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REPORT OF THE WORKING GROUP ON INTRODUCTIONS AND TRANSFERS OF MARINE ORGANISMS

Bergen, Norway, 10-13 May 1983

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CONTENTS

WORKING GROUP ON INTRODUCTIONS AND TRANSFERS OF MARINE ORGANISMS

The 1983 meeting of the ICES Working Group on Introductions and Transfers of Marine Organisms was held in Bergen, Norway, May 10-13, 1983, with assistance from the Institute of Marine Research. Twelve participants representing nine member countries were present:

C. J. Sindermann	USA (Chairman)
J. T. Carlton	USA (Rapporteur)
G. Turner	Canada
V. H. Jacobsen	Denmark
H. Grizel	France
Y. Harache	France
H. Rosenthal	Federal Republic of Germany
E. Egidius	Norway
J. Menezes	Portugal
H. Quiroga	Spain
A. L. S. Munro	UK
D. J. Solomon	UK

In addition, reports from Ireland (C. B. Duggan) and from the Netherlands (S. J. de Groot) had been received and were presented by the Chairman. The members of the Working Group were welcomed by Dr. Emmy Egidius of the Institute of Marine Research. The Chairman thanked Dr. Egidius for her remarks, and then reviewed the goals of the Working Group and of this year's meeting. The agenda for the meeting was considered, and with adjustments and additions, approved (Appendix I).

STATUS OF WORKING GROUP RECOMMENDATIONS OF 1982

The chairman reviewed the status of recommendations formulated at the last meeting in La Coruna, Spain, May 1982 (see 1982 Report, pages 45 - 46) and submitted for consideration at the 70th Statutory Meeting of ICES in Copenhagen in October 1982:

(6) That the FAO be encouraged to prepare a World-Wide Register of Marine Fish and Shellfish Introductions as a sequel to its "Register of International Transfers of Inland Fish Species"

The Mariculture Committee "agreed to recommend that the Council" so encourage FAO (Procès-Verbal, p. 61).

(7) Prepare case histories of introductions, statements on the ecological and genetic implications of introductions, protocols on introductions prior to importation, and continue reviews and study of introductions in ICES member countries at a meeting in 1983 in Bergen, Norway.

C. Resolution passed.

(1 - 5)
No resolutions passed.

STATUS OF WORKING GROUP RESPONSES TO RESOLUTIONS APPROVED AT THE 1980 and 1981 STATUTORY MEETINGS

(A) National Laws and Regulations

The national laws and regulations concerning transfers and introductions of marine organisms of twelve ICES member countries were assembled in 1981 and brought together in a bound volume (1982). The general contents of this volume, including the date(s) of most recent laws, are listed in Appendix II(a), while a title list of the legislation is presented in Appendix II(b). Members present noted that, for many countries, new legislation had either been passed or was in the process of becoming law

(see NATIONAL REPORTS, 1.0, Relevant Laws and Regulations, below). In addition, it was noted that the volume did not contain the legislation of all ICES member countries. The Chairman urged the members present to study and examine the 1981 volume and submit to the Working Group legislation and new regulations. The Chairman also noted a need to contact member countries not present at this year's meeting for copies of their most recent legislation.

A suggestion was further made that a valuable tool would be a registry of laws and regulations on introductions and transfers from non-ICES member countries, by which means relevant concepts developed elsewhere could be studied.

V. Jacobsen (Denmark) noted that, on a global level, article 196, para. 1, of the United Nations Convention on the Law of the Sea states that:

> "States shall take all measures necessary to prevent, reduce and control pollution of the marine environment resulting from the use of technologies under their jurisdiction or control, or the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment, which may cause significant and harmful changes thereto."

(B) Expansion of ICES Code of Practice: Proposed Guidelines

Proposed guidelines for implementing the ICES Code of Practice concerning introductions and transfers of marine organisms were submitted by the Working Group to the Mariculture Committee as CM 1982/F:33. It was felt that, to insure wider availability of these Guidelines, this document be issued as a Cooperative Research Report, without including the Protocols (see (C), below) at this time. The Guidelines include a section on Definitions and on an Augmentation and

Explanation of each Section of the Code.

The Working Group noted that, in support of the goal to insure wider dissemination of the Codes and Guidelines, portions of these materials have appeared in the Quarterly Newsletters of the European Mariculture Society (nos. 26 (December 1982) and 27 (March 1983)) with the permission of the ICES Secretariat and the encouragement of the Working Group.

(c) Protocols Document

The draft statement on "Protocols for Inspection of Marine Species Prior to Importation" remains in a preliminary state. A major theme of this meeting is to develop this Protocol into a detailed, usable document suitable for submission at this year's Statutory Meeting. Development of this protocol is discussed below.

RELEVANT PUBLICATIONS and REVIEW OF FAO/EIFAC ACTIVITIES

At the 1982 Working Group meeting in La Coruna, Spain, Dr. R. Welcomme of the FAO noted that EIFAC (the European Inland Fisheries Advisory Commission of FAO) was also developing guidelines relative to introductions. A "Proposed Code of Practice" (EIFAC/XII/82/17) was developed, which will be reviewed at an EIFAC meeting in Hamburg in May 1983.

Two pertinent EIFAC and FAO documents were brought to the Working Group's attention by H. Rosenthal (FRG). One, concerning in part the dangers of exotic species, is on the conservation of genetic resources in fish (FAO/UNEP, 1981). The second is a report on the Budapest May - June 1982 meeting on stock enhancement in the management of

freshwater fisheries (EIFAC, 1982).

A number of recent papers on exotic species were noted by Working Group members and a preliminary list of these distributed at the meeting (Appendix VI). Recent newspaper items on oyster and shrimp diseases relative to introduced species were also presented.

Relative to last year's discussion (1982 Report, p. 9), a few additional remarks were made concerning newsletters which provide information on introduced species. One of the few newsletters devoted entirely to the study of an introduced species is the "Corbicula Newsletter" (a freshwater and brackish Asian clam introduced into North America), now in its eighth volume (contact: Dr. J. C. Britton, Department of Biology, Texas Christian University, Fort Worth, Texas 76129 USA). The Exotic Fish Section of the American Fisheries Society also has a newsletter. Information on exotic species in mariculture (aquaculture) is often contained in the Quarterly Newsletter of the European Mariculture Society.

The abstract of the 1981 symposium, "Ecological effects and biogeography of an introduced marine species: the periwinkle Littorina littorea", were published in Malacological Review, 15: 143-150 (1982), while individual papers have been published (Vermeij, 1982) or will be published.

A symposium was held in December 1982, in Los Angeles, California, as part of the Western Society of Naturalists, on "The Biology and Ecology of Introduced Species", which included invited papers on introduced marine invertebrate populations in San Francisco Bay, California (F. Nichols), on models of fish introductions (H. Li), on the exotic biota of the Salton Sea, California (L. Oglesby), and on general models for ecological frameworks of introduced species

(J. Carlton). Over 300 attended the Symposium.

A 20-chapter, 700 page MS book is now in press, entitled, "Distribution, Biology, and Management of Exotic Fishes" (ed. W. Courtenay), Johns Hopkins University Press, based on a 1981 Arizona symposium.

Organization is beginning on a symposium for early summer, 1985, in Alexandria, Egypt, with possible FAO support, on "Exotic Fishes in Developing Nations".

During the discussion it was proposed and accepted that the increasing amount of Working Group documents be filed in some central location, for ready access at the time of the annual meeting. Dr. Rosenthal offered space in his facilities at the Biologische Anstalt Helgoland in Hamburg, and his offer was accepted.

STATEMENT OF PURPOSE OF WORKING GROUP

A statement of operating principles and responsibilities of the Working Group, including matters of both policy and philosophy, is being developed. A second draft will be circulated to WG members for revisions and comments.

NATIONAL SUMMARIES

Updates of the status of introductions were presented by members (references cited are in Appendix VI). In an attempt to both standardize and expand the National Reports, a "Guideline for the Preparation of Reports" was prepared, modified from Cooperative Research Report No. 116 and from the 1982 Working Group Report (see Appendix III, herein). The consensus of the Group was that members should attempt to assemble regular import and export data, including both species and quantities if possible. This would serve an expanded cross-checking purpose, and would also alert member countries of importations of which they were not aware.

1.0 Relevant laws and publications

Canada

Revisions to the "Pacific Shellfish Regulations" (see Appendix II(b), CANADA: (4)) were submitted, consisting of the Amendment List of 16 August 1982 (CRC, 1978, c. 826).

France

The list of regulations (Appendix II(b)) is not complete; additional materials will be gathered for submission. Reference was also made to regulations submitted last year (No. 3297 P.4), "Immersion en eaux françaises de coquillages étrangers" (1982 WG Report, Appendix IV therein).

Norway

New laws and regulations will be in effect next year. An update will be submitted for 1984.

Portugal

At the present time, Portugal only has laws concerning animal health control. Attempts are being made to draw up legislation concerning the control of introductions. A seminar is planned for July 1983 on problems associated with introductions and transfers.

U. K.

The Wildlife and Countryside Act of 1981 is in effect. Copies of pertinent sections relevant to exotic species will be submitted.

2.0 Other Procedures Concerning Introduced Species

France

Relative to the movement of hatchery seed and young destined for rearing, and to the movement of molluscs destined for direct consumption, pathological analyses are made prior to each importation in order to

establish a list of countries from which importations are acceptable. In addition, the introduced lots are regularly analyzed both at the time of introduction and during the course of rearing. Finally, for all operations, mollusks are held during analysis in quarantine basins, from which the effluents are treated. Products destined for consumption are not reimmersed in open waters.

Relative to experimental studies, microscopic analyses are carried out repeatedly on different samples, and growth, mortalities, and condition in general (including pathology) are monitored not only on the introduced animals but also on indigenous species adjacent to the experimental lots.

Netherlands

In reference to last year's information on pathogens, no further developments of new diseases are reported. Culture production is still halted in the oyster industry; however, investigations have showed that the activities of the disease agent (Bonamia ostreae) are declining.

3.1 Deliberately Introduced Fish: Fishery Enhancement

USSR

See: D. Solomon, Pacific pink salmon (Oncorhynchus gorbuscha) in Northwest Russia, under CASE HISTORIES, page 40 of this report.

3.1.2 Deliberately Introduced Mariculture

(see also: Current Status of Proposed Introductions: Salmonid Fishes -- page 30 of this report).

France

Importation of eggs of rainbow trout continued from various countries,

principally from the United States (several million eggs). Eggs of turbot (Scopthalmus maximus) continued to be imported from Great Britain.

Eggs of Atlantic salmon (Salmo salar) were imported from Norway for the purpose of smolt production.

An intentional release of coho salmon (Oncorhynchus kisutch) is known to have been made by a private promoter in the Somme estuary (Picardy) in northern France, between Normandy and Belgium.

Federal Republic of Germany

Most of the transfers in 1982 took place in freshwater. Various salmonid species as well as eels were imported for stocking purposes.

Only a few activities are reported from brackish and marine waters. Rainbow trout reared under controlled conditions in the laboratory at Kiel University (Institut für Meereskunde) have been released in 1981 and 1982 in coastal backwaters connected to the Baltic Sea (Neustädter Binnenwasser). Fish were adapted within one week to brackish water of 8 o/oo salinity prior to release. In May 1981, about 60,000 fish (average length 2.9 cm; average weight 0.15 g) were stocked near the city of Neustadt. A second release in October 1981 involved 2,200 trout of 11 g average weight and 700 fish of about 6 g weight. The 1982 releases were undertaken in June. Fish 6 weeks old had been adapted to brackish water (7 - 10 o/oo salinity) for 4 days. About 40,000 fish (average weight 0.5 gm; length 7 cm) were then planted into the Neustädter Binnenwasser. All introductions were publicized through various channels (e.g., fishermen's newsletters, fishery Union, local authorities). Until November 1982, 327 trout were reported from the Neustädter Binnenwasser and the adjacent Neustädter Bight; 200 of them were caught between August and November, weighing between 600

and 800 g. Compared to control fish kept at the Institute, released fish did grow appreciably faster (Figure 1). Although the number of recaptured fish is relatively small it is concluded tentatively that rainbow trout adapted and released into coastal waters do not migrate very far and might be considered for coastal ranching programs. The few fish recaptured sold for fifty percent of the cost of producing the fry for release. However, more detailed studies are required before any recommendations on large scale releases can be made.

