling stress as much as possible and to create conditions for maximal growth rate, so that the oysters reach a marketable size before they complete their third year, whan bonamiasis has been found to cause maximal mortality. The project, named RIOP (RIVO Oyster Project), will last for 5 years and is carried out on cultivation plots on a surface area of 120 ha in the lake. In 1990 various zootechnical alternatives will be tried out, such as varying seeding density, different fishing methods, off-bottom cultivation, seeding of nursery-produced seed and pond-breeding.

Mussel culture

Mussel research was, as in previous years, aimed at the effects of the construction of a flood barrier in the mouth of the Oosterschelde. Earlier, studies were made on the relation between growth of the mussels and food supply, and of mortality of mussels on the plots during the cultivation cycle. In particular, a case of mortality and reduced growth was studied which had been the cause of bad cultivation results on a number of plots in the Oosterschelde. This mortality occurred particularly in late spring, on plots where excessive silting had been observed. The sediment on these plots became anoxic in the period April - June, resulting in an anaerobic, greyish-

black bottom, upon and within which dead and rotting mussels were found. The phenomenon is attributed to an increased sedimentation of phytoplankton, resulting mainly from the annual bloom of Phaeocystis pouchetii, which dies off during this period. The decomposition of the phytoplankton, in combination with increasing water temperatures and the habitual post-spawning weakness of the mussels at that time of the year, are assumed to have been responsible for this mortality, which has also been observed in earlier years. On mussel plots in the Waddenzee a similar case of mortality was observed in 1989, which might have been caused by the same combination of factors.

A study of growth, condition and mortality on 40 experimental cultivation plots in the Oosterschelde is still in progress. The aim is to identify alternative locations for mussel cultivation in the changed situation after completion of the flood barrier in the estuary. The first impression is that a number of plots, that were less appreciated by the industry at the beginning of the project, are beginning to show the best cultivation results. On certain plots silting has been recorded, of the same nature as described above.

A comparison was made between the effects on the bottom and on the captured mussels of three different types of fishing gear, in use for the dredging of mussel seed: a conventional mussel dredge, an hydraulical cockle dredge without suction of the catch and a hydraulical suction dredge for cockles. The effects of the conventional dredge and of the non-suction, hydraulical dredge appeared to be almost identical. The suction dredge caused an increased concentration of suspended matter in the water.

Cockle fishery (Cerastoderma edule)

The provisional estimate of landings by the Dutch mechanized cockle fishery in 1989 is 66,500 t fresh weight. The quantity landed by hand (i.e. manually) by cockle-fishermen is not known at present.

A new method was developed for sampling natural cockle stocks, making use of a commercial, cockle suction-dredger. The mouth opening of a commercial cockle-dredge was narrowed to a width of 15 cm. While the ship is dredging continuously, the catch is suctioned aboard and samples can be taken from it at chosen intervals, whilst the total catch can also be registered. Trials were made during fishing on pre-established arrays in an intertidal area. In a relatively short time an overall assessment could be obtained of the densities hard-shelled organisms larger than 15 mm, living not deeper than 5 cm in the sediment. During a field survey, this method was compared with a traditional core-sampling survey, using the core- sampling technique. The results were most satisfactory.

In cooperation with a private company, a commercial suction-dredge for cockles was improved. Modifications in the shape of the dredge, as well as smoothing of the inner surface of the dredge resulted in a reduction of the number of damaged cockles by almost 50 %. Slight damage was found to be caused mainly by the suction pumps and the rotating sieves. Reduction of the rotation speed of the "trommel-sieves" and the flow of the water

jet which dislodges the cockles from the bottom, proved highly effective in reducing shell damage.

Hydrography

A study was initiated of current velocities on the Yerseke Bank, the main area for oyster cultivation in the Oosterschelde. This study was undertaken to compare the hydraulic conditions before and after the completion of a flood barier in the mouth of the estuary in 1987. This study was deemed necessary because, in the past, large areas had become unsuitable for cultivation of O. edulis due to excessive current speeds and moving sand.

Mollusc sanitation

Sanitary quality on plots in the cultivation area and re-watering locations in the Oosterschelde was studied by means of weekly and quarterly samplings. The percentages of samples free from faecal coliforms increased in 1989, as did counts of coli-bacteria in some individual observations. An experiment was prepared with UV sterilization of the effluent of an urban sewage-treatment plant.

