Advisory Committee on the Marine Environment **ICES CM 2000/ACME:07**
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REPORT OF THE

WORKING GROUP ON INTRODUCTIONS AND TRANSFERS OF MARINE ORGANISMS

Parnu, Estonia
27–29 March 2000

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International Council for the Exploration of the Sea

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1 OPENING OF THE MEETING AND INTRODUCTION

The 2000 meeting of the ICES Working Group on Introductions and Transfers of Marine Organisms (WGITMO) was held at the Port of Parnu, Parnu, Estonia from 27 to 29 March 2000. Professor Evald Ojaveer, Research Director of the Estonian Marine Institute, and a former ICES Vice President, welcomed WGITMO. The objectives of the 2000 meeting were reviewed; the agenda for the meeting was considered and approved. The agenda is attached as Annex 1.

This meeting, the 22nd of WGITMO, was chaired by Dr J.T. Carlton. There were 19 participants representing ICES Member Countries including countries bordering the Baltic Sea and one invited guest from Italy. The list of participants (including those from the BMB that joined for a combined WGITMO/BMB NEMOs meeting on the afternoon of 29 March) is given in Annex 2; a report of this joint meeting is attached as Annex 5.

2 TERMS OF REFERENCE

ICES C.Res. 1999/2:ACME:07

The terms of reference for the 2000 meeting of the WGITMO were to:

a) continue the assessment of ballast water research and management until the proposed reconvening of the expanded ICES/IOC/IMO Study Group on Ballast and Other Ship Vectors in 2001;

b) continue discussion on risk assessment techniques;

c) finalise arrangements for the Theme Session on "Marine Biological Invasions: Retrospectives for the 20th Century, Prospectives for the 21st Century" to be convened at the ICES Annual Science Conference in Bruges, Belgium in September 2000;

d) finalise the "Directory of Dispersal Vectors" as an *ICES Cooperative Research Report*, including a continued review of aquarium-related transportation of exotic species as well as transfer via aquaculture;

e) continue work on a standardised format for collating data on non-native species, and the method and fate of introduction;

f) report on the current status of fish, shellfish, algal, and other introductions in and between Member Countries, through:

   i) submission of the National Reports, to also include information on genetically modified organisms and the use of any biocontrol agents,

   ii) continuing to review the status of selected current invasions, and in particular, the status of the invasion of the snail *Rapana* in the Atlantic USA and other ICES Member Countries,

   iii) continuing coordination with the Baltic Marine Biologists (BMB) Working Group and the European Inland Fisheries Advisory Commission (EIFAC), and reviewing the outcomes and future projects of the EC Concerted Action Plan on Ballast Water.

WGITMO will report to ACME before its June 2000 meeting and to the Marine Habitat and Mariculture Committees at the 2000 Annual Science Conference.

3 REVIEW 1999 WGITMO REPORT AND RECOMMENDATIONS

There were no addenda/errata to the 1999 WGITMO report.

Recommendation 1

ICES indicated that Professor J.T. Carlton should be re-elected as Chair of WGITMO.

Recommendation 2

ICES recommended that WGITMO should prepare relevant material to support the impending wave of accidental introductions that are occurring and that may well occur in the future. This information, as well as colour pictures of some of the more widespread introduced species, could be publicised as part of the ICES website.

Recommendations 3 and 4

ICES had agreed that information should be sent to ICES Member Countries by the General Secretary alerting them to the Asian whelk snail *Rapana* and the possibility of its appearance in their waters. Dr Maurice Héral would compile a letter including the information as provided in Recommendation 3 of the WGITMO report. The information in Recommendation 3 would provide some additional background material for inclusion in the letter. As of April 2000, it appears that these informational materials were still in preparation.

Recommendation 5

ACME noted that WGITMO requested that the Working Group on the Application of Genetics in Fisheries and Mariculture (WGAGFM) should be consulted for advice on the use of polyploids, e.g., tetraploid oysters and polyploid *Porphyra yezoensis*. Further action has apparently not been taken on this issue.

The Recommendation that WGITMO should meet in Estonia with the ToRs as listed above was accepted.

4 NEW PUBLICATIONS, JOURNALS, WEBSITES, DATABASES

Dr J.T. Carlton explained that the amount of information coming out on new introductions has been quite staggering. (Note: A number of publications that have come to the attention of WGITMO are listed in the bibliography in Annex 4 and have not been specifically included below.)

4.1 New Journal: Biological Invasions

Publication of the first volume of this new journal, which contains four issues, is complete as of 1999. Papers on introductions in marine, freshwater and terrestrial habitats were included. Preparation of the second volume for publication is under way. It is anticipated that four issues will be published each year. Dr Carlton is the editor of the journal which is published by Kluwer Academic Publishers in Dordrecht, The Netherlands. Information is at the website: http://www.wkap.nl/journals/biological_invasions

4.2 Other Publication News

The "Summary of Introductions in ICES Countries as of 1990" was published in 1999 as ICES Cooperative Research Report No. 231.

Dr D. Minchin reported on the "Symposium on the Best Management Practices for Controlling Invasive Alien Species, A Workshop on Policies and Implementation" held at the Kirstenbosch Botanic Gardens, Cape Town, South Africa, 22–24 February 2000 that he and Dr Carlton had attended.

This was a joint United States/South African meeting to develop a better understanding of the management of exotic species. It covered terrestrial, freshwater and marine species with experts drawn from several countries to fill out the discussion. This meeting provided an opportunity to advertise the ICES Code of Practice, and also the IMO Guidelines on the management of ballast water. It was emphasised that there is a great and urgent need to examine ballast water treatment measures and that hull fouling continues to be an important issue. The main areas discussed in the marine area were trade, aquaculture and shipping. It was made clear that the best prevention is at the primary level of introduction. Areas where primary vectors overlapp with secondary vectors are likely to result in a rapid spread of unwanted species once established. By reducing opportunities for overlap, the risk of further spread may be reduced. The meeting was notable for the production of the Kirstenbosch Declaration, a commitment between the United States and South Africa to further develop cooperation between them, as well as other nations, on the management of alien species.

The Global Invasive Species Programme (GISP), which has an active website [http://jasper.stanford.edu/GISP] as well as sponsoring regular meetings, was brought to the attention of WGITMO members.

4.3 Databases (ToR "e")

During the course of the meeting, it became apparent that many databases on introduced and transferred species have been developed or are in the process of development. Many are specific to geographical regions. Such databases are valuable sources of information to scientists and other groups (e.g., HELCOM) in ICES Member Countries as well as around the world. The availability of information on websites is increasing exponentially. Databases as a source of

information for assessing risks from ballast water introductions are only one example of the value of these regional databases. WGITMO recognised that there is a need to review the databases currently available.

5 THEME SESSION FOR 2000 ICES ANNUAL SCIENCE CONFERENCE (ToR "c")

This Theme Session on "Marine Biological Invasions: Retrospectives for the 20th Century, Prospectives for the 21st Century" will focus on the ecological, environmental, and economic impacts (pros and cons) of exotic species invasions in marine ecosystems, and will further include consideration of dispersal vectors, the use of non-native species in mariculture, and the post-invasion control of alien species. It will be held at the 2000 ICES Annual Science Conference in Bruges, Belgium. Drs J.T. Carlton and S. Utting are the Co-conveners of this Theme Session. The deadline for abstracts was brought to the attention of WGITMO and a provisional list of participants to give paper or poster presentations was prepared.

6 NATIONAL REPORTS

National Reports were received from the following ICES Member Countries: Canada, Estonia, Finland, France, Germany, Ireland, Netherlands, Norway, Poland, Sweden, the UK (England and Wales), and the USA. These are attached as Annex 3.

6.1 Highlights of the National Reports

The National Reports contain details of new laws and regulations, deliberate releases, accidental introductions and transfers, live imports, live exports, planned introductions, and meetings. References cited in the national reports and elsewhere in this report are compiled in the bibliography (Annex 4).

6.1.1 Canada

A draft "National Code" on introductions and transfers of live fish and shellfish under permit into fresh and marine waters is being developed by the Department of Fisheries and Oceans in consultation with industry. Live food fish, aquarium fish and plants are not included.

A first draft of the Canadian Shellfish Health Protection Regulations has been released. A zoning system within Canada has been suggested but this will make traditional transfers more difficult.

Six green crabs (*Carcinus maenas*) were found on the west coast of Vancouver Island. This is the first record of green crab on the Canadian west coast.

Trials to control the spread of *Codium fragile* by treating oyster spat with saturated brine, 45 lime, air drying or a combination of all three were unsuccessful in destroying all *Codium* on the oyster shells.

6.1.2 Estonia

The hydromedusa *Maeotias inexspectata*, native to the Ponto-Caspian region, was recorded in Estonian waters.

The first record of the talitrid amphipod *Orchestia cavemen* was discovered. It is likely to have been present in the Baltic for a number of years although it is only now documented.

The cladoceran *Cercopagis pengoi* was very abundant in the northeastern Baltic Sea during the summer of 1999 coinciding with the highest summer water temperatures for many years.

6.1.3 Finland

In 1998, the mitten crab (*Eriocheir sinensis*) was recorded for the first time in the southern east-lake district.

One specimen of the American signal crayfish *Pacifastacus* has been reported.

A video, "Aliens: Stowaways of the deep" has been produced by the Finnish Broadcasting Company. It is also being used in secondary school education in the USA. It features Dr J.T. Carlton as one of the main speakers.

6.1.4 France

Several controls governing the introduction of shellfish were enacted or tightened in 1999.

Even though the slipper limpet, *Crepidula fornicata,* has been present for many years, it continues to spread into new areas and deeper waters where commercial shellfisheries such as scallop dredging occur.

A note on the Asian whelk snail, *Rapana venosa,* has been put out to local fish and shellfish farmers in southern Brittany to alert them to the presence of this new species in French waters. Trapping trials are in progress and no juveniles have yet been found.

Abalone, *Haliotis tuberculata*, juveniles are imported from a hatchery in Ireland for on-growing. Illegal imports of the Japanese abalone, *Haliotis discus hannai,* were also confirmed. Mortalities of *H. tuberculata* occurred in Brittany from a *Vibrio* (*V. courtier*) known to induce mortality in *H. discus hannai.* The possibility was suggested that the apparently healthy *H. discus hannai* were carriers of this *Vibrio* which then was expressed in the warmer waters of southern Brittany.

6.1.5 Germany

The mitten crab, *E. sinensis*, was found in Kiel Fjord in summer 1999. This may represent an increasing population in the Baltic spreading to more brackish areas of the German Baltic coast.

One specimen of a crab of the genus *Eriocheir* that was only the size of a juvenile *E. sinensis* but had mitten-like claws has been found. It may be a new species closely related to *E. sinensis* but this has yet to be confirmed.

NEOBIOTA is a new group of biologists and ecologists in Germany that has been set up to coordinate responses to problems caused by invasions of non-native plants, animals, fungi and microorganisms. NEOBIOTAT [http://www.uni-rostock.de/news/presse/Arbeitstreffen.htm] will concentrate on non-native species in Central Europe.

6.1.6 Ireland

Although the zebra mussel, *Dreissena polymorpha*, has increased in biomass, its further spread appears to have slowed, perhaps aided by a publicity campaign.

ASP was fifty times above the recommended level in scallops off the southwest coast of Ireland and ASP has been recorded from mussels, *Mytilus edulis*, intended for export from Ireland.

6.1.7 Netherlands

The brown kelp, *Undaria pinnatifida,* has been recorded for the first time. The cause of introduction is not known but may have been with imports of mussels, *Mytilus*.

Leathesia verruculiformis, an alga native to the northwest Pacific, was first found in 1994 and is the first record of this species in Europe.

Pacific oysters, *Crassostrea gigas*, have spawned and successfully recruited for at least the last four years in the Wadden Sea. Low spat-falls of the mussel, *Mytilus edulis*, in recent years are causing concern.

Four American blue crabs, *Callinectes sapidus,* were caught in 1999.