Ireland

Atlantic salmon smolts have been imported from Norway. In the first importation, a veterinary surgeon flew to Norway and inspected the fish prior to export. The fish were released into an enclosed lake, and health checks were conducted every two weeks during a three month quarantine period. No problems were encountered. A second importation has now taken place, involving the same importer and the same Norwegian source.

Norway

With permission and surveillance of the veterinary authority, certain amounts of rainbow trout and Atlantic salmon were imported in 1982. The table below indicates the quantities approved for import, although it is not known if these numbers were actually imported.

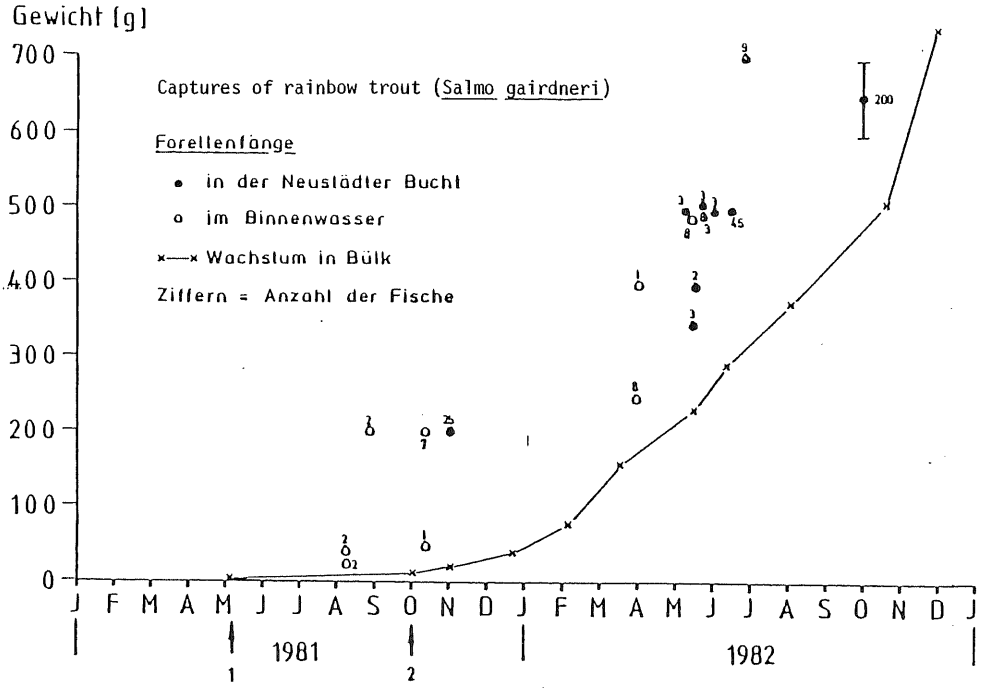

Fig.1: Average weight (g) of rainbow trout caught in the "Neustädter Binnenwasser" and in the "Neustädter Bucht" in comparison to weight of specimens grown at the Institute in running Baltic seawater (x——x) Numbers indicate sample size. Open circles = Neustädter backwater, full circles = Neustädter Bight.

IMPORT OF LIVE FISH TO NORWAY 1982

	DENMARK	FINLAND	ICELAND	SWEDEN	TOTAL
Atlantic Salmon					
- eggs	--	--	--	40,000	40,000
- fry	--	--	--	544,000	544,000
- smolts	--	5,000	--	340,000	345,000
Rainbow trout	60,000			100,000	160,000
- eggs	--	--	--	60,000	60,000
- fry	--	--	--	2,000	2,000
Gullspångtrout					
- fingerlings	--	--	--	1,500	1,500
Seatrout					
- eggs	--	--	30,000	30,000	60,000

U.S.A.

State of Maine

Sea Run, Inc., under a permit from the Maine Department of Marine Resources, is conducting a pilot program with the release of pink salmon (Oncorhynchus gorbuscha) eggs from the State of Alaska and of chum salmon (Oncorhynchus keta) eggs from Hokkaido, Japan. (Some preliminary information on these releases was presented in the Working Group 1982 report, pages 41-42). The program has been underway for three years. These releases were discussed by the Working Group at the request of the Maine Department of Marine Resources, and preliminary comments are presented on page 33 of this report).

Portugal

An increasing concern in Portugal was noted relative to the importation of aquarium fish, both freshwater and marine, without appropriate controls and also as a human health risk. It was suggested that broader attention should be paid to this problem.

3.1.5 Capture of Fish from Introductions made in Neighbouring Countries

Netherlands

On 16 December 1982 a coho salmon (Oncorhynchus kisutch) was caught by a sports angler in a brackish canal (Calandkanaal) near Europoort - Rotterdam (data: Total Length, 47.9 cm, weight 890 g, female gonads well developed). The species was identified by the Netherlands Institute for Fishery Investigations (RIVO), IJmuiden. It is believed that a second specimen was captured a few days after the first one near the same locality. This latter specimen was only partly preserved (the head) by the angler, the remaining part being consumed. No coho salmon are kept in captivity in The Netherlands.

In response to a Netherlands request for the Working Group to investigate possible release sources for these fish, Y. Harache (France) noted that in the spring of 1981 and in the spring of 1982 age 1 salmon were released by a private party in the Somme estuary in Picardy (see 3.1.2, FRANCE, above). It would be of interest in this regard to determine if portions of either of the captured fish have been preserved by which scales might be studied.

3.2.1 Deliberately Introduced Invertebrates: Fishery Enhancement

See: H. Grizel, Introduction de l'huitre creuse Crassostrea gigas en France, under CASE HISTORIES, page 37 of this report.

3.2.2 Deliberately Introduced Invertebrates: Mariculture

Canada

The bay scallop, Argopecten irradians irradians, was once again a major topic for the Advisory Committee on the Introduction of Non-Indigenous Species in the Maritimes. From the original adult bay scallops introduced into quarantine at Ellerslie, Prince Edward Island (PEI) to serve as a broodstock (see 1982 National Summary), the F3 and F4 generations were transferred to the Bideford River adjacent to the Ellerslie Station in August 1982. Growth in the holding trays and nets in the Bideford River was very fast with a portion of the scallops reaching near market size (50 mm) in the fall of 1982.

On satisfactory completion of additional disease examinations, the scallops were permitted to be relocated from the Ellerslie site to 14 specified stocking locations (test estuaries) around PEI:

1. Cascumpec
2. Malpeque
3. New London
4. Rustico
5. Tracadie
6. St. Peter's
7. Rollo
8. St. Mary's
9. Hillsborough
10. Savage Harbour
11. Murray Harbour
12. South Lake
13. Basin Head
14. Bideford River (station reserve area)

A small number of scallops were placed at each test site but were retained

in nets. Success at the diverse test locations will be judged on the basis of growth rate, survival, and other parameters. Initial indications are that the larger size scallops (25 mm plus) have little difficulty adapting to winter conditions in ambient tanks at the Ellerslie Station or under the ice at the field sites. In March 1983, the F3 and F4 generations were being successfully spawned at Ellerslie and the new F4 and F5 generations will be used for field trials during the summer of 1983.

The experimental and pilot commercial growing of Ostrea edulis using seed produced in the Pleasant Point, Nova Scotia hatchery continued in 1982. Solution of a number of persistent culture problems at the Pleasant Point hatchery during 1982 resulted in a substantial increase in the number of O. edulis seed produced. Earlier seed production was between 50,000 - 150,000 seed of 5.0 mm shell length. In 1982, 2.2 million seed with 3.0 mm shell length were produced. Overwinter survival of this seed is not yet known.

Staff of the Nova Scotia Department of Fisheries has set approximately 2.7 million O. edulis seed in 1983, the largest of which is approaching 1.0 mm. They expect to initiate 3 additional spawnings; one at the end of April, the second about mid-May and the third in early June.

During the summer of 1983, the Pleasant Point Hatchery will be spawning Mercenaria mercenaria and Crassostrea virginica. O. edulis seed in excess of Departmental needs are sold to commercial growers along the eastern and southern coasts of Nova Scotia. A 2-year project designed to study interspecific competition between O. edulis and C. virginica has recently been completed and preliminary results

indicate that O. edulis should pose no significant threat to C. virginica (native oysters) in its preferred habitat.

Some shellfish introductions to British Columbia in 1982 were reported. A small amount of Japanese oyster seed (Crassostrea gigas) was imported from two California hatcheries. A considerable amount of Manila clam seed (Tapes philippinarum)*, approximately 2.2 million with a shell length of 2-5 mm, was also imported from California hatcheries. Most were imported for experimental purposes, although one person in industry was testing clam farming in a small way.

Note:

See also: G. Turner, Introduction of the bay scallop (Argopecten irradians irradians) to Prince Edward Island, Canada, under CASE HISTORIES, page 43 of this report.

France

A voluntary release was made of post larvae of the Japanese shrimp Penaeus japonicus in several ponds of Languedoc Roussillon in the Mediterranean. The rate of recapture seems to be adequate in certain ponds and growth has been very rapid.

Seed of Crassostrea gigas and of Ostrea edulis produced in English hatcheries and in nurseries on Jersey have been introduced in France. In addition, seed of Ruditapes philippinarum produced by the SATMAR hatchery in France and reared in Senegal have been planted in

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*In this Report, the Latin names Tapes philippinarum, Ruditapes philippinarum, and Tapes semidecussata refer to the same commercial clam, originally a native of the Northwestern Pacific Ocean. In other reports it may also appear under the name Tapes japonica.

different beds on the Atlantic coast.

Juvenile scallops, Pecten maximus, have been imported from the Bay of Mulroy, Ireland, in order to supplement the potential of natural scallop beds in the Bay of St. Brieuc and in the Harbor of Brest. About 500,000 young were raised in Japanese lantern nets prior to being immersed in protected areas.

Ireland

No introductions of new species are reported. Ireland discontinued the importation of Ostrea edulis and Crassostrea gigas spat from Britain since Bonamia was found in Cornwall and Essex, pending further testing by MAFF of the British hatchery stock.

Norway

In 1982 the Directorate of Fisheries granted permission for imports of live lobsters (Homarus gammarus) for fattening purposes (and later export) from Scotland.

The Directorate of Fisheries also gave permission to import spat of Crassostrea gigas from Great Britain; in the future, these will be imported only from Scotland, however.

Spain

"A few thousand spat" of the scallop Pecten maximus were imported from Ireland in December 1982 (from Mulroy Bay, Co. Donegal) to La Coruna. These were planted in the Ria de Arosa and in the Ria de Betanzos - Sada, near La Coruna.

United Kingdom

The molluscs Crassostrea gigas, Ostrea edulis, and Venerupis decussata are regularly moved within and between the countries of the UK and are exported to other countries. All movements have been greatly reduced since the outbreak of Bonamia in Ostrea edulis in the southwest and southeast of England in 1982.

Tapes semidecussata, released from quarantine at Conwy in 1981, have been planted at sites in Wales and Ireland.

3.2.3 Deliberately Introduced Invertebrates: Live Storage Prior to Sale

Portugal

It is possible that crustaceans imported from England are maintained in natural waters prior to consumption.