Quarantine systems

A study was undertaken of the design of quarantine installations for storage of imported mussels and oysters. Special attention is paid to the elimination of possible cells and cysts of toxic phytoplankton in the effluent. As imported mussels can be mixed with high amounts of sand, mud and shell, the removal and treatment of effluent and solid waste receives special attention.

Norway - Norvège

(C.C.E. Hopkins and S. Tveite)

Chlamys islandica

Scallop beds at Straumflaket, Jan Mayen, north of Bear Island and north of Spitsbergen were surveyed by the Norwegian College of Fishery Science/University of Tromsø during a one-month cruise in summer 1989. A total of 648 scallop dredge-stations were taken using a small scallop dredge. Samples for shell height measurement were prepared from roughly every second station, and throughout the cruise 19,200 scallops were measured. The hard-bottom fauna was identified, counted and weighed at 50% of the stations. Experiments with different haul durations were also performed, which resulted in a shorter (1.5 min.) hauling time than earlier being preferred. During the cruises a preliminary investigation on the arctic clam Cerripes groenlandicus was initiated. This study is planned to be continued in 1990.

Pecten maximus

Growth experiments were started by the Div. of Aquaculture, Institute of Marine Science (Bergen) in April 1989 with scallop spat held in pearl-nets, at various depths and localities. The effects of various physical and biotic environmental parameters on growth were examined.

Mytilus edulis

Monitoring of algae which may contain toxins was conducted by the the Div. of Aquaculture, Institute of Marine Science (Bergen) throughout the year. DSP and other toxins were monitored by mouse bioassay. The content of DSP prohibited sale of mussels through most of the year, especially in the Skagerrak and Sognefjord area.

Ostrea edulis

Experiments with growth and mortality of oysters on the Skagerrak coast were terminated in 1989.

Diseases of bivalves

A new screening program has been started, with the aim of controlling the health and parasite status of the bivalve mollusks which are used in commercial production in Norway. Broodstock population of oysters and clams used in hatcheries and lagoons are the primary subjects of investigation. In the bivalves which are examined until now, no pathogen agents (Bonamia, Marteilia, Perkinsus, haplosporidians, etc.) could be detected.

Infectious Pancreatic Necrosis Virus (IPNV) has been isolated from Norwegian scallops, Pecten maximus. A study has been started to clarify the role of bivalve mollusc as potential vector-organisms for fish-pathogen viruses. The experimental part of this study consists of; one in vitro part which is subjected to the neutralization of IPNV by the scallop hemolymph.

Yoldiella - flat fish relationships

Prey-predator relationships between the bivalve mollusc Yoldiella spp. and the witch flounder (Glyptocephalus cynoglossus) have been initiated by the Norwegian College of Fishery Science/ University of Tromsø.

Poland - Pologne

NO REPORT ON MOLLUSCA

Portugal

NO REPORT ON MOLLUSCA

Spain - Espagne

(A. Pérez Camacho)

Mytilus galloprovincialis

In 1989 the growth and weight increase of this species slowed down and production levels remained at around 200,000 t/year. In this year studies continued to be carried out on genetic variability, productive characters, reproduction, energy processes, histopathology of energy reserves, biochemical composition of eggs and larvae, parasites and predators. Last November an International Symposium was held on this species, at which over 50 papers were presented. They will be published shortly.

Ostrea edulis

Research is being done on the pathology of this species (Bonamia and Maarteilia), stock evaluation, reproductive cycle, abundance and distribution of larvae, seed collecting and culture methods. Studies are also being done on the diet of larvae and seed with different types of live and inert food (microcapsules), and on filtration, respiration and digestive efficiency.

Venerupis sp.

Studies are being done on the dynamics of different populations of V. decussata, V. pullastra and V. rhomboideus, the production of triploids in V. decussata and the reproduction of V. semidecussata, as well as diet and energy balance of the larvae and seed of several of these species. Unofficial estimates place the production of these species between 3,000 and 4,000 t/year.

Cerasstoidema edule

Various studies are being carried out on the ecology of this species, diet and digestive responses, and energy balance related to the quantity and the quality of the food. Annual production is estimated at approximately 3,000 t (unofficial data).

Pecten maximus

Research continues on the distribution of this species, collection of seed and larval diet.

Loligo forbesi

Different populations of this species in the north Atlantic are being compared.