6.1.8 Norway

Two American lobsters, *Homarus americanus*, or hybrids of the American and European lobster, were found in the Oslo Fjord.

Dense populations of the Japanese caprellid amphipod, *Caprella mutica*, were found on nets at several salmon farms.

6.1.9 Poland

A mass invasion of the waterflea (cladoceran), *Cercopagis pengoi*, occurred in the Vistula Lagoon, again related to high summer water temperatures.

The round goby, *Neogobius melanostomus*, continues to spread eastward and the first specimen was found in the Vistula Lagoon in 1999.

6.1.10 Sweden

The round goby, *Neogobius melanostomus*, has still not been found in Swedish waters although its arrival has been expected.

Very large specimens of the red alga, *Dasya baillouviana*, were seen growing in the discharge water of the nuclear power plant at Ringhals.

6.1.11 UK: England and Wales

An ascidian, *Perophora japonica*, has been seen for the first time in a marina at Plymouth on the south coast.

ASP and ISA have had devastating effects on the UK scallop and salmon industries, respectively.

6.1.12 United States of America

Federal statutes and regulations are in place relative to the voluntary management of ballast water on ships entering the USA. All ships must complete a form that is sent to the National Ballast Water Clearing House at the Smithsonian Institute. At least 50 forms are arriving at the Institute each day.

Culture of the alga, *Porphyra yezoensis*, in Maine has been terminated. All further culture will be with native *Porphyra* species (see Section 7.1).

Permission has been requested to introduce triploid *Crassostrea ariakensis* into Chesapeake Bay to assess its culture potential.

More than 800 Asian whelks, *Rapana venosa*, have been caught in Chesapeake Bay to date. Between 30 and 40 individuals are caught per day.

7 STATUS OF INTENTIONAL INTRODUCTIONS

7.1 Status of Nori (Japanese Red Alga *Porphyra yezoensis*) in the Gulf of Maine

7.1.1 Report on the Status of Nori *Porphyra yezoensis* (Rhodophyta) culture in the State of Maine, USA

Dr I.A. Levine submitted the following report dated 23 March 2000.

As per the letter dated 10 January 1994 from Emory D. Anderson, General Secretary of the International Council for the Exploration of the Sea (ICES), to Mr William Brennan, Commissioner of the Maine Department of Marine Resources (MDMR), the following is *PhycoGen*, Inc.'s (formerly Coastal Plantations International Inc.'s) sixth annual report to the ICES Working Group on Introductions and Transfers of Marine Organisms (WGITMO).

Culture Sites

1992: Two culture sites were established: Johnson Cove and Mathews Island. In Johnson Cove a 24 net system was assembled. The system was removed within 60 days of assemblage due to regulatory restraints. A 30 net system, established just off Mathews Island, was maintained from July to December 1992.

1993: Three culture sites were established. Two sites in waters off Eastport, Maine, USA and one site in Harbour deLute, Campobello Island, New Brunswick, Canada. The Eastport sites, just north and east of Goose Island, were

established in June and removed in December 1993. The Canadian effort was established in late September 1993 on the aquaculture lease site of Mr John Mallack.

1994: The two Maine lease sites established in 1993 were utilized in 1994. The lease site just north of Goose Island has been shifted approximately 600 feet due west. The lease site east of Goose Island has been shifted approximately 300 feet to the east to establish a 1320-foot buffer zone between *PhycoGen* cultivation lease sites and the seabird nesting areas on Goose and Spectacle Islands. An additional 80-acre tract, Huckins Ledge, was permitted and utilized as *PhycoGen's* nursery tract. It is located 4000 yards west southwest of Goose Island, just west of Seaward Neck on "Huckins Ledge" in waters off Lubec, Maine. Six experimental nori (*Porphyra yezoensis*) nets were placed out in the waters adjacent to Blue Hill, Maine by the Blue Hill Nori Farming Cooperative.

1995: The three 1994 *PhycoGen* culture lease sites were similarly utilized in 1995. Additionally, as part of a National Marine Fishery Service (NMFS) grant, *PhycoGen* established a small, 15 net, pole farm during the 1995 growing season. The farm was located just north of Mathews Island. The experimental system was reassembled in 1996 at the company's Goose Island Aquaculture lease site. Eight experimental nori (*Porphyra yezoensis*) nets were placed out in the waters adjacent to Blue Hill, Maine by the Blue Hill Nori Farming.

1996: *PhycoGen* efforts included the establishment of a 20 net test polyculture system at the Connors Aquaculture Deep Cove, Eastport, Maine salmon lease site, and the licensing of a 100 net effort by a fisherman in Grand Manan, New Brunswick. The nori:finfish integrated polyculture system was installed relatively late in the 1996 growing season (October) but the nori quality, as measured by color, growth rates and nitrogen content, was significantly greater than the Maine Nori Company's nori harvested from its monoculture operations. A cooperative study of nori samples from the mono- and polyculture systems was initiated by researchers from the University of Connecticut (Dr Charles Yarish) and the University of New Brunswick (Dr Thierry Chopin). The study clearly indicated the ability of *Porphyra* to rapidly and continuously absorb high amounts of nitrogen and phosphorus, making *Porphyra* an ideal bioremediation candidate. Significant increases (> order of magnitude) in phycoerythrin content were recorded.

The progress made by the Peninsula Nori Farming Cooperative (formerly Blue Hill Nori Farming Cooperative) was impeded by permitting difficulties which resulted in zero cultivation during the 1996 and 1997 cultivation seasons. Presently, this organization is applying for additional grant funds to continue their earlier efforts to expand nori farming to the central Maine coastal waters.

1997: The three 1996 *PhycoGen* culture lease sites were not similarly utilized in 1997. The company's Spectacle Island lease site was not utilized in 1997 and may be abandoned due to extreme hydrographic conditions. As in the previous year, *PhycoGen* established a 30 net, pole located at the company's Goose Island Aquaculture lease site. The pole farm was the only utilization of the Goose Island site also due to extreme hydrographic conditions. Twenty-five nori (*Porphyra yezoensis*) nets were placed out in the waters of the Bagaduc River, Maine by the Peninsula Nori Farming Cooperative. Five experimental nori (*Porphyra yezoensis*) nets were placed out in the waters off of Grand Manan Island, New Brunswick, Canada. A modified pole farm was established in Grand Manan by a commercial fisherman. Significant staffing and financial difficulties were experienced by this operation and future participation is questionable.

1998: Two of *PhycoGen's* lease sites, Goose Island and Spectacle Island, were returned to the State of Maine (total 36 acres) due to extreme hydrographic conditions resulting in logistical difficulties in maintaining the cultivation system integrity. Additionally, the Company reduced its Huckins Ledge lease site by 69 % due to the increase in system productivity of the utilizable acreage.

PhycoGen repeated its 1996 integrated aquaculture efforts in the hope of developing a sustainable nori:finfish polyculture system. The test farm effort incorporated the Treats Island Fisheries, Inc.'s Treats Island site, Cobscook Bay, Maine. Twenty nori nets were strategically deployed throughout the salmon cage system to determine optimal net depth, orientation, and placement.

The 1998 season commenced 4 June 1998 and was completed 12 December 1998. The region-wide ice storm of January 1998 and the subsequent 14-day power outage resulted in the destruction of the Company's 1997 season frozen nori nets. The 1998 cultivation season was entirely dependent upon nets seeded in June and September 1998. The 1998 seeding resulted in the freezer storage of 500 nori nets for the 1999 cultivation season.

1999: *PhycoGen's* remaining acreage at its Huckins Ledge lease site was returned to the State of Maine due to the Company's refocus on the development of marine natural products. The Company closed its Eastport operations on 1 August 1999 and eliminated *Porphyra* cultivation in Cobscook Bay, Maine.

PhycoGen entered into an agreement (Damariscotta Nori Trial Agreement) with Mook Sea Farm, Inc. of Walpole, Maine. The nori trial was established to determine the ability of the partnership to cultivate *Porphyra* at Mook Sea Farm's "Abandoned Farm Site" aquaculture lease site. Appropriate permit revisions were obtained from the Maine Department of Marine Resources and the US Army Corps of Engineers.

A small (12 net) system was deployed under the guidance of *PhycoGen's* general farm manager, Andrew Stevenson. Frozen nursery nori nets cultivated in September 1998 were transported from Eastport to the new site. Maintenance of the frozen nets at appropriate temperatures proved to be a difficult challenge and nori thalli exhibited obvious freeze/thaw damage upon deployment. More than 80 % of the nori nets were completely dead. The remaining nets exhibited reduced viability. Results of the nori trial were inconclusive and the test was discontinued in early November 1999. Presently, there are no further plans for *PhycoGen* to cultivate *Porphyra* spp. in general and *Porphyra yezoensis* in particular.

Independent Monitoring Program

As stated in *PhycoGen*'s previous reports to the ICES WGITMO, a four-year study entitled "Establishment of a Monitoring Program for the Mariculture of the Non-Indigenous Seaweed *Porphyra yezoensis* in the Gulf of Maine" has been sponsored by *PhycoGen*. The study, conducted by Dr Donald Cheney and Kathy Watson, a Northeastern University graduate student, has been completed and the final report is attached. The study's conclusions reflect similar results as those previously reported by *PhycoGen*. The conclusions are: 1) *P. yezoensis* plants are present but uncommon on the shoreline adjacent to the *PhycoGen* farm during the farming season, 2) local *Porphyra* species out-recruit *P. yezoensis* on our netting substrates, and 3) there is no evidence to date that *P. yezoensis* will over-winter in Cobscook Bay and replace local *Porphyra* species.

Future Plans

PhycoGen is one of the corporate sponsors of the University of Connecticut's critical technology award effort to bring nori cultivation to Long Island Sound. Pilot farm sites off the coast of Connecticut are presently involved in permitting. *Porphyra yezoensis* is not intended for these cultivation initiatives.

This final report now concludes our reporting requirements to ICES. I would like to personally thank the Working Group for their cooperation and support over the past eight years. The group's passion and endurance for identification, investigation, and prevention of introductions and invasions has brought this challenge to the forefront. I congratulate you and the group.

7.1.2 Final Report on Biomonitoring of *Porphyra yezoensis* in Cobscook Bay for ICES

21 March 2000
Ike Levine, PhycoGen Inc.
Kathy Watson, Northeastern University
Donald Cheney, Northeastern University

Introduction

In response to concerns that *P. yezoensis* might recruit and persist in Cobscook Bay, a biomonitoring programme was undertaken to assess whether a population had become established. PhycoGen's farming operation was located at two sites. A grow-out site was established at Mathews Island, northwest of Eastport, ME in Cobscook Bay, which was exposed to high water flow rates and swift tidal currents, and a nursery site was located at Huckins Ledge, southwest of Eastport in South Bay, which was the more protected site. PhycoGen began farming *P. yezoensis* in the summer of 1991 and utilized both sites until farming at Mathews Island was discontinued in May 1997. Grow-out nets were combined with nursery nets at the Huckins Ledge site from August 1997 until November 1998 when farming ceased. The introduced species, *P. yezoensis*, was not monitored at either site before this study was initiated in August 1996.