Spain

In like manner, certain crustaceans, including Palinurus, Homarus, and Maia squinado, from Ireland, England, France, Morocco, and other North African countries, and certain molluscs, such as Ostrea edulis from Greece / Turkey may be held in open waters prior to consumption.

4.0 Species Introduced Accidentally along with Deliberate Introductions

(A) Status of Bonamia ostreae

The oyster parasite Bonamia, which caused extensive mortalities in the flat oyster (Ostrea edulis) in Brittany, France, starting in 1979, now occurs in the Netherlands (see 1982 Report, pp. 15-16; this report, 2.0, page 8), in Spain (Gallicia), and in Britain (below). Bonamia is believed to be no longer present in Denmark, although it is reported

to have occurred in the Linnfjord, West Denmark, in the summer of 1982. Reports of Bonamia in Ireland appear to be based upon findings of the parasite in Irish oysters relaid in French waters, and thus not coming directly from Ireland.

Bonamia was discovered in O. edulis in the Fal estuary in southwest England after high mortalities in the fall of 1982. Oysters from the Cornwall region were apparently subsequently moved to grounds in the West Mersea area of Essex, where Bonamia is also now reported. Following the outbreak of Bonamia, oyster movements in the UK have been greatly restricted, and certain countries, including France and Norway, have ceased importations from the infected regions.

(B) Status of IHHN shrimp virus

The Chairman brought to the Working Group's attention important new information on the existence of the infectious hypodermal and hematopoietic necrosis (IHHN) virus in the marine shrimp mariculture industry (the virus is not known to infect the freshwater prawn Macrobrachium). The most recent outbreak is in Hawaii, traced to importations of penaid shrimps from Costa Rica. The virus affects the "blue shrimp" Penaeus stylirostris; the "white shrimp" Penaeus vannamei appears to carry and transmit the virus, but is itself not directly affected. The above information is drawn from the newspaper report of Hastings (1983); studies are now in press by Lightner and others in the scientific literature.

5.0 Completely Accidental Introductions

Canada

The status of the introduced Japanese eelgrass Zostera japonica on the Canadian west coast has been reviewed by Harrison and Bigley (1982).

See also: "Comments: Ballast water discharge in the Gulf of St. Lawrence", page 32 of this report.

Federal Republic of Germany

Status of the Chinese mitten crab, Eriocheir sinensis

Compared to former years, the population size of Eriocheir is substantially reduced in most of its present area of distribution. The crab is present in all water bodies that have connections to the rivers Ems, Weser, and Elbe. It has been suggested that the present decline in population size is due to the severe winter conditions in 1978/1979, because of the sensitivity of this crab to low temperatures. In 1982 only a few specimens have been recorded from the Weser - Ems region. Since the late 1960s, large quantities of Chinese mitten crabs were transported each year by truck to the University of Lüttich (Belgium) for scientific investigations. The crabs are collected by commercial fishermen within the Weser-Ems region.

Range extensions of gammarid amphipods introduced in saline waters of Lower Saxony (Herbst, 1982)

The range extension of the very euryhaline amphipod Gammarus tigrinus seems to be supported by the heavy salt concentration of the Weser River

due to the wastes of the potassium industry. This amphipod utilizes also habitats affected by pollution, in which the natural amphipod species have disappeared. In contrast to this continued range expansion, the distribution of the ponto-caspian immigrants Chaetogammarus ischnus and Corophium curvispinum is restricted to salty parts of the Mittelland-Kanal and Elbe-Seitenkanal. The brackish water species Corophium lacustre extended its range upstream from the Weser estuary to the city of Hameln. Details on records during recent years are shown in Figure 2.

Plants

The halophilic grass Spartina townsendii, introduced from England in 1927/1928, has recently been studied in a German tidal marsh area by Meixner (1982). Under certain conditions it was found to be a useful substrate for mussels (Mytilus edulis) to settle and grow. Mussels seldom occur in the upper range of the Spartina distribution. However, the scattered stands of this grass growing on the seaward side of the Ülvesbüll reclamation fields (50 - 90 cm below mean high tide level) offer a good substrate for Mytilus.

Other taxa

The American razor clam, Ensis directus, is reported from Germany, possibly as a result of the introduction of larvae in ships' ballast water in 1978 (Cosel et al., 1982).

Netherlands

Crustaceans

Records of blue crabs, Callinectes sapidus, in the Netherlands, are

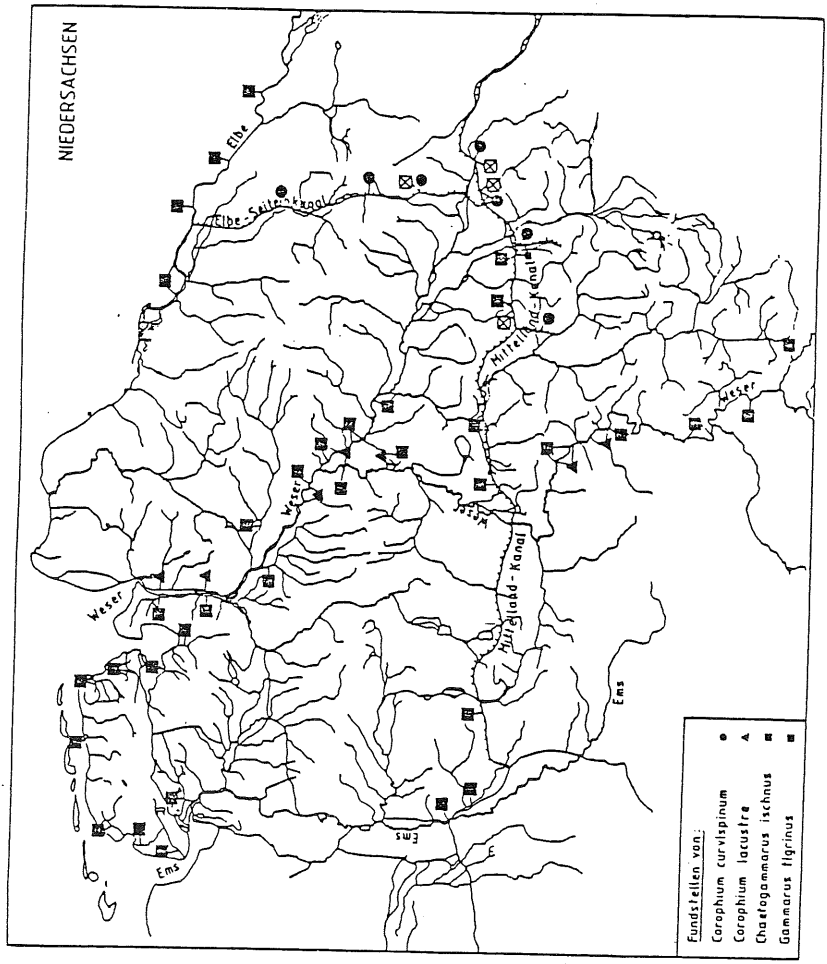

Fig.2: Distribution of the euryhaline amphipods Corophium curvispinium. ● C. lacustrae ▲, Chaetogammarus ischnus ⊠ and Gammarus tigrinus ■ in lower Saxony, FRG.

given in Table I. In the last 50 years, 17 specimens of this North American species have been caught and recorded. Except for one record (1-XI-1980), all came from the sea or from brackish water. Most specimens were mature but no females with eggs were observed.

The mud crab Rhithropanopeus harrisii (Dutch name: Zuiderzee-krabbetje), originally from the east coast of the United States and first found in the Netherlands in the mid nineteenth century, was thought to be extinct. However, it was rediscovered in 1980 near the sluices of IJmuiden. Since then it has been found in several additional localities (Adema, 1980, 1981).

Plants

In 1974, a rare marine diatom, Pleurosigma planctonicum, was observed in the Dutch coastal area. It has been known since 1966 from British waters. It is probable that it floated from the English Channel into Dutch waters; the mean transit time for water of the northerly current from the Channel is about 10 months (Kat, 1982a).

In March 1981 Thallasiosira angstii was observed in the Dutch coastal area for the first time. A striking correlation was observed between cell numbers and salinities of 33 g/kg (Kat, 1982b).

United Kingdom

The brown alga Sargassum muticum continues to spread slowly both east and west along the south coast, and to consolidate stands within its range. The south coast distribution is now from Dungeness in the east to Looe (Cornwall) in the west. A single attached plant found at Sheringham in Norfolk is the first UK record from the North Sea, although the species is well established in the Netherlands.

Table I - Blue crab Callinectes sapidus, in The Netherlands (after Adema, 1982).

ZMA = Zoologisch Museum, Univ. of Amsterdam.
RMNH= Rijksmuseum van Natuurlijke Historie, Leiden.
FNM = Fries Natuurhistorisch Museum, Leeuwarden.
ZBN = Zeeuws Biologisch Museum, Domburg.

Date	Location	Number	Width	Remarks	Collection
10.IX.1932	Zaandam, Zaan	1 ♀	135 mm	alive	ZMA
XIII.1934	Amsterdam, Entrepôt-haven	1 ♀	135 mm	alive	ZMA
9.VIII.1950	Vlissingen, Zoutelande	1 ♂	146 mm	cooked	ZMA
VIII.1950	Vlissingen	1 ♂	164 mm	cooked	RMNH
VII.1951	Nauerna, Noordzeekanaal	1	120 mm	alive	
28.I.1967	Dishoek, Walcheren	1	-	fragment	RMNH
7.V.1967	Schiermonnikoog	2 ♂♂	144, 180 mm	cooked	RMNH
"	"	1 ♀	125 mm	cooked	RMNH
"	"	1	-	carapax	FNM
19.I.1968	25 mijl NW van IJmuiden	1 ♀	205 mm	alive	RMNH
4.IX.1973	Terneuzen, Westhaven	1 ♂	107 mm	alive	ZMA
15.IX.1978	" "	1 ♂	150 mm	alive	ZBN
25.IX.1978	" "	1 ♂	140 mm	alive	-
9.X.1980	" "	1 ♂	145 mm	alive	-
1.XIII.1980	Sluiskil	1 ♀	150 mm	alive	ZBM
15.X.1980	Walsoorden, Perkpolder	1	-	alive	-

United States of America

The exotic Asian clam Corbicula fluminea (= Corbicula manilensis of some authors) continues to attract increased attention. A review paper by McMahon (1982) outlines its pest status and its effects on irrigation canals and engineering facilities, particularly in electrical generating stations, where Corbicula blocks water systems. The "Second International Corbicula Symposium" will be held June 21 - 24, 1983 in Arkansas, supported by industrial, governmental, and academic organizations. (The first Symposium was held in 1977 in Texas).

Three species of Asian copepods are newly reported in San Francisco Bay, probably as a result of ballast water introduction (F. Ferrari, T. Bowman, and J. Orsi, 1982).

The activities of the National Fishery Research Laboratory, Gainesville, Florida (U. S. Department of the Interior, Fish and Wildlife Service) relative to introductions were reviewed. The NFRL has the responsibility of developing a national research program concerning the distribution, status, and impact of exotic fishes established in open waters. The NFRL is to monitor all introductions, both existing and those that are believed to have disappeared (either by activity of man or due to other natural causes). In addition, detailed studies of exotic species in the southern U.S.A. include the ecological effects of blue Tilapia in Florida, studies on hybrid carp in Florida, and studies on the natural reproduction of the grass carp in the Louisiana-Mississippi drainage.

Finally, the distribution and status of the exotic Asian eelgrass Zostera japonica on the US west coast was recently reviewed by Harrison and Bigley (1982).

6.1 Species Introduced for Hatchery Rearing and not Subsequently Planted outside the Hatchery

Canada

The situation with respect to European oysters (Ostrea edulis) at Dalhousie University (originated from Maine and Wales broodstocks) remained essentially static. The F_2 generation produced in 1981 (see National Summary, 1982) are being tested for disease and preliminary indications suggest no disease or parasite problems. No spawning was done in 1982 but plans call for the production of more F_2 in 1983 under quarantine conditions.