Sepia officionalis

Studies continue on the diet of this species.

Opisthoteutis agassizi

Research has been started on the different aspects of the biology of this species.

Necora puber

Studies have been performed on the larval distribution of this species as well as on the effect of temperature and salinity on larval development.

Aristeus antennatus

Studies were carried out on the feeding ecology and the role of the cuticle calcification in the life cycle.

Uca tangeri and Panapeus africanus

Larval development of both species has been studied.

Sweden - Suède

(H. Hallbäck)

Mytilus edulis

There are still problems with toxin from Dinophysis. About 500 t of Mytilus were landed during the last season.

United Kingdom - Royaume Uni

1) England and Wales
(R.C.A. Bannister)

Cerastoderma edule L.

The series of annual transect surveys was continued by MAFF in the Burry Inlet in Wales (VIIf), and a long term analysis of abundance and population regulation begun. In the Wash (IVc) survival and growth continue to be monitored in a small study area, whilst high-shore stocks around the Wash were assessed by quadrat and transect using an all terrain vehicle. Suction dredging effects are being studied on the Lafan sands in North Wales by the North Western and North Wales Sea Fisheries Committee. MAFF has initiated the formation of an informal scientific and management discussion group for all regional interests. Stocks are in general rather low and fisheries await the growth to harvestable size of recent settlements.

Mytilus edulis

In the Wash the annual measurement of spat settlement and stock abundance continued, whilst work was completed on a preliminary evaluation of areal survey trials. There has been no settlement in this area for several years and stocks are poor.

Ostrea edulis

In the Solent (VIIe) stocks were surveyed by dredge, and monitoring continued for the disease Bonamia. Fishable stock is at low point, and pospects are poor in the continuing absence of

a settlement. Bonamia reappeared at the mouth of the Beulieu River, but there were no other changes in the distribution of the disease in this area.

Pecten maximus

In 1989 scientists reintroduced size composition sampling at channel ports. Otherwise, field work has largely been in abeyance in order to concentrate on the analysis of existing information. Topics in progress are an analysis of historical fishery trends in the western Channel area; analysis of dredge efficiency data; analysis of estimates of abundance obtained by underwater camera and TV. In a preliminary study recruitment problems were examined by a particle following model to simulate larvae dispersal. Modelling studies on scallop populations continued. Joint studies on reproductive cycles were initiated with Professor Lubet of Caen.

2) Scotland
(C.J. Chapman)

Pecten maximus and Chlamys opercularis

Monitoring and sampling of scallops (Pecten maximus) and queens (Chlamys opercularis) in all the main fishing areas continued and the provision of catch per unit effort data by selected boats was maintained. The landings of queens increased from 3701 t in 1988 to 5079 t while scallop landings increased to 4673 t.

The study of settlement of both species on artificial collectors continued on the west coast. Settlement was better than in 1988; queen settlement was better than of scallops and scallop spat were generally more abundant in the north west of Scotland than in the south west. Five thousand pecten spat were maintained for culture experiments in collaboration with the Sea Fish Industry Authority at Ardtoe.

Cephalopods

Studies on population structure and stock identity of Loligo forbesi continued. Samples were obtained from the main fishing areas and some research vessel time was devoted to examining squids on the Tockall Bank. A photograpic survey, using still and television cameras, was made of the grounds at Rockall on which squids are known to concentrate. A joint project was initiated with CSIC Spain to compare morphometric and meristic characteristics of L. fobesi populations off Scotland and off the Azores.

A fishery for the octopus Eledone cirrhosa has recently started in Scotland and data on this species is now being collected.

Cerastoderma edule

During 1988 3549 to of cockles were landed from a new fishery in the Solway Firth; landings fell to 2836 t in 1989. Surveys carried out on the Solway cockle beds in August and December 1989 have shown that while a substantial biomass of cockles re-

mains on the grounds the number of areas where densities are high enough to suppert suction dredging methods has decreased. The survey also revealed an age stucture dominated by one year class and evidence that recent recruitment levels are low.

Other Bivalve Species

During 1989 a survey of underexploited bivalve species was carried out in the waters off the Scottish coast to assess the commercial potential for fisheries for these species. The areas covered were

1. The inner Moray Firth
2. The Orkney Islands
3. The Western Isles from the Sound of Harris to Barra
4. The north and west coast of Scotland from Loch Eriboll to Islay

Within these areas attempts were made to identify and sample all places where commercial resources might occur.