P. yezoensis recruitment was monitored at PhycoGen's grow-out site at Mathews Island from August 1996 to May 1997, and a follow-up survey was conducted in July 1999. The results of this study will be summarized in this report. The Huckins Ledge nursery farm site was monitored seasonally from August 1997, until July 1999, and results of this study are being published in the "Proceedings of the First National Conference on Marine Bioinvasions" (Watson *et al*., 2000; see attached). Natural *Porphyra* populations were monitored by sampling along ten-metre transect lines at low and high tide locations around each farm site and artificial substrates were constructed of Japanese netting strung between poles to trap and settle *Porphyra* spores in the water column. These were deployed at low and high tide locations in the vicinity of both farm sites. *Porphyra* blades were collected from both transects and artificial substrates

approximately four times a year and transported to Northeastern University's Marine Science Center in Nahant, MA, for identification. *Porphyra* blades have simple morphologies and species can be difficult to distinguish. In addition to morphological traits, isoenzyme electrophoresis has been found to be a useful molecular tool for differentiating *Porphyra* species (Lindstrom and Cole, 1990, 1992; Brostoff and Gordon, 1997). Current researchers have also begun utilizing DNA methods for *Porphyra* species strain identification and classification (Freshwater *et al.*, 1999; Yamazaki *et al.*, 1996; Kunimoto *et al.*, 1999). In this study, morphological traits and isoenzyme electrophoresis were used to identify plants collected in our monitoring surveys and DNA methods were used to verify putative *P. yezoensis* blades from electrophoretic screening. Markers for differentiating *Porphyra* species were determined using isoenzymes and the DNA regions coding for *rbc*L and ITS1. With this combination, *P. yezoensis* could be successfully distinguished from all local species encountered.

Summary of Methods: Mathews Island Study

Porphyra species identification was attempted with microscopic and macroscopic examinations using the key of Bird and McLachlan (1992). Identifying traits included thallus shape, size, cell height, number of cell layers and patterns of reproductive cells when available. After initial examination, isozyme electrophoresis was used to identify random samples to support visual identification. A modified starch-polyacrylamide isoenzyme electrophoresis screening was carried out using a Tris-citrate buffer and stained for the enzyme phosphoglucose isomerase (PGI) (Cheney and Babbel, 1978; Cheney, 1985). The *P. yezoensis* PGI protein migrates in the gel more slowly than that of the local species tested and electrophoresed in a consistent pattern. DNA methods were used to verify putative *P. yezoensis* identified in isoenzyme screening. Primer sequences designed for local *Porphyra* species were obtained for an 817 bp portion of the *rbc*L gene (A. Klein and D. West, pers. comm.). ITS1 primers designed for use with *P. yezoensis* (Kunimoto *et al.*, 1999) were also tested experimentally with local *Porphyra* species.

Summary of Results: Mathews Island Study

PhycoGen's grow-out site at Mathews Island was monitored using the above techniques in a preliminary investigation conducted in 1996–1997 (Roberts *et al.*, 1997). The distribution and density of *Porphyra* blades in transects varied, with most from both artificial substrate and transect collections light to dark brown in color, either lanceolate or umbilicate, and 5–35 cm long. Transect samples were primarily epilithic on small cobble, with a few blades epiphytic on fucoid algae. Microscopic evaluation of cross sections revealed most of the blades were monostromatic, which is characteristic of *P. yezoensis* and most of the local species. Microscopic analysis of most cross sections revealed cells taller than wide ranging from 40–60 µm thick, which is consistent with the major local species, *P. purpurea* and *P. umbilicalis*. Isoenzyme electrophoresis analysis for PGI identified three *P. yezoensis* blades of 18 *Porphyra* electrophoretically analyzed in August 1996 transect sampling directly following the summer farming season, with the majority identified as *P. umbilicalis*. In subsequent transect collections in May 1997, September 1998, and July 1999 a total of 96 *Porphyra* blades were analyzed but no others were identified as *P. yezoensis*. In both May and September the predominant *Porphyra* identified were *P. umbilicalis* and *P. purpurea*. In July 1999, 52 blades were collected during transect sampling and assessed morphologically and 45 of these individuals were identified electrophoretically as *P. purpurea*.

The original artificial substrates recruited both native *Porphyras* and *P. yezoensis*, and all were distinguished as the transect samples were using morphology and isoenzyme electrophoresis gels stained for PGI. Of 42 *Porphyra* blades morphologically assessed and 20 blades electrophoretically analyzed, one *P. yezoensis* blade was identified on artificial substrates collected in January 1997, after the autumn farming season. However, *P. yezoensis* was not found during the following spring sampling events, although 13 *Porphyra* blades were morphologically assessed and 12 blades were large enough to be electrophoretically analyzed in March and 64 blades of 290 collected and morphologically evaluated specimens were electrophoretically analyzed in May 1997. Morphological and electrophoretic identifications again corresponded to *P. umbilicalis* and *P. purpurea.* A follow-up survey at Mathews Island in July 1999 consisted of transect samples taken near and *Porphyra* blade samples taken from artificial substrates deployed in September 1998, which were allowed to remain undisturbed for one year. Approximately 686 *Porphyra* blades were removed from recovered artificial substrates. Of these, most matched morphotypes for *P. umbilicalis* and *P. purpurea*. The remaining few blades were unusual in color (dark pink) and texture (very silky), ranged in shape from lanceolate toumbilicate and were monostromatic with cells approximately 35 µm thick in cross-section; they were tentatively identified as *P. leucosticta*. Electrophoretic screening of 145 individuals from this collection at Mathews Island identified 72 blades as *P. umbilicalis*, 61 blades as *P. purpurea*, and 9 blades as *P. yezoensis.* The nine blades electrophoretically identified as *P. yezoensis* were all taken from the samples tentatively identified as *P. leucosticta*. Both species share many similar morphological traits and are known to be very closely phylogenetically related (Brodie *et al.*, 1998), so additional molecular tools were needed for final differentiation.

DNA analysis for both the *rbc*L and ITS1 genes was conducted on the remaining seven frozen samples of the nine putative *P. yezoensis* blades identified electrophoretically. In addition, 24 *Porphyra* blades taken from the same electrophoresis experiments were also run, for DNA verification of the isozyme analysis used in species identification. Restriction enzyme fragment length polymorphisms (RFLPs) in the *rbc*L after digestion with *Hae* III and *Hin*d III corroborated isozyme species identifications and corresponded to expected sizes. The seven putative *P. yezoensis* were all identified as *P. leucosticta*. The ITS1 region did not amplify as readily with the primers used, which were designed for *P. yezoensis*. After repeated trials, PCR products that were obtained from ITS1 amplification did show polymorphisms due to the presence of introns (Kunimoto *et al*., 1999) and could be used to differentiate species. In addition, RFLPs generated from *Msp* I digestions of the ITS1 products showed polymorphisms that were also species-specific and useful for differentiating *P. yezoensis* from local species. Both analyses verified the results shown in the *rbc*L experiments and also identified the putative *P. yezoensis* as *P. leucosticta*.

Conclusions: Mathews Island Study

The methods used to collect *Porphyra* blades in this study were successful and the use of artificial substrates for the monitoring of *Porphyra* was novel. Species identifications of blades collected from the ten-metre transects were similar to those collected from the artificial substrates and the combination of sampling methods provided a thorough picture of the *Porphyra* species present in these locations during the sampling events. The collections of *Porphyra* blades throughout the duration of the monitoring study were obtained as significantly from the artificial substrates as from the transects. The netting used in the construction of the artificial substrates exceeded expectations and recruited large numbers of *Porphyra* spores which grew into blades that were easily collected and transported for analysis. Electrophoretic screening with the enzyme marker phosphoglucose isomerase (PGI) was effective for distinguishing *P. yezoensis* consistently from the most commonly encountered local *Porphyra* species, *P. umbilicalis*, and *P. purpurea*. Overall, using PGI isozyme electrophoresis was an efficient and inexpensive method to distinguish between the majority of local species that are not so closely related to *P. yezoensis (*as is *P. leucosticta),* and it was very useful in this study to differentiate all but a handful of specimens. In the DNA analyses, the amplified portion of the chloroplast *rbc*L used was particularly effective in distinguishing *P. yezoensis* from local species, including *P. leucosticta*. Use of the ITS1 region was promising and gave results that concurred with the *rbc*L data.

During the three years of this study, limited recruitment of *P. yezoensis* was seen at both Mathews Island, in transect sampling and on artificial substrates, and at Huckins Ledge, on artificial substrates alone, during and immediately following a farming season. Putative *P. yezoensis* recruits discovered on artificial substrates in July 1999 at Mathews Island after farming had been discontinued there for over a year were verified using DNA analysis and determined to be *P. leucosticta*. Local *Porphyra* populations in Cobscook Bay are very successful, where *P. yezoensis* was environmentally restricted to asexual reproduction and did not appear to thrive under local regimes. *P. yezoensis* recruitment in the intertidal was considered dependent upon the presence of PhycoGen's farm nets for reseeding and there has not been any evidence to date of an overwintering population in Cobscook Bay.

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8 STATUS OF INVASIONS

8.1 Current Status of the Rapa Whelk (*Rapana venosa*) in Chesapeake Bay, USA

Please see the USA National Report in Annex 3.

8.2 Current Status of the Zebra Mussel (*Dreissena polymorpha*) in Ireland (Dr D. Minchin)

Zebra mussels probably arrived in Ireland in 1994 or earlier with the movement of second-hand boats on trailers from either Britain, The Netherlands, or both countries. The zebra mussel has expanded its range rapidly within the navigable areas of the Boyle, Shannon and Erne systems, over a distance of approximately 250 km. Significant increases in abundance took place in most of the major lakes in the navigable areas of the aforementioned rivers in 1998 and 1999. Densities of almost 25 000 per square metre have been found at standard monitoring sites in Lough Derg and Lough Key. At the outflow to Lough Key densities of up to 147 000 per square metre were found attached to cobbles. Zebra mussels attached to aquatic plants. In some muddy lakes a significant part of the biomass of zebra mussels may be attached to the stems of *Phragmites australis* and *Shoenoplectus lacustris*, but also to the rhizoids, stems and leaves of other submerged macrophytes. Zebra mussels were found attached to drifting plant materials.

Larvae of zebra mussels appeared from June (14 °C) to when studies finished in October (13 °C). Larval abundance was generally greatest in July/August. There was evidence of post-settlement drift in the plankton on windy days. Population studies indicate that there is a highly variable population structure that may reflect different settlement patterns and varying mortality within different regions of the same lake.

The zebra mussels are readily spread throughout inland navigable waters while attached to a wide range of craft from barges to paddle boats. Most vessels that used copper-based antifouling agents lacked zebra mussel fouling, and with the general awareness of zebra mussels fouling, fewer boats were now found with attaching mussels. The planned development of the Ulster Canal from the Shannon-Erne navigation to Lough Neagh will inevitably mean that the zebra mussel will gain access to this Lough following its completion, unless carried overland there by fouled boats.

Anglers have been advised about the problems of boat movements on the lake and the possibility that they may inoculate areas with zebra mussels that are not presently colonised. Vulnerable lakes and seasons have been identified when caution should be exercised and this information has been spread in a management campaign.

The above results were presented at the Aquatic Nuisance Species Conference in Toronto, Canada, 14–18 February 2000.

8.3 Studies on the Water Flea (*Cercopagis pengoi)* in the Baltic Sea and Great Lakes (Dr H. Ojaveer)

Spatio-temporal dynamics of *Cercopagis pengoi* populations in the Baltic Sea are strongly dependent upon climatic conditions, mediated through abiotic parameters of the aquatic environment, water temperature and stability of the water column. The *C. pengoi* population is more abundant in sheltered locations (e.g., Parnu Bay in the northeastern part of the Gulf of Riga) than in open areas and the animal was not found in environments characterised by strong

current systems (e.g., archipelago in western Estonia). In a cold summer, the distribution area and population abundance of the cladoceran are remarkably smaller than in a warm summer.

The development of the *Cercopagis* population exhibits strong seasonality. Higher abundances (mean > 200 individuals per cubic metre and maximum over 700 individuals per cubic metre) were recorded during the warm season (July to September) often with more than one abundance peak per season. In the 1990s, after the invasion of *C. pengoi* into the Gulf of Riga ecosystem, a decrease in the abundance of *Bosmina coregoni maritima* was recorded. Higher densities of the *C. pengoi* population (threshold about 10 ind. m^{-3}) resulted in selective predation pressure of herring (selectivity index > 0.82) on its stock whereas *C. pengoi* abundances below this threshold did not result in predation by herring. *C. pengoi* was found in different proportions in different length groups of various fishes, probably due to their different spatial distribution pattern and feeding ecology. Herring (*Clupea harengus membras*), smelt (*Osmerus eperlanus*), three- and nine-spined stickleback (*Pungitius pungitius* and *Gasterosteus aculeatus*, respectively), bleak (*Alburnus alburnus*) and, also, accidentally sprat (*Sprattus sprattus*) fed on this exotic species. Based on observations in the main feeding grounds during the essential feeding period in 1994–1998, the mean share of the water flea in the diet of herring and smelt did not exceed 8 %, but reached as high as 83 % in case of bleak (by wet weight).