One shipment of sea scallops (Placopecten magellanicus) -- 25 males and 25 females -- and one shipment of Japanese scallops (Patinopecten yessoensis) -- 25 males and 25 females -- were imported to British Columbia and held under quarantine conditions at the Pacific Biological Station for use in breeding work.

France

Due to the economic crisis arising from the development of Bonamia disease which caused a dramatic drop in the production of the flat oyster Ostrea edulis, it became critical to search for a flat oyster to replace O. edulis. To this end, a broodstock of Ostrea densallamelosa was introduced from Korea and held in quarantine. This oyster was chosen because of the

absence of known pathogens and the existence of the proper habitat (biotope), comparable to that of O. edulis, on the Brittany coast. An F_1 generation was obtained at the beginning of this year, which will be reared and tested for its sensitivity to Bonamia.

The importation of coho salmon eggs continued (600,000 in 1982). Eight farms reared the coho salmon in 1982 for a total production of about 100 tons. No major escapes were recorded, but occasional recaptures of fish have been made in the estuaries of north Brittany and at Cherbourg.

United Kingdom

1.5 million eggs of Salmo salar were imported from Norway to Scotland for hatchery purposes.

The stock of coho salmon by Unilever Ltd. in Scotland in strict confinement is now reduced to about 10 individuals. Male fish matured and died, but females did not mature and many died. All remaining fish are believed to be females. Sperm from males has been cryopreserved.

United States of America

The Department of Fisheries of the State of Washington issued (February 1983) a permit to a private interest to import 200 seed and 200 adults of the Japanese scallop Patinopecten yessoensis from Miyagi or Aomori Prefectures, Japan, to be held in quarantine at the University of Washington's Manchester Laboratory facility. The provisions of the permit require that a minimum of 20 adult scallops

from the seed area in Japan be examined by a pathologist in Washington to investigate potential disease problems. Detailed mortality monitoring procedures are further required. The permit conditions further state that "The adult scallops may be spawned and all eggs, larvae and seed scallops produced must be kept in quarantine at Manchester. The seed must be inspected by a Department of Fisheries-approved pathologist before a permit will be issued for planting in state waters."

6.3 Hatchery Rearing: Stock Supplied in Larger Quantities to the Industry or to Some Other Organization

See: 3.2.2, CANADA, relative to Ostrea edulis (p. 15 of this report).

7.0 Planned Introductions

United Kingdom

There are plans to import small quantities of Crassostrea virginica and of Crassostrea rivularis from the east coast of North America and from Oregon respectively into quarantine at Conwy, Wales. Following disease clearance the intention is to distribute small stocks to the industry as broodstocks.

8.1 Live Exports for Consumption: Molluscs

8.2 Live Exports for Consumption: Crustaceans and Sea Urchins

These data are not generally reported in the National Summaries of the ICES member countries. Discussion at the Working Group produced the consensus that an attempt should be made to assemble some of these data, especially relative to alerting receiving (importing)

countries of species brought in for consumption which may also be temporarily stocked or held in open waters prior to sale. The following data, for example, have been assembled from discussions.

	SPECIES IMPORTED TO:					
EXPORTING COUNTRY	Ostrea edulis	Mytilus	clams	sea urchins	lobsters	other crustaceans
FRANCE					Spain	
GERMANY,FED.REP.		France				
IRELAND	France				Spain	
NETHERLANDS		France				
NORWAY				France		
SPAIN		France	France			
UK					Spain	Portugal

9.1 Live Exports for Purposes other than Direct Consumption: Molluscs
9.2 : Crustaceans and Fish

As with categories 8.1 and 8.2 these data are not generally reported in National Summaries, but the consensus to assemble this information was similar to that developed for those categories. The following data have been assembled from discussions.

	SPECIES IMPORTED TO:							
EXPORTING COUNTRY	lobsters	Pecten maximus	Crassostrea gigas	Rainbow trout	Sea trout	Atlantic salmon	turbot	Gullspran trout
DENMARK				Norway				
ICELAND					Norway			
IRELAND		Spain France						
NORWAY						Ireland France UK		
SWEDEN				Norway	Norway	Norway		Norway
UK	Norway		Norway				France	
USA				France				

CURRENT STATUS OF PROPOSED INTRODUCTIONS: SALMONID FISHES

France

Y. Harache reviewed and updated the status of the French proposal to introduce coho salmon. Information on this project is contained in the Working Group reports of 1980, 1981, and 1982 (pp. 35-37) and the results of experiments conducted up to that time are reviewed therein. A further study was presented, "Etude preliminaire de la competition entre alevins de saumon Atlantique, Salmo salar L., et de saumon coho, Oncorhynchus kisutch Walbaum, en eau douce" (Appendix IV, page 70), which is part of a continuing series of experiments. The present study, by E. Beall, M. Heland, and Ph. Saglio, was conducted with fry of Atlantic salmon ("salars") and of coho salmon in both large outdoor experimental streams and in laboratory "streams", and included examination of intra- and interspecific effects and differences on microdistribution, behavior, and chemosensory interactions among juveniles. It was again found that the behavior of young cohos was very different than that of salars, the cohos having "un comportement beaucoup plus pélagique et grégaire qui entraîne une exploitation trophique du milieu beaucoup plus active et sans doute efficace." Salars, on the other hand, are distinctly benthic, and prefer riffle areas (while cohos prefer deeper pools). Microdistribution patterns appear to be the same in allopatric or sympatric situations. Also tested were effects of "experienced" and "inexperienced" salars and cohos on each other. At low densities, experienced and inexperienced cohos had a net repulsive effect on inexperienced salars. Among

inexperienced cohos, the presence of inexperienced salars had a perceptible attractive effect at low densities. These effects were also manifested relative to upstream movements of the two species.

In another set of experiments involving 1,000 salars and 1,000 cohos occurring together, the presence of one species did not appear to affect the growth rate of the other. In a second set of experiments, growth of Atlantic salmon appeared to be somewhat better at lower coho densities.

Relative to predation, "Dans le cas du lot d'élevage interspécifique, nous avons pu constater au cours de l'expérimentation une prédation importante des 'cohos' sur les 'salars (20 percent)." However, "Dans des conditions plus naturelles d'expérimentation, une telle action prédatrice entre poissons de même classe d'âge n'est pas apparue." This situation may be linked to the artificial feeding regime and biochemical degradation modifying chemosensory interactions.

The Chairman appointed a subgroup, chaired by A. Munro, to examine this latest study and prepare comments. In the meantime, the release of coho salmon smolts by CNEXO has not been made, pending a decision on this project by the Ministry of the Environment.

United Kingdom

D. Solomon updated the status of UK proposals for pink salmon (Oncorhynchus gorbuscha) ranching. In 1977 he travelled to the Pacific coast of North America to study pink salmon there; in 1979 a proposal was prepared for potential ocean ranching of pink salmon in the UK

with a pilot hatchery as an experimental approach. A UK working group studied this proposal in 1980; in 1982, a second meeting was held, following which a preliminary statement was made at the ICES working group meeting in La Coruna (see that report, pages 39-41). Possibilities at that time included the establishment of an all-female line, as opposed to mixed sex releases. At the present time, the desk study and consultation with interested agencies continues, and the proposed project has not yet been initiated.

COMMENTS: BALLAST WATER DISCHARGE IN THE GULF OF ST. LAWRENCE, CANADA

G. Turner (Canada) presented a communication from the Associate Director, Fisheries Research Branch, Gulf Region, Quebec, relative to the discharge of seawater ballast from bulk-cargo vessels near the Magdalen Islands in the Gulf of St. Lawrence, eastern Canada. The development of a salt mine, located in the northwestern part of the Grande Entree lagoon in the Magdalen Islands, involves voyages of large bulk-carrying vessels to ports in Quebec, the Maritimes, and the eastern seaboard of the United States. These vessels follow a dredged channel about 7km long to the wharf located near the mine site. As salt is loaded on, the ships pump out their ballast tanks which can contain as much as 10,000 m^3 of water. The lagoon supports an important population of juvenile lobster, for which harvesting is prohibited, as well as molluscs, crab, plaice, and other species. Concern had been expressed over the potential deterioration of the water quality of the lagoon, and of the resources contained therein, through the introduction of chemical contaminants, marine organisms, and enteric bacteria and viruses. Concern was also expressed over the

possibility of introduction of dinoflagellates which produce the toxin for paralytic shellfish poisoning (PSP). The Working Group acknowledged the receipt of this information, and proceeded to discuss the role of seawater ballast as a transport mechanism for marine organisms, bacteria and viruses, and pollutants. The Group shared the potential concerns of the Fisheries Research Branch, and encouraged certain studies that were mentioned as being planned. The Working Group further advised that, to its knowledge, pertinent studies on ballast water discharge, from pathological, biological, and ecological points of view, had been, or were being, conducted in Australia, Canada, and the USA, and urged that the results of these investigations be obtained by the FRB for detailed study. The Working Group encouraged the FRB to keep ICES and the Group fully informed of the direction of the FRB's investigations, and further offered to provide additional advice and comments if necessary.

COMMENTS: OCEAN RANCHING OF PACIFIC SALMON IN THE STATE OF MAINE

The Working Group acknowledged the receipt of information from the Department of Marine Resources of the State of Maine, USA, and from Sea Run, Inc., of Yarmouth, Maine, regarding certain aspects of a pilot program, now in progress, involving the importation and release in Maine of pink salmon eggs from the State of Alaska and of chum salmon eggs from Hokkaido, Japan. A request from the Chairman, Technical Advisory Committee of the Maine Department of Marine Resources for an advisory opinion on this project was presented to the Working Group, although no formal proposal with details of the experiment was received

by the Group.

The Working Group noted that the "ICES Revised Code of Practice to Reduce the Risks of Adverse Effects Arising from Introduction of Marine Species" includes but is not limited to the following procedures prior to an introduction:

(1) "Member countries...should be requested to present to the Council at an early stage" information on all biological, ecological, and geographic aspects of the proposed introduction (Code of Practice, I(a)),

(2) An evaluation of the effects of the introduction should be made, which the W.G. interprets as including pathological, ecological, and genetic impacts and implications, in the broadest sense (Code of Practice, I (b,c)),

(3) "If the decision is taken to proceed with the introduction... A brood stock should be established in an approved quarantine situation. The first generation progeny of the introduced species can be transplanted to the natural environment if no disease or parasites become evident, but not the original import". The W.G. interprets this to mean that full consideration of all of the impacts noted in (2) above, not only pathological effects, will have been made in order to arrive at the decision to proceed or not to proceed (Code of Practice, II(a)).

The Working Group then noted that, based upon the information received on the present releases of Pacific salmon in Maine, none of the recommended

procedures outlined above appear to have been followed. Therefore, the W.G. strongly urges, cognizant that incomplete information on the project is at hand, that the recommended procedures of the Code of Practice be followed, to wit:

(1) (a) An extensive study be made of the possible ecological, genetic, and pathological effects and implications, as detailed in the Code and in the Proposed Guidelines for Implementation of the Code, of the introduction of pink and chum salmon to North American Atlantic waters, utilizing not only all possible existing data, but also the data derived from the releases in 1981, 1982 and 1983,

(b) that, in company with such a study, detailed information on biological, ecological, and geographic aspects of all planned introductions be presented to the Council at an early stage,

(c) that no further imports of eggs be made except for purposes of establishing an all-captive brood line (Code of Practice II(a)).

(2) The Working Group finds that until such detailed studies are completed, submitted, and reviewed, and in accord with the Code of Practice, it cannot recommend continued release of Pacific salmon into Atlantic waters.