Commercial quantities of razor clams (Ensis spp.) were found in the Orkney Islands, around Barra and in the southern part of the Inner Sound. Commercial quantities of palourdes (Venerupis ssp. were found in Orkney, the Inner Sound and Sound of Sleat. In some areas large quantities of other species (Dosinia spp., Lutraria spp. and Mya trucata) were found. If outlets for these species can be found they could provide valuable additional income to vessels engaged on fisheries for razor clams and palourdes.

Limited diving observations were carried out on the gear during its operation and on the environmental impact of this type of fishing but further studies are needed. Pests and diseases of molluscs

During 1989 monitoring of consignments of bivalve molluscs for deposition in Scottish waters continued. These consignments came from England, Northern Ireland and the Channel Islands. The species involved were Crassostrea gigas and Tapes phillipianum.

During the summer months mussel samples were examined for PSP contamination at a number of sites on the east and west coasts of Scotland. Levels of toxin were generally low and only one sample from the east of Scotland registered toxin levels above the danger level.

During the year the number of farming operations registered under the "Registration of Fish Farming and Shellfish Farming Business Order 1985" continued to increase. By the end of the year 223 shellfish farms had registered with the Department of Agriculture and Fisheries for Scotland. During the year the programme of visits to farms in relation to pest and disease monitoring continued. Apart from small areas of the Clyde known to be subject to Mytilicola infestation no known pests and diseases of bivalve molluscs were found.

Scottish mollusc quarterly sampling data, 1989. C = Commercial samples, R = Research samples.

Species		IVa		IVb		VIa		VIb		
Squid (Loligo)	1					133				
	2	43				60				
	3	60	111			98		86	774	
	4		250			253	525			
Scallop	1	929								
	2	2529				1643	890			
	3	4048		364		3717	1801			
	4	1349		497		2724	785			152
Queen	1									402
	2	510				90	450			3557
	3	1373				1702	209			
	4	610				760				4793

United States - Les Etats Unis

(C.H. Peterson and S.A. Murawski)

This report summarizes research activities on commercially important mollusc and crustacean species (aquaculture research excluded) conducted during 1989, by U.S. Federal and state agencies and academic institutions. Research described is for North and South Atlantic waters exclusively.

MOLLUSCA

The Northeast Fisheries Center (NEFC) of the National Marine Fisheries Service (NMFS) conducted spring and autumn bottom trawl surveys off the northeast coast which provided data for epibenthic bivalves and squids. Summer surveys were also completed in the same region for sea scallop(**Placopecten magellanicus**), and Iceland scallop (**Chalamys islandica**), and an hydraulic dredging survey was completed for Atlantic surf clam (**Spisula solidissima**) and ocean quahog (**Arctica islandica**). State agencies, i.e. those of Massachusetts, Rhode Island, and Connecticut, conducted inshore trawling surveys which provided data for various mollusc species.

A small scale fishery has developed off Massachusetts for the arctic surf clam (**Mactromeris polynyma**), and routine fishery monitoring and biological sampling of fishery landings was initiated. This fishery is providing clam meats primarily for an asian export market.

Considerable research in 1989 was conducted by various state, federal and academic institutions concerning the impact of toxic algal blooms on bivalve resources, and the occurrence, dynamics, and prevalence of paralytic shellfish poisoning in both nearshore and offshore bivalve species (mussels, clams, and scallops).

Inventories of bivalve resources were completed or ongoing in a number of states, and an intensive effort to certify shellfish growing waters as producing shellfish acceptable for human consumption was dictated by federal law.

American Oyster (**Crassostrea virginica**)

Projects undertaken in a number of the states sought to restore and enhance natural and cultured populations of oyster. In New Hampshire projects to repopulate oyster producing areas centered on artificial improvements of bottom sediments and control of drills. New Jersey and Delaware projects sought to develop oysters resistant to the disease MSX, and to implement propagation methods to sustain seed production potential from natural oyster beds.

Researchers at Rutgers University have been conducting studies of the genetics of disease resistance, in an effort to develop and enhance propagated oyster stocks. The State of Maryland continued research on the development of a comprehensive plan for oyster management in Chesapeake Bay, including aspects of seed planting on natural beds, the role of aquaculture in augmenting natural production, and examination of the efficacy of alternative oyster species for the Chesapeake (i.e. Pacific oyster). Studies of the pathology, immunity and fitness of alternative oyster species was also ongoing at the Virginia Institute of Marine Science.