A study was conducted in Lake Ontario during September 1999 to examine the distribution, both horizontal and vertical, of *Cercopagis pengoi*. Epilimnetic densities (maximum around 2500 individuals m^{-3}) tended to be higher in the western part of the lake. Abundances were higher in open areas than in coastal locations—a statistically significant relationship ($p = 0.05$) was found between distance from shore and log (abundance). *Cercopagis* abundance was remarkably lower in deep tows than in the epilimnion roughly by a factor 3. At two stations, diurnal vertical migration of *Cercopagis* was studied. No evidence of diurnal migration was found; most of the *Cercopagis* population remained in the epilimnion, although some individuals were also distributed within the upper part of the seasonal thermocline. The proportion of individuals found in colder water layers was marginal (below 3 %).

8.4 The Eel Nematode (*Anguilla crassa*) from Ireland (Dr D. Minchin)

The Japanese eel air-bladder nematode was commonly found in the Lower Erne in 1998 and 1999 and was known from the Shannon River in 1998. There are three potential ways in which this species may have entered Ireland.

Eel tanks on trucks may be partly loaded with eels in Britain. Further consignments may be then collected in Northern Ireland and Ireland to return to Britain or The Netherlands. The water in these tanks is almost certainly drained from time to time and replenished with fresh water to maintain the condition of the eels. Infective stages may be released in the drained water carried from Britain and in this way the nematode could be released to the environment. Infected eels that may have died during transportation could also be discarded, and these could also form a founder population.

The nematode has an intermediate stage occurring in planktonic crustaceans that may be eaten either by young eels or by other fishes. If eaten by young eels the nematode will develop to the adult stage, but if consumed by other fishes, such as cyprinids, it will remain as an intermediate stage until devoured by an eel. It is clear that large numbers of planktonic crustaceans are carried in ballast water and that ballasting can occur in an infested river port, such as Hamburg from where the crustaceans containing the intermediate stage can be ferried to a further estuarine or river port. Living copepods have been found in ballast water taken up in Hamburg and discharged in the Dublin dry dock, which shows that large numbers of crustaceans could survive these journeys. There are river/estuarine ports in Ireland at Waterford, New Ross and Limerick where infected crustaceans could be discharged and could survive. Migrating glass eels pass through these port regions and in this way may acquire the nematode and spread it up-river.

In 1998, 150 kg of glass eels were imported for cultivation in Ireland at one isolated small river site. These eels came from England and could have been contaminated before they were collected there.

The arrival of the nematode in Ireland could be explained by the first two modes of introduction. The glass eels that were imported were to an eel farm on a small river and it is very unlikely that they could have got access to the Barrow, Shannon or Erne river systems.

8.5 Current Status of Introductions in Italy

Professor Anna Occhipinti gave a comprehensive review on introductions that have been made intentionally or that have occurred through other vectors. Her report is included with the other National Reports in Annex 3.

8.6 Impacts of Non-indigenous Species on Habitats and Communities in Poole Harbour, Southern England (Dr P.E.J. Dyrynda)

Poole Harbour is one of several natural tidal basins located on the central southern coast of England. It can be classified as intermediate between an estuary and a lagoon, having a microtidal range, tidal exchange limited to a narrow entrance, and predominantly stable polyhaline salinities. The harbour is a high-risk environment with respect to NIS. It has long been a centre for molluscan aquaculture, deposits of native oysters and mussels being augmented historically by adult stocks of exotic taxa imported directly from continental Europe and North America. The Harbour has been a seaport since Roman times and has had historical links with North American ports. Moorings are provided for > 1000 small vessels, many located within the 7 marinas.

Integrated surveys of epibenthos undertaken during the 1980s revealed the extent of non-indigenous species occupancy within the 35 km network of sub-tidal channels. A dredge survey indicated the slipper limpet *Crepidula fornicata* to be the dominant epibenthic species (wet biomass) followed by the ascidian (sea squirt) *Styela clava* and the alga *Sargassum muticum*. Dredging, however, under-samples certain important epibenthic species such as the tube-dwelling polychaete *Sabella pavonina*. A novel cross-channel dive transect technique revealed complex spatial patterns involving discrete epibenthic communities, related to hydrodynamic gradients (principally involving tidal energy). Current-scoured downstream areas were dominated by sand, gravel and cobble beds characterised by mobility and brasion-resistant epibenthos. Upstream areas were dominated by cohesive muds with heavy sedimentation and minimal epibenthos. Intermediate areas were most favourable for epibenthic development. Dense "forests" of *Sabella pavonina* (considered native) provide the foundation for the most biodiverse assemblage. High density *Crepidula fornicata* beds occupy a range of bottom types and support a relatively modest range of flora and fauna.

Copses of *Sargassum muticum* feature within clearer water regions of the channel system. In the absence of stable bedrock, plants colonise cobbles and mollusc shells. In summer, large fronds are often mobilised along with their anchoring substrata and any epibionts, aggregating into copses, particularly within areas of reduced tidal flow. *Styela clava* occurs as a subsidiary epibiont within any of the aforementioned communities but is most prevalent towards the upstream end of the zone of epibenthic domination where "islands" of epibenthos occur within soft sediment.

Poole Harbour contains a wide range of other known NIS. Of the species that have fundamentally and irreversibly altered the ecology of the harbour, the greatest impact has been exerted by *Crepidula fornicata* which has largely displaced the native *Ostrea edulis*. The process of non-indigenous species-induced change continues with the recent colonisation of intertidal sediment flats by the Manila clam *Tapes philippinarum*, recruited since the early 1990s from larvae produced by farmed stock deposited in the harbour.

9 RISK ASSESSMENT (ToR "b")

9.1 Risk Management Strategies for Live Imports of the Fish *Tilapia* into British Columbia, Canada (with Special Emphasis on Fish Imported for Human Consumption) (Dr D. Kieser)

Many different species of marine and freshwater fish are routinely imported for human consumption into the markets in Vancouver, British Columbia, Canada. Regulations are in place to ensure that such products are safe for human consumption; however, little regulatory control exists to ensure that such imports do not negatively impact local fish species. For the pet/aquarium trade, regulatory controls are also minimal. By contrast, imports for use in aquaculture are subject to stringent conditions. The risks and management strategies for the three pathways of introduction are compared using recent importations of *Tilapia* (*Oreochromis niloticus*) as an example. Because little information is available on the risks associated with the pet trade and table market imports, it is recommended that information be collected and risk assessments be carried out on a number of species, both fresh water and marine. This will aid in developing risk management strategies for imports via different pathways.

10 DISPERSAL VECTORS: THE DIRECTORY OF VECTORS (ToR "d")

WGITMO again discussed the range of vectors that were involved in introductions and transfers. The compilation of information for WGITMO's new ICES *Cooperative Research Report*, "Directory of Dispersal Vectors", is nearing completion.

11 UPDATES AND REPORTS ON BALLAST STUDIES

Information on current ballast studies in ICES Member Countries for 1999–2000 is found in the report of the ICES/IOC/IMO Study Group on Ballast and Other Ship Vectors [SGBOSV] for 1999–2000.

12 RECOMMENDATIONS TO ICES COUNCIL

The recommendations to the ICES Council are listed in Annex 6 of this report.

13 ADJOURNMENT OF THE MEETING

A final review of the 2000 terms of reference was made and the proposed agenda and action points for 2001 were considered. Final draft recommendations were discussed, revised and approved by the WGITMO participants. There was then some discussion on the venue (Spain) and dates for next year's meeting.

Dr J.T. Carlton, as Chair, then thanked all of the WGITMO members and guests for their dedicated work and thanked the Port of Parnu for hosting the 2000 meeting.

Before adjourning the meeting, Dr Carlton expressed his sadness at leaving the WGITMO after 22 years. He wished WGITMO every success in the future before adjourning the meeting at 12.45 hrs, Wednesday, 29 March 2000.

Before finally closing the meeting, WGITMO delegates thanked Dr Carlton for his many years of dedication and commitment to WGITMO. He has been with WGITMO since 1979, in the position of Rapporteur from 1982 to 1990 and then as Chair from 1991 to 2000. During that time, he has been an inspiration to both the more established members of WGITMO and those who have joined in recent years.

WGITMO wished him every success in the future.

ANNEX 1: AGENDA

27 March 2000 Monday

9:00 Opening Session

*Welcomes and Introductory Remarks
*Appointment of Rapporteur
*Introduction of Participants and Guests
*Logistical Announcements
*Review of Agenda: changes, corrections, additions
*WGITMO Report Deadline

9:45 Review of the Previous Meeting: 1999, Conwy, Wales

*Review of 1999 Conwy Report and Addenda/Errata
*Review of Recommendations from 1999 Conwy meeting
*Terms of Reference (ToRs) for this meeting

a) continue the assessment of ballast water research and management until the proposed reconvening of the expanded ICES/IOC/IMO Study Group on Ballast and Other Ship Vectors in 2001;

b) continue discussion on risk assessment techniques;

c) finalize arrangements for the Theme Session on Marine Biological Invasions: Retrospectives for the 20th Century, Prospectives for the 21st Century to be convened at the ICES Annual Science Conference in Bruges, Belgium, in September 2000;

d) finalize the Directory of Dispersal Vectors as an ICES Cooperative Research Report, including a continued review of aquarium-related transportation of exotic species as well as transfer via aquaculture;

e) continue work on a standardized format for collating data on non-native species, and the method and fate of introduction;

f) report on the current status of fish, shellfish, algal, and other introductions in and between Member Countries, through:

i) submission of National Reports, to also include information on genetically modified organisms and the use of any biocontrol agents,

ii) continuing to review the status of selected current invasions and, in particular, the status of the invasion of the snail Rapana in the Atlantic USA and other ICES Member Countries,

iii) continuing coordination with the Baltic Marine Biologists (BMB) Working Group and the European Inland Fisheries Advisory Commission (EIFAC), and reviewing the outcomes and future projects of the EC Concerted Action Plan on Ballast Water.