(3) The above does not preclude:

(a) the immediate establishment of confined experiments designed to generate data toward such studies,

(b) continued studies on the 1981 - 1982 - 1983 releases,

(c) the establishment of a captive broodline based upon eggs obtained from returning adults from the releases already

made. Such a broodline could be used for experimental purposes, for maintaining stock (a gene pool), for possible eventual releases, and for investigating the possibility of establishing an all-female line,

(d) the possible eventual release of all-female stocks for evaluation of rearing techniques, investigation of straying rates, and perhaps full commercial operation--such possible releases making the establishment of wild reproducing populations not possible,

(e) the development of brood line in quarantine from the country or area of origin from which to derive first generation progeny for study and for possible release (Code of Practice, II(a)).

(4) Relative to salmon already released, the Working Group encouraged the State of Maine and Sea Run, Inc., to publicize these releases, including a reward system, in order to maximize reports of captured fish, and

(5) Finally, the Working Group encouraged the State of Maine to keep ICES and the Group fully informed of the direction and outcome of this pilot program, in which all members of the Group expressed great interest and concern.

CASE HISTORIES OF INTRODUCTIONS AND TRANSFERS

A strong consensus expressed at the 1982 Working Group meeting was that a pressing need existed for detailed "case histories" of introductions and transfers of marine organisms, histories that would

include not only the history, rationale, and details of the introductions, but also the ecological, biological, pathological, genetic, and other implications of introducing nonnative species. A set of such case histories, involving invertebrates, fish, and plants, would thus provide a strong foundation by which to consider proposals for future introductions.

One such history has been prepared, concerning a history of Pacific salmon in the North Atlantic Ocean (Solomon, 1980), which now, however, requires expansion and updating. Two other case histories, at an "early stage," include the long and detailed processes relative to the proposed introductions of pink salmon in the United Kingdom and of coho salmon in France.

Three case histories were presented to the Working Group; one on oysters in France, a second on scallops in Canada, and a third on pink salmon in the Soviet Union. As each of these has been developed only into a preliminary state, and as each require expansion and further work, summaries, rather than the entire documents, are presented at this time.

(A) Introduction de l'huître creuse Crassostrea gigas en France (Introduction of the cupped oyster Crassostrea gigas in France) by H. Grizel (ISTPM)

The first specimens of Crassostrea gigas were probably imported about 1966 by French oystermen in response to the declining production of Crassostrea angulata. These first introductions were favorable and led to the importation of additional seed, mainly from Sendai. At the

same time, however, increasing mortalities were being observed among Crassostrea angulata in different production centers; the moribund oysters showed, in most cases, characteristic gill lesions. These mortalities, concomitant with the introduction of C. gigas, induced the ISTPM to propose a cessation of importation of seed originating from Japan. This measure led to a mission to Japan in 1969, which resulted in the discovery that gill malformations in C. gigas and in C. angulata were different and not related. Massive mortalities of C. angulata (the Portuguese oyster) in 1970/1971 on the Atlantic coast, and the resistance of C. gigas to diseases led to the resumption of importation of Japanese oysters. In particular, "Opération Résur" was put into effect in 1971, consisting of the importation from British Columbia (following an exploratory mission there in 1970) of large quantities of oysters to revitalize the French oyster beds. In the Arcachon Basin, in particular, brood stocks became established through which seed could be provided to other oyster growing centers. Parallel to "Opération Résur," importations of seed for rearing were made from 1971 to 1977, but the tonnages declined after 1975. In addition to these, the first experimental trials of imported seed were made in 1969 (139 tons of shells, being about 69 million seed) and again in 1970 (200 tons of shells, being about 100 million seed).

Data on growth, fattening, reproduction, and pathology of the Japanese oyster were reviewed. It was noted that the thermal requirements for larvae of C. gigas are greater than those for C. angulata, sets are irregular from year to year, but nonetheless, seed

production centers have nearly assured a good supply since 1975. No pathogens are known to have affected the Japanese oyster since its introduction; although some mortalities are noted in the summer in some years in the Arcachon Basin and in Marennes-Oleron. Only lesions of the epithelium of the digestive diverticulae have been noted, and these are similar to some cases described in the USA. A parasitic copepod, Mytilicola orientalis, has been introduced with the oysters, but it has not appeared in native species.

Importation of Japanese oysters into France has permitted the oyster industry to remain in existence, following the decline of not only the Portuguese oyster Crassostrea angulata but also the flat oyster Ostrea edulis. Indeed, oyster production now exceeds 100,000 tons, as opposed to the normal production of C. angulata which in 1960 was about 66,000 tons. New techniques of oyster culture have been developed. Some introduced species of free-living invertebrates were reported, but their establishment has not been demonstrated. However, two species of algae, Undaria pinnatifida and Sargassum muticum (the latter may not have been introduced with the oysters) have developed in the Mediterranean culture area.

With the perspective of almost 10 years, and given the framework of the grave economic crisis under which these importations were made, it may be stated that, in balance, the importation of the Japanese oyster to France has been largely positive.

(B) Pacific pink salmon (Oncorhynchus gorbuscha) in North-West Russia, by D. J. Solomon (MAFF)

While the history of introductions of pink salmon to the Kola Peninsula is fairly well-documented, the published details are diffuse and in some instances obscure. The declared intention of the introductions, which involved the movement of over 220 million eggs from the Pacific Ocean between 1956 and 1979, was to establish self-sustaining runs of fish for commercial exploitation. However, conditions for reliable natural reproduction proving marginal, the aim was modified to maintaining runs based on hatchery stocks.

Most of the eggs were imported to hatcheries from Sakhalin, Kamchatka and the Magadan districts in the Pacific Ocean (Bakshtansky, 1980), but all of the fish released as fry in 1974, and some in 1965, 1966, 1976, and 1978, were from eggs taken from returning fish. The 1979 release, of unknown magnitude, is believed to have been the last. Peak years of fry release were 1962, 1963, and 1964, with (in millions) 34.3, 23.7, and 35.9 fish being released respectively (Grinyuk et al., 1978; Bakshtansky, 1980).

Data on recaptured adults (return rates) are not complete and are difficult to analyze for two major reasons: one, exploitation and monitoring were incomplete (it is estimated only about 50 percent were caught), and two, in many years the contribution of natural spawning to the total return is not known. However, in most years survival rates were well below those associated with the salmon in its natural range.

From the start, significant numbers of adult fish entered rivers other than those in which they were released, and in many cases

these fish spawned successfully. In some years spawning fish were observed in as many as 40 Norwegian rivers; odd fish were also reported to enter rivers in Scotland and possibly in Iceland. Russian workers have attempted to account for the high straying rate, particularly to northern Norway; generally invoked is a combination of local temperature regimes and current patterns (Grinyuk et al., 1978; Androv, 1963).

Interactions between pink salmon and native Atlantic salmon

It is generally believed that a direct interaction between pink and Atlantic salmon is likely to occur only in the river and not in the open sea; thus, possible interactions between spawning adults, eggs and fry require consideration.

Relative to timing of spawning, pink salmon appear to spawn somewhat earlier than the Atlantic salmon, but in some years there may be overlap. Relative to spawning site, pink salmon tend to spawn in somewhat shallower water, leading to a high degree of spatial separation, but again not without overlap. The data suggest that ecotonal regions would exist accessible to both species.

Few data are available relative to possible effects of interactions on the spawning grounds, and at no time have the Russian scientists suggested that there have been any adverse effects of the introduction of pink salmon on the native Atlantic salmon. Later spawning by Atlantic salmon might disturb pink salmon eggs which, however, would be washed away. On the other hand, it has been suggested that spawning pink salmon may affect the gravel beneficially by clearing it of silt and organic material to the benefit of the later-spawning Atlantic salmon; a pair of

spawning pink salmon are recorded to move on the order of 100 kg of gravel.

Finally, it is of particular interest to note that a protracted freshwater stage has been observed in pink salmon on the Kola Peninsula; within the natural range of this species, pink salmon usually emigrate as fry almost immediately after emergence from the gravel. The fact that some pink salmon may remain in the rivers for several weeks, feeding and growing, suggests that such fish could act as potential competitors with native salmonids. This unusual behavior may be a reflection of the harsh climate and polar light cycle. Increasing water temperatures on the Kola Peninsula, which may be coincident with emergence from the gravel, occur with increasing day length. As migration normally occurs only at night, the situation at high latitudes where nights become very short or disappear altogether, may upset normal behavior patterns.

Possible reasons for low return rates

Despite the fact that exact survival rates are not known, it is evident that they are nonetheless much lower than natural return rates in the Pacific. Possible reasons for this include (1) that the conditions on the Kola Peninsula are marginal, particularly relative to the temperature regime, and (2) that since most of the stocking has been of imported eggs, the fry are not well adapted to conditions on the Kola Peninsula. Indeed, some data suggest better survival and homing performance when locallyproduced eggs and fry are used, a situation linked to natural selection in subsequent generations.

(C) Introduction of the bay scallop (Argopecten irradians irradians) to Prince Edward Island, Canada

A document developed by M. I. Campbell, T. W. Rowell, R. Townsend, and G. E. Turner (Canada Department of Fisheries & Oceans)

Presented by G. Turner.

Discussion of introducing exotic shellfish species to the Maritime Provinces of Canada occurred as early as 1955 and 1956. Although the bay scallop was suggested as a suitable candidate in 1961, and despite one 1969 attempt, it was not until 1976 that the Prince Edward Island (PEI) Department of Fisheries requested permission to introduce the scallop. As part of a comprehensive plan to develop and expand the fisheries resource, the possible approach of introducing non-indigenous species was considered. The rationale for considering the bay scallop as a prime candidate included the following:

(1) Biogeographically, PEI waters are part of the Magdalen Pocket, a warm-water pocket containing southern species known otherwise south of Cape Cod, the area in which the bay scallop is now indigenous,

(2) "a vacant ecological niche" appears to exist for bay scallops in PEI estuaries, in particular the habitat of barrier beaches sheltering shallow, high salinity, warm water bays,

(3) a one-year monitoring of PEI estuaries indicated acceptable temperatures (20.0° C) and salinity levels (27 o/oo) for bay scallop growth,

(4) major areas of potential habitat to support a scallop fishery exist,

including about 2,000 hectares (6,000 acres),

(5) Argopecten has been introduced to the State of Maine, a region presently beyond its natural northern most range,

(6) PEI fishermen were interested in attempting to grow scallops, which,

(7) had not been associated with any major disease-related mortalities, and finally,

(8) "the bay scallop was considered an ideal aquaculture species, in that they have a high market value, high market demand, short growth period to market size, reproduce in high numbers, can be hatchery spawned, and are easily fished with a minimum of gear and capital equipment."

In early 1977, the Advisory Committee on the Introduction of Non-Indigenous Species was established by the Maritimes Region of the Department of Fisheries and Oceans. This Committee assumed the role of advising on the proposed introduction. The Committee examined both negative and positive potential aspects of the proposed introduction. Positive aspects included,

(1) the bay scallop has a short life span (maximum age, 20 months) and a rapid growth rate (to 50 mm market size in 12-17 months),

(2) no apparent negative interaction with the oyster Crassostrea virginica exists, although they occupy roughly the same habitat in shallow estuaries with eelgrass beds,

(3) no known negative impact on other species, or on the environment generally, is known,

(4) a "vacant niche" appears to exist in the Southern Gulf of St. Lawrence, and

(5) many of the bay scallop's known predators are either absent or less likely to have significant impact in Canada.

Negative aspects included,

(1) competition with existing species could result. Although no negative impact on Crassostrea virginica appears to exist in the native region, at high densities "there could be significant competition for both space and food",

(2) a potential for unexpected biological impact exists, or, conversely, the introduced species may fail to meet expectations, and

(3) the introduction of undesirable predators, parasites, or other pests could occur; this risk can be virtually eliminated through sound quarantine practice and by rearing of F1, F2, or F3 generations for eventual release.