Sea Scallop (**Placopecten magellanicus**)

Research on sea scallop populations focused primarily on seasonal fluctuations in adductor muscle weight, and the annual cycle (s) of maturation and spawning (Northeast Fisheries Center and Virginia Institute of Marine Science). Stock assessments of sea scallop, based on research vessel surveys and commercial production data, were intended to serve as the basis for a comprehensive management approach for the intensive sea scallop fishery. Bioeconomic studies focusing on fleet behavior and profitability of vessels were initiated. Additionally, the New England Fishery Management Council initiated a modeling study to predict recruitment and fishing mortality rates based on R/V data and seasonal patterns of landings.

Blue Mussel (**Mytilus edulis**)

An important new research program focusing on production modeling of blue mussel to determine optimum seeding densities in bottom culture situations was undertaken by researchers in Maine. This project seeks to examine in detail the various factors influencing mussel production (e.g. food flux, mussel pumping rates, food quality), and the extent to which seeding density influences these production parameters in a mussel culture situation. A U.S. national program called 'Mussel Watch' used blue mussel as one indicator organism to index the extent and effects of coastal pollution. Results have become available both from Atlantic and Pacific **Mitulus** populations.

Hard Clam (**Mercenaria mercenaria**)

Studies focusing on factors influencing the recruitment and survivorship of hard clams, particularly in relation to pollution gradients was undertaken by NEFC researchers. These studies have compared settlement rates, growth and survivorship at several sites in western (relatively polluted) and eastern (relatively pristine) areas of Long Island sound. A variety of recruitment-related

studies on hard clam were likewise undertaken by researchers in Florida, New York, New Jersey, Virginia, and North Carolina. Growth and production of hard clams was evaluated in several studies, including those by researchers in New York, Rhode Island, South Carolina, and Georgia.

Ocean Quahog (**Arctica islandica**)

Growth, reproduction and the validation of ageing structures for the ocean quahog were undertaken in studies by scientists from NEFC, and by researchers from the University of Maine-Machias, and Rutgers University. NEFC research involved re-calculation of growth equations from additional years of mark-recapture data. Work in Maine evaluated density-dependent growth, and comparisons of wild and laboratory reared animals. Work at Rutgers University focused on internal shell structure as indicative of age. An hydraulic dredge survey of the ocean quahog resource off the Middle-Atlantic Bight was completed by NEFC.

Surf Clam (**Spisula solidissima**)

A region-wide hydraulic dredge survey for surf clam was completed by NEFC. Additionally, stock assessments for populations in the Middle Atlantic, Southern New England, and Georges Bank regions were completed, and simulation studies on optimal harvesting policy were published. Researchers at Rutgers University completed several studies concerning the socioeconomic consequences of regulating the Middle Atlantic Bight surf clam fishery.

Soft-Shell Clam (**Mya arenaria**)

Factors influencing recruitment dynamics of soft-shell clams were evaluated in studies conducted by researchers in Maine and Connecticut. Internal shell lines as indicators of seasonal and annual growth were evaluated in a project conducted by investigators from the State University of New York at Stony Brook.

Short-Finned Squid (**Illex illecebrosus**)
Long-finned Squid (**Loligo pealei**)

Assessment updates were completed for these resources, based on research vessel bottom trawl surveys conducted by NEFC and the States of Massachusetts, Connecticut, and Rhode Island. Alternative survey indices were developed to predict CPUE in the spring **Loligo** fishery, based on preceding autumn bottom trawl surveys.

USSR - URSS

(G.I. Luka)

Squid and scallops

Studies of squids Gonatus fabricii in the Norwegian and Barents Seas and Iceland scallop Chlamys islandica in the south-eastern Barents Sea and in the area of Spitsbergen archipelago were continued in 1989. Investigations of squids were carried out in August/September, while those for scallops were carried out in May-August. 238 scallop samples were collected and processed.

The Iceland scallop investigation confirmed that the commercial dredging targetted at scallops in the south-eastern Barents Sea in 1988-89 has a detrimental influence on the state of the scallop stock as well as that of the bottom-biocenosis as a whole.