10:00 New Publications, Journals, Websites, Databases

*New Journal: Biological Invasions (J.T. Carlton)
*Other Publication News
*Data Bases (ToR e)

10:30 Coffee Break

11:00 Marine Bioinvasions: Retrospectives for the 20th Century, Prospectives for the 21st Century

*Discuss Theme Session for the 2000 ICES Annual Science Conference in Belgium (Bruges) (ToR c)

11:30 Open

11:50 Group Photo

Lunch (12:00–2:00)

2:00 Reconvene for Afternoon Session

National Reports
*Canada
*Estonia
*Finland
*France

*Germany
*Ireland
*Netherlands
*Norway
*Poland
*Sweden
*UK: England and Wales
*USA

3:30 Coffee Break

4:00 National Reports (continued)

5:00 Review Tomorrow's Agenda

5:30 Adjourn

28 March 2000 Tuesday

9:00 Review of Previous Day

*Today's Agenda
*Announcements

Status of Intentional Introductions

9:15 Nori (Japanese Red Alga *Porphyra yezoensis*) in the Gulf of Maine: Final Report (Provided in absentia by I. Levine)

Status of Invasions

9:30 **Mollusca: Gastropoda:** The current status of the Rapa Whelk (*Rapana venosa*) in Chesapeake Bay USA (J.T. Carlton)

9:45 **Mollusca: Bivalvia:** Zebra mussel (*Dreissena polymorpha*) in Ireland: Current status (D. Minchin)

10:05 **Crustacea: Cladocera:** Studies on the waterflea *Cercopagis pengoi* in the Baltic Sea and Great Lakes (H. Ojaveer)

10:20 **Nematoda:** The eel nematode *Anguillicola crassa* from Ireland (D. Minchin)

10:30 Coffee Break

11:00 **Overview:** Report on the current status of introductions in Italy (A. Occhipinti)

11:20 **Overview:** Impacts of non-indigenous species on natural habitats and communities in Poole Harbour, UK (P. Dyrynda)

11:50 **Crustacea and Rhodophyta:** Update on the *Caprella mutica* [Crustacea, Amphipoda] *Dasysiphonia* sp. [Red Alga] introductions in Norway (A. Jelmert)

Lunch (12:00–2:00)

2:00 **Risk Management:** Risk management strategies for live imports of *Tilapia* into British Columbia, Canada with specific emphasis on fish imported for human consumption (D. Kieser)

2:20 **Risk Assessment**: Discussion (TOR b)

2:40 Draft Recommendations

3:00 to 5:00 pm WGITMO tour of Port of Parnu

7:00 Reception in Honour of the ICES Working Group

29 March 2000 Wednesday

9:00 Review of Previous Day

*Today's Agenda
*Announcements

9:15 Dispersal Vectors: The Directory of Vectors (ToR d)

9:30 Updates and Reports on Ballast Studies

10:30 Coffee Break: IMO video on Black Sea and ballast water (S. Gollasch)

11:00 Updates and Reports on Ballast Studies (continued)

11:30 Review of Recommendations: Discussion and Final Editing

Principal Agenda Items for 2001 WGITMO Meeting
Place and Date for 2001 Meeting: March 2001, Spain (Prof. M. Ribera, Host)

12:00 Adjournment of the 22nd Annual Meeting of WGITMO

Adjourned by Dr J.T. Carlton, WGITMO, 1979–2000
(Rapporteur, 1982–1990; Chair, 1991–2000)

Lunch (12:00–2:00)

2:00 Joint meeting with the Baltic Marine Biologists (BMB) Working Group on Non-indigenous Estuarine and Marine Organisms (NEMOs); Co-Chaired by E. Leppakoski and J.T. Carlton

Opening Session
*Welcome and introductory comments (E. Leppkoski, J.T. Carlton)
*Introduction of participants
*History and perspective of the ICES and the WGITMO, including the ICES Code of Practice (J.T. Carlton)
*History and perspective of the BMB (S. Olenin)
*History and perspective of the BMB NEMOs (E. Leppakoski)
*National Reports

3:35 Coffee Break and Group Photo

3:50 Update on Legislations/Guidelines on Treatment and Management of Ballast Water (North America: US and Canadian representatives)

Results of international projects

*The EU Concerted Action
*IMO workshop in the Black Sea (S. Gollasch, S.Olenin)
*IMO GEF Project (S. Gollasch)

Future Research Priorities

Group discussion: Options for cooperation between WGITMO and BMB member countries

*defining research needs and fields of cooperation.

INTAS plan (V. Panov, S. Gollasch)

Development of ERNAIS (European Research Network on Aquatic Invasive Species) (V. Panov)

Summing up (J.T. Carlton, E. Leppakoski)

17.00 Adjourn

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ANNEX 3: NATIONAL REPORTS

NATIONAL REPORT FOR CANADA

1 LAWS AND REGULATIONS

The Department of Fisheries and Oceans (DFO) is continuing to develop a National Code on Introductions and Transfers of Aquatic Organisms. The code will apply wherever a permit is required to put fish (including shellfish) into water. It will be applied nationally both in the fresh and marine waters. The Code will not apply to live food fish or aquarium fish or plants.

The first draft of the Canadian Shellfish Health Protection Regulations was released to federal and provincial government representatives as well as shellfish industry representatives for review between September 1998 to April 1999. During 1999, regional committees met to discuss local issues pertaining to the draft and technical aspects have been reviewed by international experts in shellfish health (USA, France, and New Zealand). The disease lists and pertinent information are available as stand-alone scientific background information at the website: http://www.pac.dfo-mpo.gc.ca/sci/sealane/aquac/pages/title.htm to permit non-regulatory updating as conditions and information evolve.

2 DELIBERATE INTRODUCTIONS AND TRANSFERS

2.1 Finfish

Significant numbers of eggs and fish of the established cultured species continue to be transferred into the country, between provinces and intra-provincially, in support of aquaculture (not intended to be released into the natural environment) and enhancement programs (released into the natural environment).

In Canada Pacific Region, finfish imports for aquaculture were limited to Atlantic salmon eggs (total 2.4 million) from farms in the US Pacific Northwest. Small numbers of rainbow trout were imported for bioassays and for stocking of Yukon lakes. The sockeye transfers reported previously also continued. A new venture for growing Tilapia in culture is being started in the province.

In Eastern Canada, there continues to be interest in new aquaculture species (e.g., Atlantic cod, *Gadus morhua*; winter flounder, *Pleuronectes americanus*; summer flounder *Paralichthys dentatus*; yellowtail flounder, *Limanda ferruginea*; haddock, *Melanogrammus aeglefinus*; Atlantic halibut, *Hippoglossus hippoglossus*; striped bass, *Roccus saxatilis*; tilapia, *Tilapia* spp. and koi, *Cyprinus carpio*) which has resulted in introductions and transfers into the country, between provinces, and intra-provincially for research and developmental purposes. An Atlantic halibut facility in Nova Scotia (mentioned in last year's report) continues to import large numbers of juvenile halibut from Iceland to be grown to market size in totally enclosed seawater tanks with chlorine treatment of all effluent.

Nova Scotia imported tilapia (6000 fish from Ontario and 2000 fish from Thailand) into a totally enclosed recirculation facility for research and developmental purposes.

2.2 Invertebrates

In Atlantic Canada, American oysters (*Crassostrea virginica*), European oysters (*Ostrea edulis*), blue mussels (*Mytilus edulis*), soft-shell clams (*Mya arenaria*), hard-shell clams (*Mercenaria mercenaria* and the selected variety *M. m. notata*), bar clams (*Spisula solidissima*), ocean quahog (*Polynema mactromeris*), giant sea scallops (*Placopecten magellanicus*) and bay scallops (*Argopecten irradians*) were transferred as seed stock, broodstock or for relay purposes throughout the region in 1999. As in previous years, all official movements of shellfish destined for hatchery use or for remote setting, are screened for parasites, pests and diseases, prior to transfer. Research on non-traditional shellfish species for aquaculture continues to constitute the bulk of I&T health screening requests.

We are continuing to track the progeny of hard-shell clams (*Mercenaria mercenaria* var. *notata*) introduced via quarantine from Massachusetts to Prince Edward Island (PEI) in 1998.

The BC industry depends on an on-going supply of seed for *Tapes philippinarum* and *Crassostrea gigas* culture from the US. Most sources are located in the Pacific Northwest, with a few suppliers being located in Hawaii. A new species being cultured in BC is *Crassostrea sikamea* (Kumamoto oyster). All imports must be from health-certified sites.

In addition, there was a transfer of sporangia from *Laminaria* species (*L. longicruris* and *L. saccharina*) from Newfoundland to Bamfield (Pacific Coast). New young sporophytes were produced in BC and transferred back to NF as "seedstring" sporophytes on 2–6 mm twine.

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.1 Finfish

Specimens of round goby (*Neogobius melanostomus*) have been transferred by inter-lake shipping to Hamilton harbour and the east end of Lake Ontario near Kingston. A specimen had also been captured in the St. Lawrence River near Quebec City.

At the 10th International Aquatic Nuisance Species and Zebra Mussel Conference in Toronto the occurrence of a population of tench (*Tinca tinca*) in the Richelieu River between Lake Champlain and the St Lawrence River was reported. The fish had escaped from an aquaculture pond.

Cercopagis pengoi is the latest exotic crustacean to invade the Great Lakes. Canadian scientists first identified this predatory cladoceran in early August of 1998. *Cercopagis* is indigenous to the Caspian, Azov, and Aral seas, and was reported to have invaded the Baltic Sea in 1992.

3.2 Invertebrates

Atlantic Region

The distribution and expansion of green crab, *Carcinus maenas*, in Prince Edward Island is documented in a report (see references). The westward expansion of the crab into the southern Gulf of St. Lawrence has also recently been confirmed. Eel net fishers in eastern Prince Edward Island (PEI) started to capture green crab in 1998 and in 1999 the catch increased considerably. There is considerable concern about the crab's expansion into prime shellfish farming/harvesting areas in the Gulf of St. Lawrence, as the impact on the conchili culture (oyster, mussel) may not be negligible.

In Cape Breton, it is believed that green crab only arrived in the lakes in the last five years or so, but in 1999 they were captured throughout the Lakes. The survey team also trapped near the northern tip of Cape Breton (Aspy Bay area) and the crabs were present there as well.

As mentioned in last years report, the clubbed tunicate, *Styela clava*, was first identified on a market mussel crop in Prince Edward Island, in 1998. In 1999 an increase in numbers was observed. It, like the green crab, has only been reported from the eastern portion of the Island (Montague River, Brudenell River, Murray River, and St. Mary's Bay). Thus far, there have been no significant fouling problems attributed to *Styela clava*.

Pacific Region

Updates on green crab findings are available at http://www.pac.dfo-mpo.gc.ca/ops/fm/shellfish/crab/greencr.html

Since the first siting in June 1999, 5 crabshave been found in Barkley Sound on the west coast of Vancouver Island, and one has been confirmed from Esquimault Harbour also on Vancouver Island. These are all adults, about 60 mm across the carapace. Some are male, some female. No females with eggs have been found yet. The size indicates that the crabs have been here at least one year, possibly two.

3.3 Algae and higher plants

The spread of a seaweed identified as *Codium fragile tomentosoides* in Atlantic Canadian waters has been mentioned in our reports since the 1996 meeting. The PEI Department of Fisheries and Tourism continues to monitor the *C. fragile* populations in Enmore Bay (Northumberland Strait side of the Island) and Malpeque Bay (Gulf of St. Lawrence side). On PEI the plant has not been identified outside of these areas, other than the one isolated finding on mussel lines in Tracadie Bay (also on the Gulf of St. Lawrence side). The PEI Department of Fisheries and Tourism is still experimenting with various treatment immersion trials in an attempt to control the seaweed's spread with shellfish movements. Results indicate that the plant is very difficult to kill and that it takes a long period of time to assess treatment efficacy.

4 LIVE IMPORTS AND TRANSFERS

A wide variety of marine and freshwater organisms continue to be imported into Canada and/or transferred between provinces for research, display or for human consumption purposes. The organisms are usually held in quarantine or other containment facilities, and are generally destroyed after research is completed or used as food. Although we believe that the stringent conditions of quarantines and many containment facilities effectively eliminate the risks that such importations may pose to Canadian fisheries resources, we are still unable to assess the true risks from other cases, such as the large-scale importation of live fish for human consumption.

Especially in the Pacific Region, there is a growing number of freshwater and marine species being imported live for human consumption (e.g., *Channa channa*, *Muranaesox* (*Congresox*) *talabonoides*, *Oreochromis niloticus*) in addition to the traditional species found in the live food market (e.g., *Homarus* sp., *Mytilus edulis*). Fish brought in for live table market sales are now primarily under the jurisdiction of the Canadian Food Inspection Agency (CFIA) and, thus, in general are no longer reviewed by the federal-provincial introductions and transfers committees. However, species regulated under the Pacific Fisheries Regulations, 1993, must be reviewed by the federal-provincial Fish Transplant Committee in British Columbia.

5 LIVE EXPORTS TO ICES MEMBER COUNTRIES

Canadian aquaculturists continue to ship Atlantic salmon (*Salmo salar*), Arctic charr (*Salvelinus alpinus*), brook trout (*Salvelinus fontinalis*), and rainbow trout (*Oncorhynchus mykiss*) eggs and fish to the USA subject to US Title 50 fish health conditions.