Careful consideration of these positive and negative aspects led the Committee to recommend permission for the introduction provided that requirements related to disease and parasite control were met. At that time (October 1977) the protocol established for the introduction of bay scallops to PEI included the requirement that broodstocks be examined prior to leaving the USA (Milford, Connecticut) and again upon arrival. Suitable quarantine facilities were to be established, and a further requirement was established relative to testing of indigenous species (oysters and quahaugs, Mercenaria mercenaria) held in association with the imported bay scallops. This latter requirement would aid in assessing the potential disease impact, if any, of the bay

scallop on local shellfish stocks.

In July 1979 the first bay scallops were imported for the purposes of spawning to produce an F1 generation in 1979; this generation later yielded an F2 (1980), an F3 (1981) generation, an F4 (1982) and an F5 (1983). The scallops were examined in detail for all known external and internal associated organisms, including invertebrates, bacteria, viruses, and fungi. No known shellfish pathogen was discovered throughout the quarantine period. An unidentified prokaryote, which occurred in F1 and F2 generations, failed to vertically transmit to F3 after careful husbandry techniques in the hatchery. In 1982, F3 and F4 generation bay scallops were allowed to be moved to the Bideford River adjacent to the Ellerslie Station; disease and parasite examinations continued on these generations and were negative. In October 1982 permission was given to PEI staff to move bay scallops to other specified locations around the Island, these plants to be closely monitored to determine movements and interactions with native species.

In retrospect, deliberations related to this bay scallop introduction have spanned almost 7 years, at a considerable expenditure of not only time but money as well. This introduction has provided a platform for the Committee members, the proponents of the introduction, and others, upon which to consider many of the fundamental questions of time, money, and manpower relative to such proposals.

DISCUSSION

The three case histories presented were the subject of considerable

discussion by the Working Group members. A strong consensus was that a great deal can be and was learned from the examination of such case histories, involving a diverse array of species, regions, and situations. Several members underscored the costs, in time and money, of a proper and thorough study which should properly precede a planned introduction, and there was extensive discussion as to who should assume such costs. The balance between the role of central governmental administration and the role of the proponent of the introduction was also considered.

Discussion also focused on the example of difficulties in potential pathological problems with exotic species as detailed in the Canadian report on bay scallops. In particular, the presence of a "purple parasite," a Chlamydia- or Rickettsia-like prokaryote, proved particularly vexing, especially its appearance in F_2 quarantine stock.

Various Working Group members then suggested numerous other examples of introductions, both intentional and accidental, that could profitably be developed into working case histories, histories which explore in detail the results of these introductions at all levels, even including social and economic implications, the latter perhaps requiring input from specialists in those fields. These histories would thus be multiple purpose, and could be developed to serve both the interests of scientists, industry, and government. A strong conclusion was that further and increased attention be given to the encouragement, development, and presentation of additional case histories, which would span the entire range from introductions

which are only in the planning stages to those which have resulted in exotic species becoming long-established members of the community.

Relative specifically to the UK report on the history of pink salmon introductions, it was agreed that the Chairman would request information from delegates of Baltic region countries of any known releases and captures of salmonids and sturgeons (Acipenser) in the past several years.

GENETIC IMPLICATIONS OF INTRODUCTIONS

A discussion was convened on the genetic implications of the transfer and introduction of marine organisms. The discussion was led by Dr. Gunnar Naevdal, from the Institute of Marine Research, Bergen, to whom the Working Group extended their appreciation. Dr. Naevdal reviewed certain papers and documents relative to genetic resources and structure in populations; as chairman of the ICES Working Group on Genetics, Dr. Naevdal noted that that Working Group was also discussing the possible effects of aquaculture practice on the genetics of natural populations.

Dr. Naevdal discussed the following genetic implications (presented here in outline form):

(1) Genetic effects in intensive (closed) fish and shellfish farming;

(2) Genetic effects in extensive farming, for (a) enhancement and (b) sea ranching. This involves both (i) escape and (ii) liberation, both of which may result in establishing new populations and/or

crossing with native stocks or species.

These effects involve matters of genetic variation both within and between populations (involving "statistical" genes and polymorphism). There are two points of view relative to the basic genetic resource involved and relative to how variation should be preserved: one, the preservation of genes and two, the preservation of gene frequencies. Gene frequencies may change rapidly if and when environmental factors are changed, and readaptation may occur. Further to be considered are,

(1) Selection and adaptation rates

Rapid adaptation: preserve genes;

Slow adaptation: preserve gene frequencies (populations; genotypes),

(2) Loss of genes: inbreeding, low numbers of brood stock, selection(?),

(3) Loss of populations: through (a) introgression (hybridization and breakdown of isolation mechanisms) and (b) competition,

(4) Loss of species: competition between transferred or introduced species and native species may result in reduction in numbers of native, and/or may effect the gene pool (and thus a loss of fitness) of the native through either competition or predation,

(5) Transfer of diseases and parasites

From resistant to nonresistant species or populations

From an equilibrium to a nonequilibrium state,

Relative to (4) above, it was further noted that an introduced species

may have, for example, high short-term fitness, or low long-term fitness. If these attributes are found in an introduced species which has caused the decline or extinction of a native species, the introduced species may itself then disappear, and the native species will then not have been replaced. Some species have high long-term fitness.

It was further emphasized that all mixing of genetic material should generally be avoided, and that this should occur only with local species populations if it cannot be avoided. The link between genetics and ecology was emphasized, and it was noted that there is little hard quantitative data on most of these matters, but a considerable amount of potential danger exists.

Extensive discussion followed Dr. Naevdal's presentation. The phenomenon of beginning with a limited gene pool was discussed (founder effect) by D. Solomon. H. Grizel presented a means by which multiple comparisons could be made between sessile and mobile species, in open and closed systems, relative to both intensive culture and sea-ranching, in three categories: nonindigenous (introduced), indigenous (transferred), and genetic species (genetically engineered). Within these categories (columns) and along the rows noted, observed modifications and possible (or new) modifications could be observed and studied, with some assessment made of the net effect.

The Working Group members focused on some of the possible genetic results of introductions, including hybridization, and the changing of gene frequencies and of disease and parasite

resistance. These were then contrasted to both the possible positive and negative outcomes (effects) of each of these possible results. A summary of these results and effects, using the categories noted as examples, is shown in the chart on page 52.

A final consensus was that these concerns should be developed into a formal working document by the Group, in company with a similar document on ecological concerns.

ECOLOGICAL IMPLICATIONS OF INTRODUCTIONS

The Working Group began preliminary discussions on the development of a statement of concern about ecological implications of introductions and transfers. Examples of topics that were raised and discussed to varying degrees were:

(a) ecological assessment of the species proposed for introduction in its native habitat,

(b) ecological assessment of the proposed recipient areas,

(c) life cycles, and the relationship to the physical, chemical, and biological environment in both the donor and receiving areas,

(d) the carrying capacity of various environments, and the need for comparative studies in this regard,

(e) the relative roles of competition and predation, including but not limited to competition for trophic and spatial resources (for the latter, including spawning sites),

SOME GENETIC IMPLICATIONS OF INTRODUCTIONS AND TRANSFERS

SOME POSSIBLE RESULTS (Upon entire species or individual populations)	SOME POSSIBLE EFFECTS "POSITIVE"	"NEGATIVE"
HYBRIDIZATION	"Hybrid Vigor"	Loss of Fitness
CHANGE OF GENE FREQUENCY	Increased Variability ("gene pool revitilization")	Reduced Variability (by loss of local populations or by inbreeding)
DISEASE AND/OR PARASITE RESISTANCE	Increased	Decreased

(f) fecundity and other aspects of a species reproductive biology in relation to its environment, both new and old, and in relation thus to the success or failure of the introduction,

(g) the nature of a self-sustaining population,

(h) how recruitment processes of an introduced species may impinge on native species, and

(i) the potential for reversible introductions in the marine environment, as, for example, by using single-sex populations.

Working Group members agreed on the fundamental importance of these and related matters, and concluded that the development of an operational statement of concern on ecological implications should be an additional focus of the next meeting. The Chairman asked Y. Harache (France) and D. Solomon (UK) to begin the preparation of such a statement.

PROTOCOLS FOR THE INSPECTION OF MARINE SPECIES PRIOR TO IMPORTATION

Working Group members convened in several subgroups for lengthy drafting sessions to continue work on the "Protocols" relative to procedures for the proper treatment and consideration of introduced species. Three major categories were defined:

(1) New species introductions for commercial purposes,

(2) New species introductions for scientific purposes,

(3) Species transfers which are part of common commercial practice.

Within each of these categories, protocols were drafted, to various levels of completion, relative to: feasibility analysis, evaluation, and

decisions (relative to ecological, genetic, pathological, and economic matters), transfer procedures, inspection procedures (lists of allowable species, lists of diseases and disease agents), quarantine procedures, release, surveillance, and hatchery certification and certification of inspectors.

The Draft Protocols will be submitted at the Statutory Meeting, and will be completed and finalized at the next Working Group meeting.

FUTURE INITIATIVES FOR THE WORKING GROUP

During the course of the meeting, the Group defined the following initiatives for continued development, study, deliberation, or completion at the next meeting:

(1) To develop the statement of purpose and operating principles of the Working Group (see page 6).

(2) To expand and update the national laws and regulations, and to newly obtain those laws and regulations relative to introductions and transfers from ICES member countries not now represented in the materials assembled to date (see pages 2-3 and 7).

(3) To encourage more detailed reporting procedures with revised guidelines for National Summaries, and to emphasize the need to obtain data on exports and imports of live marine organisms (see page 6).

(4) To continue to monitor the status of proposed or ongoing introductions of salmonid fishes in France, the UK, and the USA (see pages 12 and 30-32).

(5) To extend the review of Case Histories with a view toward the development of a multipurpose reference document (possibly a book) useful for governmental, industrial, and scientific agencies.

(6) To prepare documents on the genetic and ecological implications of introductions and transfers, including the development of recommended procedures by which the potential effects may be monitored and studied. Experts in genetics and ecology could be invited to contribute to the preparation of these materials.

(7) To finalize the Protocols for Inspection of Marine Species Prior to Importation and consider routes for their dissemination.

RECOMMENDATIONS

During the course of the meeting, recommendations to the parent committee were formulated by the Working Group on Introductions and Transfers of Marine Organisms. They are:

(1) That the "Revised Code of Practice to Reduce the Risks for Adverse Effects Arising from Introductions of Marine Species" and the "Guidelines for Implementing the ICES Code of Practice Concerning Introductions and Transfers of Marine Species" be published together as a single document in the COOPERATIVE RESEARCH REPORT series, and by this means be widely and publicly available.

(2) That ICES member countries currently not represented in the assembled volume on laws and regulations concerning introduced and transferred species (see Appendix II, herein) be requested by the Council

to submit, through their delegates and national representatives, copies of pertinent recent legislation relative to these matters.

(3) That the Council, through the Secretariat, encourage the FAO to prepare and assemble a world-wide Register of International Laws and Regulations on Introduced Species, the FAO having been instrumental in the preparation of other Registers relative to marine introductions, and by which the Working Group, ICES member countries, and the international community in general could study relevant concepts developed elsewhere.

(4) That, recognizing that there is still a serious world-wide disease problem associated with and created by introductions and transfers of marine organisms, in spite of the increasing acceptance of the ICES Code of Practice on Introductions and Transfers, and whilst acknowledging the early work of the FAO/OIE government consultation on the control of the spread of major communicable fish diseases, of the proposal of an EIFAC Code of Practice in 1982 for freshwater organisms, and of the FAO involvement in encouraging similar codes in other regions, both the Working Group on Pathology and Diseases and the Working Group on Introductions and Transfers encourage the Council to recommend that ICES member countries and other countries develop more effective legislation to avoid and control the continued spread of diseases and disease agents among marine organisms and populations on a world wide basis.