In 1999 Arctic charr eggs from a fish health certified facility in Quebec were shipped to Germany and shipments of Arctic charr eggs and brook trout were eggs made to France. A Yukon farm exported Arctic charr eggs to farms in Ireland, China, Scotland, and several locations in the USA. Atlantic salmon eggs were transferred from BC to Chile and chinook (*Oncorhynchus tshawytscha*) eggs were shipped to Japan.

European oysters were shipped to Belgium for marketing in 1998/1999. However, relay at the import site resulted in a prohibition of further shipments from Canada. This coincided with erroneous reports of mass shipments of American oysters from Atlantic Canada into France. Media reports, also erroneously, indicated that Canadian oysters (*Ostrea edulis*) were infected by all OIE listed diseases of molluscs (including the now-deleted Irido virus causing Oyster Velar Virus Disease of European oysters). Later it was reported that the importation of Canadian oysters into Belgium coincided with a severe outbreak of bonamiasis in the Ostende growing area in 1999. Canada's European oyster health was not in question.

A variety of local, marine finfish and invertebrate species are collected annually in BC and shipped to aquariums in other countries. Last year export certificates were issued for shipments going to France, Portugal, and the Netherlands. The species (e.g., rockfishes, octopus) shipped match those of the 1998 report.

Quebec shipped striped bass (*Morone saxatilis*) to New England aquaria.

6 PLANNED INTRODUCTIONS AND TRANSFERS

6.1 Finfish

Continued importations and transfers of various species of finfish for aquaculture, enhancement and research purposes from other provinces in Canada and from international sources are likely.

6.2 Invertebrates

Continued importations and transfers of invertebrates for aquaculture, enhancement and research purposes from other provinces in Canada and from international sources are likely. Of particular note: Abalone (*Haliotis rufescens* and *H. discus hannai)* have been approved for quarantine introduction into Nova Scotia, for research purposes, from Iceland. Dates, numbers and size of abalone are still being discussed. Quarantine inspection is scheduled for March 2000 and samples will be collected at time of arrival. A certificate of health has been received from the Iceland Ministry of Agriculture, Veterinary Service, stating that no OIE listed disease agents have been detected along with no evidence of Withering Foot Syndrome or *Labyrinthomyxa haliotis*.

7 MEETINGS, CONFERENCES, SYMPOSIA OR WORKSHOPS

National Shell Fisheries Association special session on health issues of relevance to cold water culture of shellfish Halifax, NS, April 1999.

Shellfish Health Protection Regulations Regional Technical Committee Meeting, Halifax, NS, April 1999.

Aquaculture Canada 2000 (Aquaculture Association of Canada), special sessions on regulatory requirements, health controls, etc., Moncton, NB May 2000.

10th Annual Aquatic Nuisance Species Zebra Mussel Conference, Toronto, ON, 13–17 February 2000.

Shipping Live Aquatics, Seattle, WA, 15–17 November 1999.

Submitted by: D. Kieser and M. Campbell

NATIONAL REPORT FOR ESTONIA

2 DELIBERATE INTRODUCTIONS AND TRANSFERS

2.1 Finfish

New data and statistics on deliberate releases into the Baltic Sea for fisheries enhancement purposes during 1995–1999 (numbers in thousands) are as follows:

Species	**1999**	**1998**	**1997**	**1996**	**1995**
Whitefish *Coregonus lavaretus*	37.1	79.0	80.0	0	29.9
Pikeperch *Stizostedion lucioperca*	86.6	34.4	97.5	79.8	54.7
Pike *Esox lucius*	370.0	4.0	?	3300	2510
Sea trout *Salmo trutta trutta*	31.6	30.5	31.9	31.1	178.2
Eel *Anguilla anguilla*	38.0	10.0	0	0	0
Carp *Cyprinus carpio*	2.7	3.7	104.0	6.9	0

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

Maeotias inexspectata

Occurrence of a new species native to the Ponto-Caspian region—the hydromedusa *Maeotias inexspectata* Ostroumoff, 1896 (Cnidaria, Hydrozoa)—was recorded on the Estonian western coast of the Baltic Sea in 1999.

Cercopagis pengoi

After rather relatively low abundances in 1998, mass occurrence of the cladoceran was recorded in the northeastern Baltic in 1999, probably due to favourable environmental conditions. *Cercopagis* populations reached maximum abundances of ca. 700 ind m^{-3} and comprised maximally ca. 10 % of the total zooplankton biomass in late July and August. Analysis of fish feeding data in the Gulf of Riga for 1994–1998 confirmed previous statements on the importance of the invertebrate in fish diets in summer. Although the mean share of *Cercopagis* in the diet of herring (*Clupea harengus membras*) populations in the Gulf of Riga remained low (6.3 %, biomass units), its importance was as high as 17 % in August. Except for non-commercial bleak (*Alburnus alburnus*), the mean share of the water flea in the diet of other fish remained below 8 %.

Marenzelleria viridis

The polychaete is expanding its distribution area around the Estonian coast. Presence of the invertebrate has been documented over the Gulf of Riga and most recently at the entrance of the Gulf of Finland. Although adult stages of the

polychaete are not very abundant, remarkable increase in larval density was observed in the Gulf of Riga in 1998–1999 compared to that during1991–1997 (> 30 thousand and < 10 thousand individuals per m^{-3}).

Dreissena polymorpha

This bivalve is also expanding its distribution area in Estonian marine waters, being recently found in several new sites in the Gulf of Finland. Studies on filtration activity of zebra mussels indicate that it may cause phytoplankton biomass decline.

4 LIVE IMPORTS AND TRANSFERS

Country	Fish	Quantity (kg)
Russia	unidentified freshwater fish	70
Ukraine	unidentified freshwater fish	27821
Finland	salmon (*Oncorhynchus gilae* and *O. chrysogaster*)	10000
Denmark	unidentified salmon	45
Finland	unidentified salmon	15
United Kingdom	eel (*Anguilla anguilla*)	640

5 LIVE EXPORTS TO ICES MEMBER COUNTRIES

Country	Fish	Quantity (kg)
Russia	salmon (*Oncorhynchus gilae* and *O. chrysogaster*)	16

Submitted by: H. Ojaveer

NATIONAL REPORT FOR FINLAND

1 LAWS AND REGULATIONS

Finnish disease regulations concerning import of live aquaculture and fishery animals and products from EU countries and from non-EU countries, as well as GMO regulation, have been harmonized according to EU directives. No relevant changes occurred in 1999.

2 DELIBERATE INTRODUCTIONS AND TRANSFERS

2.1 Fish

Preliminary estimations of the deliberate releases into the Baltic Sea area (including rivers draining into the Baltic Sea) for fishery enhancement purposes in 1999 are as follows:

- 3.9 million salmon (*Salmo salar*) (newly hatched–4–years old);
- 2.2 million sea trout (*Salmo trutta m. trutta*) (newly hatched–4–years old);
- 28 million newly hatched and 10 million one-summer-old whitefish (*Coregonus lavaretus*).

About 14 million kg of rainbow trout (*Oncorhynchus mykiss*) and about 1 million kg of whitefish (*Coregonus lavaretus*) were cultivated in net cages for human consumption in the Finnish Archipelago.

As in previous years, veterinary authorities allowed the import of elvers from England (River Severn) via Swedish quarantine to be released into inland waters in southern Finland and the Gulf of Finland, Baltic Sea (total 62 500 ind.).

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.2 Invertebrates

A novel species for Finnish fresh waters, the mitten crab, *Eriocheir sinensis*, was reported from the southeastern lake district in 1998. Range extensions occurred of the predaceous water flea *Cercopagis pengoi* (up to 63 °N) and the polychaete *Marenzelleria viridis* (spreading south from the Northern Quark on the Swedish coast of the Bothnian Sea).

4 LIVE IMPORTS AND TRANSFERS

4.1 Fish

Rainbow trout (83 500 kg) from Sweden to Åland, elvers from Sweden (see Section 2.1), tropical aquarium fish, a small amount of grass carp, *Ctenopharyngodon idella*, were imported to a private inland pond.

4.2 Invertebrates

As in previous years, aquarium shops and some restaurants and stores may import live tropical marine animals such as oysters, lobsters and crabs for sale or consumption without the authorization of the Veterinary Department because it is obvious that they cannot survive in natural Finnish waters.

4.3 Algae or higher plants

None apart from aquarium plants.

5 LIVE EXPORTS TO ICES MEMBER COUNTRIES

5.1 Fish

Fertilized eggs:

- Atlantic salmon to Estonia
- Arctic charr to Italy, Austria, Germany
- (Rainbow trout to Thailand)

Submitted by: R. Rahkonen and E. Leppäkoski

NATIONAL REPORT FOR FRANCE

1 LAWS AND REGULATIONS

Several new regulations at the European Union level were enacted and/or updated in 1999: JOCE NºL302–11.25.99 following the European decision 1999/767/CE concerning shellfish bivalves and fishery products originating /or exported from Turkey, which modifies the 94/777/CE and 94/778/CE decisions.

JOCE NºC356 12.8.99 following the EU1999/C356/01 decision which specifies the names and addresses of the management organisations and scientific authorities designated by the State Members in agreement with the IX article 1, Convention on the International Trade of endangered flora and fauna species and concerned by the 12th article of the Nº338/97 Council law (December 1996). Similarly, the 1999/C356/02 decision concerns the authorized sites for introduction and exportation specified by the State Members for endangered species described in the 13th article of the previously cited Council law.

JOCE NºL22/62 1.27.00 concerns the EU decision 2000/61/CE specifying the importation sanitary constraints for fishery products originating from Chile (including shellfish bivalves and gastropods).

The EU decision 2000/170/CE provides the country list from where imports are authorized for human consumption, including live shellfish bivalves. Among the numerous countries are included Japan, Chile, Canada, USA, French Polynesia, New Caledonia.

A State Decree (28 February 2000) has specified and updated the sanitary conditions and constraints to transport live shellfish before marketing (French Official Journal, 19 March 2000). It provides the transport tags, and the authorization forms required for any transport in agreement with the EU directives.

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.1 Molluscs

Crepidula fornicata

This species is now well distributed along the French Atlantic coastline, and its expansion is still in progress. The last stock assessment campaign provided high figures in specific locations, e.g., 250 000 metric tonnes in the Bay of St Brieuc, and 100 000 metric tonnes in the Bay of Cancale. The comprehensive research programme (RP LITEAU) is currently under development by four research institutes and funded by the French Ministry of the Environment. The on-going program is carried out on four pilot sites, Bay of St Brieuc, Bay of Brest (Northern Brittany), specifically concerned with interactions with scallop fisheries, the Bay of Marennes/Oleron and Bay of Arcachon (southwest coastline Bay of Biscay), where the colonization side-effects affect the oyster farming industry. It aims to assess 1) interactions between environmental factors and species proliferation, 2) effects on biodiversity, 3) interactions with species of commercial interest, 4) improve knowledge on proliferation mechanisms for this species to develop a spatialized model to simulate population removal, and 5) the efficiency of management practices to limit invasion.

The gastropod *Rapana venosa*

In addition to the three living adult gastropods *Rapana venosa* harvested in a sub-tidal area of the Bay of Quiberon (Southern Brittany) (biometric characteristics, height 140 and 136 mm; width 101–102 mm) collected earlier, a fourth one was caught 21 March 2000 in the same location (total weight=750 g and 158 mm height). A meat sample will be sent to the VIMS (USA) where an on-going research programme is addressing genetic issues for this species: sample comparisons might provide further information on the animal origins. So far, no juvenile has been found and there is yet no evidence that a local population is established. However, all the individuals were caught in the same area and depth. A diving campaign is scheduled for early spring to try an eradication process.