(5) That, because of the need to expand and update national laws and regulations, to continue its oversight of proposed or of ongoing

introductions of salmonid fishes in ICES member countries, to prepare and extend case histories of introductions, to prepare documents on the genetic and ecological implications of introductions and transfers, to finalize the protocols for inspection of marine species prior to importation, and to continue its general oversight of introcutions and transfers in all ICES member countries, the Working Group on Introductions and Transfers of Marine Organisms meet in Boothbay Harbor, Maine, USA, May 22-25, 1984.

Appendix I

Agenda of Meeting, Bergen May 1983

AGENDA

ICES WORKING GROUP ON INTRODUCTIONS AND TRANSFERS
OF MARINE ORGANISMS

Bergen, Norway
Institute of Marine Research
May 10 - 13, 1983

May 10, 1983 (Tuesday)

9:00 am	Convene opening session
	o Welcome and remarks by officials of host institute
	o Introduction of participants
	o Introductory comments by chairman
	o Consideration of modifications to Agenda
	o Status of Working Group responses to resolutions approved at the 1980 and 1981 Statutory Meetings (a) National laws and regulations (b) Expansion of Code of Practice (Guidelines) (c) Protocol document
	o Status of recommendations submitted to Mariculture Committee in 1982
	o Reviews of FAO and EIFAC activities
	o Review of relevant publications
	o Summaries of new national laws and regulations concerning introductions and transfers
	o Consideration of Statement of Purpose
	o National summaries of current activities concerning introduced species
1:00 pm	Lunch
2:00 pm	Reconvene
	o Continue and complete national summaries
	o Consideration of guidelines for preparation of national summaries
	o Request by the Government of Canada for an advisory opinion on ballast water discharge in the Gulf of St. Lawrence
	o Request by the State of Maine for an advisory opinion on ocean ranching of Pacific salmon in the Atlantic Ocean
6:30 pm	Adjourn

May 11, 1983 (Wednesday)

9:00 am	Reconvene
	o Case histories of introductions and transfers
	→(1) H. Grizel (France) Introduction de l'huître creuse Crassostrea gigas en France
	→(2) D. Solomon (UK) Pacific pink salmon (Oncorhynchus gorbuscha) in Northwest Russia
	→(3) G. Turner (Canada) Introduction of the bay scallop (Argopecten irradians irradians) to Prince Edward Island, Canada
	o Discussion of case histories
	o Review of status of proposed introductions
	(1) Coho salmon in France (Y. Harache) (2) Pink salmon in UK (D. Solomon)
1:00 pm	Lunch
2:00 pm	Field Trip
	o Akvakulturstasjonen Austevoll (Austevoll Marine Aquaculture Station, Institute of Marine Research)

May 12, 1983 (Thursday)

9:00 am	Reconvene
	o Resume discussion on request by the State of Maine for advisory opinion on Pacific salmon in Atlantic waters
	o Review status of "Protocols for inspection, certification, and quarantine of marine species prior to importation"
	o Form working group parties to continue drafting of protocols
12:00 noon	Reconvene Working Group to consider draft protocols
1:00 pm	Lunch
2:30 pm	Reconvene
	o Discussion: Genetic implications of introductions (Dr. Gunnar Naevdal, IMR, Bergen)
	o Discussion: Ecological implications of introductions (Consideration of preliminary statement by D.Solomon)
	o Working Group Discussion on Genetic/Ecological Implication
6:00 pm	Adjourn

May 13, 1983 (Friday)

9:00 am	Reconvene o Resume discussion on implications and effects (pathology, ecology, genetics) of introduced species, and consider draft of statements o Working group parties reconvene for draft of protocols
1:00 pm	Lunch
2:30 pm	Reconvene o Final review of draft protocols and statements o Final review of Working Group advisory opinions to Canada on ballast water and to Maine on Pacific salmon o Recommendations o Review draft Working Group Report o Time and place of next meeting
5:00 pm	Adjourn

Appendix II

Contents and List of National Laws and Regulations of ICES Member Countries Concerning Transfers and Introductions of Marine Organisms (1981)

II(a)

NATIONAL LAWS AND REGULATIONS OF ICES MEMBER COUNTRIES CONCERNING TRANSFERS AND INTRODUCTIONS OF MARINE ORGANISMS

Assembled in 1981 in response to ICES Resolution 1979/4:11

CONTENTS
1982 Volume

Country	Date(s) of most recent laws in volume*	Approximate length (pages)	Submitted by
Belgium	1976 (November)	62	P. Hovart
Canada	1980 (June)	86	T. Rowell
Denmark	1971 (September)	4	V. Jacobsen
France	1980 (May)	14	A. Kiener, H. Grizel
Germany (FRG)	1978 (February)	18	R. Meixner
Iceland	1970 (June)	25	I. Jónsson
Ireland	1959 (1972)	4	F. Gibson
Netherlands	1963 (1977 footnotes)	4	P. Van Banning
Norway	1978 (December)	22	E. Egidius
Spain	1970 (March)	3	O. Cendrero
U.K.	1980	70	A. J. Lee
U.S.A.	1981	87	C. Sindermann, A. Rosenfie.
U.S.S.R.	< 1980	3	S. A. Studenetsky

*Earlier laws and regulations are also often included; see Contents List.

II(b)

NATIONAL LAWS AND REGULATIONS OF ICES MEMBER COUNTRIES CONCERNING TRANSFERS AND INTRODUCTIONS OF MARINE ORGANISMS

CONTENTS OF 1982 VOLUME (ASSEMBLED 1981)

BELGIUM

(1) Arrêté royal rélatif au commerce des animaux invertebres marines susceptibles d'être consommes crus. 9 March 1965. Belgisch Staatsblad. pp. 6249-6250

(2) Lois arrêtés royaux et actes du Gouvernment (Ministère de la Santé publique et de la famille). 15 April 1965. Belgisch Staatsblad. pp. 6173-6179

(3) Arrêté royal rélatif à l'expertise et au commerce du poisson. April 1976. Belgisch Staatsbladd. pp. 7166-7174

(4) Amendments to item 3). Belgisch Staatsbladd. 29 November 1976. pp. 16456-16460

(5) Arrêté royal rélatif au commerce intérieur et dans les pays membres de la communauté économique européene de certains produits de la pêche. April 1971. Belgisch Staatsblad. pp. 1-7.

(6) Addition to 5) with regard to Crangon crangon. 9 November 1971. Belgisch Staatsblad. pp. 3757-3758

CANADA

(1) Fisheries Act. RSC 1970. c.F.14. Amendment list. February 1980

(2) Fish health protection regulation made under the Fisheries Act. CRC, 1978c. 812. Amendment list. 7 November 1979

(3) British Columbia Regulation 140/76

(4) Pacific Shellfish regulations, established by P.C. 1977-2397. Amendment list. 13 August 1979.

(5) New Brunswick Fishery Regulations. CRC 1978. c. 844. Amendment list. 13 February 1980.

(6) Nova Scotia Regulations. CRC 1978. c. 848. Amendment list. 29 November 1979.

(7) Prince Edward Island Fishery Regulations. CRC 1978. c. 850. Amendment list. 30 October 1979.

CANADA (continued)

(8) Newfoundland Fishery Regulations. P.C. 1978-1557 (SOR/78-443). Amendment list. 25 October 1979.

(9) Quebec Fishery Regulations. CRC 1978. c.852. Amendment list. 12 June 1980.

(10) British Columbia Fishery (General) Regulations. CRC 1978. c.840. Amendment list. 25 June 1980.

DENMARK

(1) Landbrugsministeriet bekendtgørelse. 23 February 1966. Nr. V.246-9-66

(2) Fiskeriministeriets bekendtgorelse. 7 September 1971. Nr. b 1/49, 23-9-M. 5462.

FRANCE

(1) Code Rural Français. 22 March 1957. No. 57-352. Article 439-1, 439-1(3).

(2) Decret No. 62-813. 16 July 1962.

(3) Code Rural Français. Articles 397, 401, 434.

FEDERAL REPUBLIC OF GERMANY

(1) Schleswig-Holsteinische Fischereiordnung. 9 June 1971. Ausgabe A. (V3232A). GS-Schl.-H. Gl. No. 793.

(2) Niedersachsisches Fischereigesetz (Nds. Fisch. G.). 1 February 1978. Niedersachsisches Gesetz und Verordnungsblatt. 32(7), 81 (H5321 AX).

ICELAND

(1) Law on salmon and trout fisheries (Lög um lax-og silungsveidi). Stj. tíð. A. No. 76/1970.

NETHERLANDS

(1) Dutch Fishery Law (Visserijwet). 1963. Articles 4 (paragraph 1), 1 (para. 2), 17 (par. 1).

NORWAY

(1) Regulations of 28 April 1978 relating to the imports and quarantine of lobster

(2) Regulation of 20 March 1970 relating to the import of oysters and oyster seed

(3) Act concerning measures to counteract diseases in freshwater fish, 6 December 1968

SPAIN

(1) Regle 19. Ministere de Commerce de 25 mars 1970. Importation of molluscs for aquaculture.

UNITED KINGDOM

(1) Molluscan shellfish (control of deposit). Order 1974.

(2) Disease of fish (oysters) (Northern Ireland). 1973.

(3) Risk of infection (fish) order (Northern Ireland). 1978.

(4) Fisheries (shellfish) order (Northern Ireland). 1972.

(5) The import of live fish (coho salmon). (Prohibition) (Scotland). Order 1980.

(6) The import of live fish (England and Wales) Act, 1980.

UNITED STATES OF AMERICA

(1) Lacey Act Amendments. 1981. Molluscs and crustaceans. 18 USC 43-44.

(2) Executive Order 11987. 24 May 1977. Federal Register, 42: 101.

(3) Black Bass Act. 16 USC 851-856. Fish.

(4) Code of Federal Regulations, Title 50, Wildlife and Fisheries. Chapter 1, Subchapter B, Part 13: Importation of wildlife or eggs thereof

USSR

(1) Three page summary, by S. A. Studenentsky (pre - 1980).

Appendix III

Guidelines for Preparation of National Reports

ICES: WORKING GROUP ON INTRODUCTIONS AND TRANSFERS OF MARINE ORGANISMS

Guidelines for Preparation of National Reports

(Modified from Cooperative Research Report 116; category 3.1.5 added here)

SUBJECT HEADINGS:

LAWS	1.0 Relevant laws and regulations in ICES member countries 2.0 Other procedures concerning introduced species
DELIBERATE INTRODUCTIONS	3.0 Deliberately introduced animal or plant species 3.1 FISH 3.1.1 Fishery enhancement (establishment of new breeding populations) 3.1.2 Mariculture (growth and fattening) 3.1.3 Live storage prior to sale 3.1.4 Recreational purposes 3.1.5 Captures of introductions originally made in neighbouring countries 3.2 INVERTEBRATES 3.2.1 Fishery enhancement (establishment of new breeding populations) 3.2.2 Mariculture (growth and fattening) 3.2.3 Live storage prior to sale 3.2.4 Improvement of food supplies for other species 3.2.5 Research purposes (excluding use in hatcheries) 3.3 PLANTS
ACCIDENTAL INTRODUCTIONS	4.0 Species introduced accidentally with deliberate introductions 5.0 Completely accidental introductions

HATCHERY INTRODUCTIONS	6.0 Species introduced for hatchery rearing 6.1 Stock not subsequently planted outside the hatchery 6.2 Stock relaid in small quantities under controlled experimental conditions 6.3 Stock supplied in larger quantities to the industry or to some other organization
PLANNED INTROS	7.0 Planned Introductions
LIVE EXPORTS	8.0 Live Exports for consumption 8.1 Molluscs 8.2 Crustaceans and Sea Urchins 8.3 Fish 9.0 Live Exports for purposes other than direct consumption 9.1 Molluscs 9.2 Crustaceans and Fish

Appendix IV

Étude préliminaire de la competition entre alevins de saumon Atlantique, Salmo salar L., et de saumon coho, Oncorhynchus kisutch Walbaum, en eau douce.