The muricid gastropod *Ocinebrellus inornatus* (= *Ceratostoma inornatum*, = *Ocenebra japonica*)

A new species of gastropod *Ocinebrellus inornatus* has been observed along the French Atlantic coastline, in the Marennes—Oleron and Arcachon Bays. The first sighting was observed in April 1997, but it seems to be more common since 1998. The two last years were characterized by favourable environmental conditions to obtain large recruitment of gastropods species (mild winters). The species has spread drastically by the shellfish trade. A sampling programme was carried out in 1999 to estimate the species distribution and to develop biological and genetic studies. First data showed that the species stet observed on the Atlantic coastline from southern Brittany to the Bay of Marennes—Oleron. Fixed samples originating from Japan, British Columbia, and Washington State will be genetically compared to establish relationship and population origin. Moreover, interspecific comparisons will be carried out on *Urosalpinx* sp., *O. erinacea*, and *O. inornatus*. Species distribution is likely to increase in the near future by shellfish transport.

3.2 Crustacea

Hemigrapsus penicillatus

First reported in 1994 around La Rochelle harbour (Atlantic coastline), the crab *Hemigrapsus* then spread quickly northward to the Loire estuary and southward to Laredo (Spain). Since 1997, the species distribution has not shown further extension. In Northern Spain, strong populations of *Pachygrapsus marmoratus* tend to limit the *Hemigrapsus* spread (habitat competition) (P. Noel, pers. comm.). For unknown reasons, the northern distribution limit, southern Brittany, seems a significant obstacle for further colonization. In contrast, the species is proliferating in Le Havre harbour (Normandy, English Channel).

A first sighting of the crab *Rhithropanopeus harrisii* has been observed in the Berre Lagoon, near Marseille, Mediterranean Sea. This is the first report for Mediterranean France; it had been noted earlier in the 1990s in Italy.

3.3 Other Invertebrates

Polychaete Serpulidae: *Ficopomatus (Mercierella) enigmaticus*

This species was first noticed in France in 1921 (Fauvel, 1923). Local population outbreaks showing rapid build up were recently reported in the Bays of Veys and Honfleur harbor (Normandy), in southern Brittany (Lorient and Vannes harbours) and in the Atlantic southwest coast of France (Poitou-Charentes). Although without significant environmental impacts being reported, these outbreaks had several impacts on harbour management and structures (e.g., pipe clogging, blocking tide-gates) as well as on ships. The latter case facilitates spread by dispersal of mobile adults on ship hulls. A national monitoring and enquiry was carried out in 1999 to assess the species distribution and impacts. This facilitated the drawing of the first distribution map along the French coastline and the arrival timing. Actually this species is now well distributed along the English Channel, Atlantic coastline, and the Mediterranean Sea. Reaching southern Brittany around the 1970s, the species spread to the Southwest Atlantic coastline during the 1980s (1982) and was first observed in the Mediterranean lagoons in 1999.

3.4 Algae and Higher Plants

Caulerpa taxifolia

Since the first sighting of *Caulerpa taxifolia* on the French Mediterranean seaside, this species has extended its distribution considerably (4600 ha in 1998), colonizing areas in Croatia, Monaco, Italy, and Spain. An additional exotic species *C. racemosa* is presently observed in eastern Mediterranean Sea and was recently reported in Genoa (Italy) and Marseille (France). In 1998, several campaigns were carried out to assess the present distribution of *Caulerpa taxifolia* (4600 ha). First sightings of *Caulerpa* within dense *P. oceanica* seagrass was observed in 1998. Depth distribution showed *C. taxifolia* pieces down to 108 m, while the sampling was carried out to 182 m. The direct predation on *Caulerpa taxifolia* by the molluscan *Lobiger serradifalci* was confirmed. Several trials of destruction by using electrodes are currently under investigation. The second European research program LIFE aims to specify management tools to limit further expansion in the Mediterranean Sea. Although in progress, a report entitled “Controle de l'expansion de *Caulerpa taxifolia* en Mediterrane” was published.

4 LIVE IMPORTS AND TRANSFERS

4.2 Invertebrates

The Pacific giant octopus *Octopus dofleini* was imported from Canada to the Aquarium Nausicaa.

The shellfish farming industry imported Pacific cupped oysters *C. gigas* for direct marketing from Ireland, Portugal, Netherlands, and the UK.

A shellfish trade between Ireland, France, and Portugal is focusing on the abalone *Haliotis tuberculata*. Abalone juveniles are provided by an Irish hatchery, then imported for growing in France and Portugal. Moreover, illegal imports of the second species *Haliotis discus hannai* in culture in Ireland have been confirmed. Recent mortalities have affected *Haliotis tuberculata* in Brittany resulting from a Vibrio *V. courtier*, already described in Japan and known for inducing *H. discus hannai* mortality rates. On-going investigations aim to assess if a transfer of *H. discus hannai* could be considered as a healthy carrier for a bacterial transfer, which would then expressed itself in warmer sea waters.

6 PLANNED INTRODUCTIONS AND TRANSFERS

6.2 Invertebrates

Several strains of *C. gigas* were imported and are currently being held under total quarantine (closed system) at the IFREMER’s research hatchery in La Tremblade for genetic studies. A management plan is under progress aiming to transfer these strains which did not show any abnormal mortality rates, nor any pathogen, in spite of a comprehensive monitoring. Although based on the ICES recommendations, the plan will be proposed with further and stricter constraints.

7 MEETINGS, CONFERENCES, SYMPOSIA OR WORKSHOPS

Several meetings have been held in France among State Administrations and Research Institutes concerning the OSPAR Convention and the IMPACT Working Group (Working Group on Impacts on the Marine Environment). Invited by the French Ministry of Environment, 12 participating countries, the EU and ICES representatives, and non-governmental agencies (as observers) attended the meeting held in Brest (15–19 November 1999). The meeting focused on species and habitat protection following the adoption of the new OSPAR annex. Several issues were addressed including habitat and biogeographic zoning, species selection criterion, and objectives for the North Sea ecological quality, dredging, artificial reefs, exotic species introduction, GMOs, solid wastes.

MEPC (Marine Environment Protection Committee) meeting under the IMO in London, 10–13 March 2000. The ballast water issue was discussed and the French point of view presented (based on on-going studies).

Submitted by: P. Goulletquer

For further information: http://www.ifremer.fr

NATIONAL REPORT FOR GERMANY

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

No new accidental introductions were reported from German marine or brackish waters in 1999. The following paragraphs present news of previously reported non-indigenous species.

The oyster farm located on the island of Sylt in the North Sea is continuing its operation. Because of logistic problems of the German oyster farm, seed oysters had to be "parked" for a few days (up to two weeks) outside the hatchery in Northern Ireland. As a result non-target species were transmitted into the Wadden Sea: *Sargassum muticum, Ascophyllum nodosum, Aplidiumnordmanni* and *Styela clava* (see previous German National Reports). All species were previously introduced to the area due to shipping and other vectors. These unintentional introduced species constantly spread further.

Culturing the Pacific oyster resulted in increased settlement outside the farm particularly on mussel beds in the adjacent Wadden Sea. There, the oysters showed good growth and seem to have reached maturity while spawning may have taken place. The establishment of the species itself in the Wadden Sea occurred on hard substrates. So far the oysters have settled on the abundant mussel shells (Reise, pers. comm.).

3.1 Fish

The previously introduced goby (*Neogobius melanostomus*) first recorded in Poland is spreading further and was found near the island of Rügen (Germany).

3.2 Invertebrates

Teredo navalis

In former times it was believed that the ship worm *T. navalis* was not able to establish self-sustaining populations in the Baltic Sea and was re-introduced several times with water currents or ships' ballast water from the North Sea. Today, *Teredo navalis* can be considered as fully established with self-sustaining populations in western Baltic regions (Kiel Bight and east of Rostock). Repair costs of submerged wooden installations are estimated to be as high as 15 Million USD along the German Baltic shores annually.

Anguillicola sp.

The reported level of the swim bladder nematode infestation remains unchanged (up to 90 % of the eels caught are infested). In eutrophic freshwater lakes of northern Germany the ruffe (*Gymnocephalus cernuus*) continues to act as a reservoir of *A. crassus.*

Dreissena polymorpha

As in many other countries the zebra mussel is spreading and this seems to take place mainly at the fringes of previous distribution patterns in Europe. Several reasons for this behaviour can be considered: (1) improvement in water quality of some German rivers (Elbe and Weser Rivers) in the past few years, through additional urban waste water treatment plants installed in former Eastern Germany; (2) at present several companies in Hamburg harbour, which depend on a supply of cooling water, have suffered from extensive costs (an estimated 1 Million USD in 1999). In 1999, the Institute for Marine Research has undertaken a monitoring programme on the settling pattern of zebra mussels in the port of Hamburg which serves several industries. Distribution and growth at various sites including the cooling water systems were investigated over a period of 9 months (March–December 1999). The data are presently being analysed and will be reported next year. (3) There may be a re-introduction of zebra mussels to Europe from areas where the mussel was transmitted several decades ago (e.g., Great Lakes and Mississippi River basin): transport vector - modern shipping.

Eriocheir sinensis

Several specimens of the Chinese Mitten Crab were found in the Kiel Fjord in summer 1999. This has not been recorded since about 30 years ago. It is assumed that the recently found species document an increasing population in the Baltic spreading to more brackish areas along the German Baltic coast. At the end of 1999 one specimen of the genus *Eriocheir* was found that carried mitten-like claws but was of the size of juvenile *Eriocheir sinensis* which do not carry these kind of claws. It is suspected that this specimen may represent a closely related species and taxonomic identification of this specimen is presently under way (Senckenberg Institut, Frankfurt, Germany).

4 LIVE IMPORTS AND TRANSFERS

Aquaculture and power plants

Several aquaculture facilities are in operation (for more than 20 years) using warm water effluents of power plants. Species are cultured for the aquarium industry (ornamental species: koi carp, gold fish, sterlett), human consumption (carp, Tilapia species) and restocking (glass eels). Glass eels are imported from various countries according to the ICES Code of Practice. At a weight of 25 g the individuals are used for restocking in German inland waters. The total annual production in 1999 of all kinds of species cultured was approximately 250 tonnes.

4.1 Fish

Several sturgeon species are still imported from Russia by local farmers for small-scale culture, among them is the Siberian sturgeon *Acipenser baeri*. On and off there are records of captures of escapees although these are rare events.

Live salmon were imported from Sweden for human consumption in an unknown quantity, while eels are imported from Sweden and Italy. Sources of glass eels for the nursery systems supporting various stocking programmes of eels in Germany are difficult to trace, most of the consignments originate from Dutch, Irish or French sources.

4.2 Invertebrates

Live blue mussels (*Mytilus edulis*) were imported from Denmark for human consumption in an unknown quantity while German mussel production is to a large extent targeted for the Belgian and Dutch market.

Live crustaceans (*Nephrops norvegicus, Homarus gammarus, H. americanus, Callinectes sapidus* and *Cancer pagurus*) have been imported for human consumption from various countries in an unknown dimension. *Homarus* spp. originate mainly from Canada, Ireland, and Norway.

5 LIVE EXPORTS TO ICES MEMBER COUNTRIES

5.2 Invertebrates

Living juvenile Chinese Mitten Crabs were shipped to China for re-stocking purposes in 1998. Chinese authorities are concerned with gene-pool interactions with German and native individuals, but still consider importing specimens in huge quantities.

A German commercial fisherman holds a permit to ship 10 tonnes of adult crabs to China annually. Neighbouring countries (Taiwan, Korea and Japan) indicated their interest to import juveniles from Germany. Also, recent efforts in culturing this species in Southeast Asia signals the existence of a potential market.

7 MEETINGS, CONFERENCES, SYMPOSIA OR WORKSHOPS

7.1 EU Concerted Action "Testing Monitoring Systems for Risk Assessment of Harmful Introductions by Ships to European Waters" (See Section 11.1)

7.2 Genetic Studies on *Teredo navalis* and *Marenzelleria* spp.

Presently work is going on regarding genetic studies (including DNA fingerprints) on populations of *Teredo navalis* and *Marenzelleria* spp. in both the North Sea and the Baltic Sea.