Par

E. Beall, M. Heland et Ph. Saglio

(1983)

ÉTUDE PRÉLIMINAIRE DE LA COMPÉTITION ENTRE ALEVINS DE SAUMON ATLANTIQUE, *Salmo salar* L., ET DE SAUMON COHO, *Oncorhynchus kisutch* WALBAUM, EN EAU DOUCE

E. BEALL, M. HELAND, Ph. SAGLIO

Dans le cadre d'un programme de recherche plus général sur la compétition éventuelle entre le Saumon Atlantique indigène et le Saumon Coho susceptible d'être introduit dans les eaux françaises, nous nous sommes attachés à l'étude des relations interspécifiques au début de la vie potamique entre alevins d'une même cohorte chez les 2 espèces et dans les conditions d'environnement de la frayère.

En effet, la compétition entre une population de Saumons Atlantique autochtone et une autre de Saumons Coho introduits, ne peut s'exprimer qu'au moment où les 2 espèces se trouvent confrontés dans un milieu limité. Cette confrontation se produit essentiellement en ruisseau pendant la vie potamique juvénile ou plus hypothétiquement, compte tenu du décalage prévisible des périodes de fraye, sur les zones de frayère pendant la phase de reproduction.

L'analyse des relations interspécifiques entre les alevins des deux espèces devrait apporter des précisions sur l'existence et la nature des interactions à ce stade en se referrant au milieu naturel. Une première analyse de ces phénomènes a été effectuée à 3 niveaux:

- Au niveau de l'èmercence et de la stabilisation spatiale dans un ruisseau semi-naturel extérieur de grandes dimensions.

- Au niveau des relations sociales et territoriales dans des ruisseaux artificiels de laboratoire.

- Au niveau de la communication chimique à rôle social dans des olfactomètres linéaires simples.

1 - ÉMERGENCE ET SÉDENTARITÉ DES ALEVINS EN CONDITIONS SEMI-NATURELLES

Rappelons que cette expérimentation a été réalisée dans un chenal de frai expérimental alimenté par dérivation d'un ruisseau naturel, le Lapitxuri, affluent de la Nivelle.

Une première série d'observation a porté sur 3 biefs de 30 m^2, contenant respectivement 2 000 "salars", 2 000 "cohos" et 1 000 "salars" + 1 000 "cohos" introduits avant la résorption de la vésicule et dont la dévalaison contrôlée chaque jour au niveau du piège aval des biefs a été suivie pendant 7 semaines avant l'inventaires final par pêche électrique.

Il apparaît que ces rythmes de dévalaison, ainsi que la proportion d'alevins dévalants sont identiques pour les 2 espèces dans les situations d'isolement ou de compétition. De même, les rivières ne sont pas significativement différentes.

En ce qui concerne la micro-répartition, si on sépare chaque bief en 3 zones aux caractéristiques morphodynamiques différentes, il apparaît que les alevins de "cohos" se retrouvent en grande majorité dans les zones profondes de l'amont et de l'aval, alors que les alevins de "salars" s'établis en grand nombre dans la zone intermédiaire de radiers peu profonds et à courant vif. Cette répartition s'observe dans les situations d'allopatrie comme de sympatrie.

La présence d'une espèce n'affecte pas le taux de croissance de l'autre puisqu'il n'apparaît pas de différences significatives entre la croissance des poissons seuls et celle de ceux qui sont en compétition.. Il est remarquable d'observer toutefois la taille très supérieure des "cohos" comparée à celle des "salars", différence qui va en s'accentuant.

La deuxième série d'observation a été effectuée avec des alevins âgés de 3 mois et répartis dans 8 biefs de 30 m^2.

Deux biefs contenaient 200 "salars" et 200 "cohos" respectivement. Les 6 autres biefs contenaient 200 "salars" auxquels ont été ajoutés, 25, 50, 100, 150, 200, 300 alevins de "cohos".

Un certain nombre d'alevins quittent les biefs et sont capturés dans les pièges avals relevés chaque jour depuis l'introduction jusqu'à l'inventaire final, 8 semaines plus tard. Chez les alevins de "salars", cette dévalaison est relativement modérée (10 à 20 % des poissons introduits) et sans grande différence d'un bief à l'autre. Pour les alevins de "cohos", les captures des pièges avals sont variables selon les biefs. Ils sont capturés en nombre d'autant plus grand que leur densité est forte dans le bief et il est à noter que c'est le 1er jour d'expérience que ce réajustement sous forme de dévalaison est le plus massif.

En ce qui concerne la micro-répartition, il semble qu'à ce stade, les alevins de "salars", comme ceux de "cohos", préfèrent les zones plus profondes du bief, en particulier l'aval, alors que la zone intermédiaire de radiers est occupée par quelques sujets parmi les plus petits.

En matière de croissance, on retrouve les différences très nettes observées chez les alevins plus jeunes entre la taille des "salars" et celle des "cohos". Toutefois, si chez les "cohos" il n'apparaît pas de différences entre les biefs, chez les "salars", il semble que la croissance soit d'autant meilleure que les "cohos" sont moins nombreux.

2 - COMPORTEMENT SOCIAL ET TERRITORIAL DES ALEVINS EN RUISSEAUX ARTIFICIELS

Rappelons que l'expérience a été réalisée dans 3 ruisseaux expérimentaux parallèles de 10 m de long, 0,42 m de large et 0,25 m de profondeur alimentés par un circuit fermé. Comme dans la Lapitxuri, une première expérimentation a eu lieu avec des alevins à la résorption de la vésicule et une deuxième avec des poisson âgés de 3 mois. Le principe de l'expérience est le même: des "cohos" et des "salars" introduits seuls dans un ruisseau sont comparés entre eux et avec leurs congénères spécifiques introduits ensemble dans le 3ème ruisseau.

Les conclusions exposées l'année dernière après la réalisation de la 1ère expérimentation se trouvent confirmées. Il n'y a pas de différences notables entre les alevins seuls ou mélangés. Mais le comportement des "cohos" est très différent de celui des "salars". Ils ont un comportement beaucoup plus pélagique et grégaire qui entraîne une exploitation trophique du milieu beaucoup plus active et sans doute efficace. Les "salars" sont nettement

benthiques et attachés à un emplacement particulier. L'activité intense des "cohos" qui "occupent l'espace d'une façon très dynamique" a pour conséquence une attitude de "sub-dominants" des "salars" propriétaires de territoires. Ce phénomène pourrait être measurable à la longue au niveau de la croissance des individus au cours d'une expérience de longue durée.

Compte tenu des différences de taille, spectaculaires entre alevins des 2 espèces et du comportement pélagique du "coho", l'hypothèse de la prédation possible des juvéniles de "cohos" sur les "salars" restent à tester dans des conditions aussi proches que possible du milieu naturel.

Une expérimentation est en cours mettant en présence dans différents biefs du chenal de frai du Lapitxuri des alevins de "salars" et des juvéniles de "cohos" ou de "salars" d'un an.

3 - ÉTUDE EN OLFACTOMÈTRE DES INTERACTIONS CHIMIOSENSORIELLES CHEZ LES JUVÉNILES

Présentation et méthode

Les observations ont été menées dans 6 olfactomètres linéaires (type ruisseau artificiel), placés en parallèle, permettant d'apprécier l'effet de substances biologiques d'origine intra et interspécifique sur les déplacements des deux espèces.

Dans le but d'évaluer l'importance de l'expérience sociale antérieure sur la réponse des poissons, trois lots ont été séparés dès l'émerge

- un lot "salar" intraspécifique strict: "salars" inexpérimentés vis-à-vis du "coho";
- un lot "salar" en élevage mixte (50/50) avec le "coho" : "salars" et "coho": "expérimentés";
- un lot "coho" intraspécifique strict: "cohos" inexpérimentés vis-à-vis du "salar".

A partir de la constitution de ces lots, 20 types de confrontation (4 témoins, 8 intra et 8 interspécifiques) ont été éprouvées chez les deux espèces, à deux densités différentes (5 poissons dans le compartiment amont

et 10 poissons dans la zone d'orientation; 10 et 20 poissons idem). Chacun de ces types de confrontation a été testé 3 fois.

Résultats

1 - Effets intraspécifiques

Chez les "salars" ayant subi un conditionnement intraspécifique strict, les deux densités testées n'ont pas fait apparaître d'effet des conspécifiques sur les déplacements amont ou aval des poissons.

Chez les "cohos", la dévalaison s'est avérée très importante tout au long de l'étude, particulièrement dans le cas de forte densité. Pour la faible densité est apparue une attraction des "cohos" expérimentés sur les "cohos" inexpérimentés. Toutefois, aucun effet sur les déplacements n'a été observé à l'intérieur d'un même lot de "coho", aux deux densités testées.

2 - Effets interspécifiques

- "Cohos" sur "Salars"

A faible densité, les 2 lots de "cohos" ont présenté un net effet répulsif sur les "salars" inexpérimentés. De même, le pourcentage de remonté présenté par les "salars" expérimentés lors des cas témoins de forte densité (pas de poisson en amont et 20 poissons dans la zone d'orientation) diminue de façon importante lorsque des "cohos" se trouvent en amont.

- "Salars" sur "Cohos"

Chez les "cohos" inexpérimentés, la présence de "salars" inexpérimentés en amont possède un effet attractif sensible dans la situation de faible densité.

De même, le pourcentage de remontées présenté par les "cohos" expérimentés se trouve augmenté aux 2 densités lorsque des "salars" (expérimentés ou inexpérimentés) se trouvent en amont.

- Discussion et conclusions

Les phénomènes observés ne doivent pas être dissociés des conditions d'élevage subies par les poissons avant expérimentation.

Les pré-conditionnements intra et interspécifiques ont été effectués à haute densité dans des bassins de type Ewos dans lesquels les poissons ont reçu une alimentation exclusive de farine de poisson.

Dans le cas du lot d'élevage interspécifique, nous avons pu constater au cours de l'expérimentation une prédation importante des "cohos" sur les "salars" (20 %).

Dans des conditions plus naturelles d'expérimentation, une telle action prédatrice entre poissons de même classe d'âge n'est pas apparue. En outre, il est possible que l'alimentation artificielle et les phénomènes de dégradation biochimique importante liés à l'utilisation de farine de poisson ait modifié la sensibilité chimiosensorielle et les caractéristiques d'odeur individuelle et intraspécifique.

Considérant l'influence probable de tels facteurs sur les résultats obtenus, il demeure indispensable de reprendre cette expérience sous des conditions avant-test (alimentation, densité, substrat) plus proches des exigences naturelles des juvéniles des deux espèces.

Appendix V

Austevoll Marine Aquaculture Station

AUSTEVOLL MARINE AQUACULTURE STATION

On 11 May 1983 the Working Group visited and examined the experimental research facilities of the Institute of Marine Research's Austevoll Marine Aquaculture Station (Akvakulturstasjonen Austevoll), on the island of Huftarøy on Bjørnefjorden, a side fjord of Hardangerfjorden. Dr. Bjørn Braaten gave the Group a detailed tour of the Station, founded in 1978. Species currently being cultured or studied at the Station include:

Rainbow trout, Salmo gairdneri

Sea trout, Salmo trutta

Atlantic salmon, Salmo salar

Cod, Gadus morhua

Halibut, Hippoglossus hippoglossoides

Saithe, Pollachius virens

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