7.3 Fishing People's Knowledge of Chinese Mitten Crab

A study gathering fishing people' information on the distribution and population density of the Chinese Mitten Crab in German waters during recent decades is in its final phase and will be ready for presentation shortly.

7.4 Competition Experiments with the Invader *Hemigrapsus penicillatus*

After its first record in Europe (1994 along the French coast near Bordeaux), the crab *Hemigrapsus penicillatus* was studied intensively. It was believed that the native European Shore Crab *Carcinus maena*s could be a competitor for food and/or habitats. After the spread of the invader it was clear that the crab might have the potential to successfully invade many European countries. Competition experiments between the invader and the native crab were carried out at the Institute for Marine Research, Kiel, Germany, using environments with different salinities and temperatures. Both species of crabs were placed together in little aquariums in different densities (1:3, 3:1 and 1:1 native and introduced crabs of the same size per aquarium). Preliminary results show that the invader is more successful than the native crab at higher temperatures (15 ºC and 20 ºC). At lower temperatures (5 ºC and 10 ºC) it was observed that the crabs attack each other, but none of the specimens were found dead in the aquariums.

7.5 NEOBIOTA Group

New German Group on Biological Invasions

Biologists and ecologists from Germany founded a research consortium on biological invasions. This group will coordinate responses to the ever increasing problems caused by the invasion of non-native plants, animals, fungi and micro-organisms. These "new species" (Neobiota) can threaten the biodiversity of existing native species, alter the structure and function of ecosystems, and can eventually cause severe economic and human health problems.

The scientists in the new group will work together on theoretical and applied aspects of biological invasions, but also aim at educating the public and consulting with policy makers.

The tasks of the consortium are as follows:

1) enhance communication and contact between scientists from different fields.
2) collect all available information on non-native species in Central Europe, their invasion pattern and their distribution. Identify information deficits and coodinate efforts to solve them.
3) disseminate and coordinate research progress on theoretical and applied aspects: causes, mechanisms, and effects of biological invasions; potential control methods.

Meetings of experts in the field will be held regularly. A conference in Berlin, with international participation, is planned for October 2000.

Coordinator of the group: Prof. Dr Ingo Kowarik, Institut für Ökologie und Biologie der TU Berlin, Rothenburgstr. 12, 12165 Berlin.

7.6 Marine Environment Protection Committee44 (MEPC44), International Maritime Organization (IMO), Ballast Water Working Group (BWWG)

Agenda Item 4 Harmful Introductions with ships

As during MEPC43, the topic "Harmful Introductions with Ships" was of great interest and as a result more and more nations became active members of the BWWG (especially in Mediterranean and Asian countries).

Topics discussed:

Chairs Concept (1. No uptake of ballast water, 2. No ballast water management action required (in an area), 3. All ships required to take some ballast water management action, and 4. Action required by some states and not others).

Application of arrangements: each country has the right to decide on restrictions consistent with criteria developed by IMO relating to the discharge of ballast water within its jurisdiction. Allow countries to agree on regional or bilateral approaches to ballast water management. There should be established a base (minimum) level of action/requirement for ships on international voyages that can carry ballast water. These requirements include:

i) vessels have a ballast water management plan and... record book;
ii) vessels have some ability to manage ballast water;
iii) vessels are required to manage sediment in an accepted manner in accordance with guidelines defined by IMO.

No agreement was reached how to include existing ships.

Development of standards for ballast water management:

1) Management practice for uptake of ballast water;
2) Management practice during discharge of ballast water;
3) Management of sediments;
4) Management approaches to minimise risk;
5) Ballast water management options;
6) Verification methodologies (including ship sampling).

Summary of European Union Concerted Action entitled: Introductions with ships, coordinated by Germany (see above). Of special interest were the results of the intercalibration workshops comparing the efficiency of previously used ballast water sampling techniques.

Outstanding key issues: Responsibilities of Flag States, Port States, Coastal States and the IMO, Implementation (existing and new vessels), Ballast Water Management Plan, Ballast Water Record Book and Entry into Force Provisions.

Suggested Timetable, Progression towards a diplomatic conference on ballast water. A schedule was submitted indicating that a diplomatic conference on ballast water might be possible at MEPC48, in 2002

7.7 IMO Workshop in the Black Sea

The purpose of this Workshop, beside fulfilling the request put forward at the Varna Workshop, was to raise awareness of problems regarding potential introductions of exotic species through ballast water and to improve the ability of participating countries to establish mechanisms whereby the unique ecology of the Black Sea and the Caspian Sea can be protected from further introductions of alien species through ships' ballast water.

The Workshop was funded by IMO's Technical Cooperation Fund and the United Nations Development Programme, and arranged by IMO in close cooperation with the Shipping Safety Inspectorate of Ukraine and Dr Stephan Gollasch, IMO consultant. Forty participants from Azerbaijan, Bulgaria, Georgia, Germany Kazakhstan, Lithuania, Romania, Russian Federation, Turkey, Turkmenistan, Ukraine, and IMO attended the Workshop.

7.8 EU IMPACT Cluster

The first meeting of the IMPACTS cluster was held in Brussels on 2 March 2000 and was organised by the European Commission/DG RTD-D1. IMPACTS is a new cluster formed following FP-V requirements and objectives. It includes projects on anthropogenic impacts on the marine environment under the Environment and Sustainable Development Programme. It integrates studies on marine pollution, contaminant transport, ecotoxicology, and key element cycling. Members of the following projects were involved (in alphabetical order):

ACE (Assessment of antifouling agents in coastal environments),
BIOHAB (Biological control of harmful algal blooms in European coastal waters: role of eutrophication),
21BIOMARK (Biomarkers in marine sponges),
CA (Concerted Action) Introductions with ships,
CYCLOPS (Cycling of Phosphorus in the Mediterranean),
EUROHAB (European Initiative on Harmful Algal Blooms),
MARA,
MATBIOPOL (Role of microbial mats in bioremediation of hydrocarbon-polluted coastal zones),
MEAD (Marine Effects of AtmosphericDeposition),
MEDAR,
MEDNET,
NUTOX (Effect of nutrient ratios on harmful phytoplankton and their toxin production),
SIGNAL (Significance of external/anthropogenic nitrogen for Central Baltic Sea N-cycling).

Key objectives of the IMPACT Cluster are:

- management models of transport pathways and impacts of pollutants, key elements and nutrients in marine environments;
- development of strategies for dealing with anthropogenically caused environmental degradation;
- scenario of socioeconomic benefits arising from the reduction of anthropogenic effects;
- exchange of data between the projects;
- plan synergy affects due to merged and complimentary issues;
- coordination of publications from projects in the Cluster.

Meetings of the IMPACT Cluster group are planned annually or semi-annually.

7.9 North Sea 2000

A conference on broad environmental issues regarding the North Sea will be held in May 2000, in Wilhelmshaven, Germany. A session on ballast water is scheduled. A presentation, entitled “How to investigate life in ballast tanks”, will be prepared by S. Gollasch.

7.10 ASLO 2000

A conference on environmental issues will be held in June 2000 in Copenhagen, Denmark. A session on ballast water is scheduled. A “special symposium on aquatic species invasions” will be held. A presentation entitled: “Life in ballast tanks” will be prepared by S. Gollasch, H. Botnen, S. Olenin, M. Robertson, and J. Hamer.

7.13 BMB meeting Klaipeda 1999

Results of the Concerted Action “Introductions with Ships” were presented at the meeting. A manuscript was submitted.

Submitted by: S. Gollasch and H. Rosenthal

2 DELIBERATE INTRODUCTIONS AND TRANSFERS

2.1 Invertebrates

The abalones *Haliotis tuberculata* and *H. discus hannai* continue to be cultivated on west, southwest, and south Irish coasts.

The clam *Venerupis philippinarum* is cultivated using hatchery seed. This is grown under mesh in a number of bays and estuaries on all Irish coasts. The brown-ring disease-like symptoms in clams on the northwest Irish coast may be from an endemic and less virulent form of the disease.

The Pacific oyster *Crassostrea gigas* is produced in Irish hatcheries and is also imported from France. Cultivation takes place on all Irish coasts with the main production from Carling Ford Lough (east coast) and Dungarvan Bay (south coast). At a recent meeting with Irish oyster growers, they were advised against bringing in half-grown oysters because of the high risk of importing unwanted biota and that samples of imported seed would continue to be examined.

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.1 New Toxic Events

Amnesic Shellfish Poisoning (ASP) was detected in *Pecten maximus* at the end of 1999, mainly around the west coast of Ireland and closures of certain areas are still in force. The causative agent is the diatom *Pseudonitzchia* sp., which is present around the coast, where there are both toxic and non-toxic forms of certain species which cannot be distinguished through routine microscopic observation. Therefore it is proposed to use RNA probes developed in California as an early warning monitoring system. Results are given by colourimetric, radiometric and epifluorescence responses to antibodies, lectins, and nucleic acids of each *Pseudonitzchia* sp.

A new toxin ASP in 1995 caused 8 people in the Netherlands to report symptoms similar to those of DSP after eating mussels from Killary Harbour, Ireland. Five years later, the Azaspiracid toxin now has three analogues and due to the similar effects caused by DSP poisoning it is thought to be caused by a dinoflagellate species, but presently no phytoplankton species can be ascribed as the causative organism Though present around the coast of Ireland, it is primarily dominant in the north west. In the last year a standard of the toxin has been isolated, and current work is involved in finding the appropriate monitoring test for this toxin and defining safe levels for human consumption.

3.2 Invertebrates

The parasite of eels, *Anguillicola crassa*, has been found on the Shannon River, Lower Lough Erne in 1998 and 1999 and there are unconfirmed reports that it was found in the Barrow in 1997 or 1998. It may have been carried to Ireland by trucks transporting eels or by ships' ballast water.

The zebra mussel, *Dreissena polymorpha*, has expanded its population but retained its known range to inter-navigable areas. It is now presently known from the lakes or reservoirs of the midlands, west or south. This may be due in part to the public information campaign.

4 LIVE IMPORTS AND TRANSFERS

4.2 Invertebrates

Pacific oyster seed continues to be imported from France and the UK.

5 LIVE EXPORTS TO ICES MEMBER COUNTRIES (AND OTHER AREAS)

5.1 Fish

Salmon eggs have been exported to Chile. There is presently no known account of ISA in Ireland.

5.2 Invertebrates

No significant changes since last year

7 MEETINGS, CONFERENCES, SYMPOSIA OR WORKSHOPS

10th International Congress on Marine Corrosion and Fouling, Melbourne (February 1999). The presentations consisted of new paint coatings, corrosion, effects of TBT, biochemistry and biofilms and some papers on fouling and exotic species movements. Selected papers will be published (paper by D. Minchin and S. Gollasch on hull fouling and exotic species transmittal).

Best management practices for controlling invasive alien species, Cape Town (February 2000). This meeting reviewed aliens and management policies for reducing the risk of their entry or of control methods once they became established in the terrestrial and freshwater and marine environments.

Submitted by: D. Minchin and D. Clarke

NATIONAL REPORT FOR ITALY

1 LAWS AND REGULATIONS

Italy has subscribed to the 1992 Rio Convention which was ratified by law No. 124 on 14 February 1994. This implies the forbiddance to introduce alien species.

Italy has subscribed on 24 November 1996 to a Protocol for Protected Areas and Biological Diversity in the Mediterranean issued during the Convention for the Protection of the Mediterranean Sea against Pollution held in Barcelona (Spain) in June 1995. The Protocol considers (Art. 13) the adoption of measures to prevent the voluntary or accidental introduction of non-indigenous species and the eradication of introduced species that cause nuisance.

2 DELIBERATE INTRODUCTIONS AND TRANSFERS

2.1 Fish

No indications of deliberate release of marine fish.

2.2 Invertebrates

The main species of invertebrate introduced in the open environment for fishery are the bivalves *Crassostrea gigas* and *Tapes philippinarum*. *Crassostrea gigas* was introduced in 1960 in the Northern Adriatic, from Atlantic cultures. It is now largely widespread, colonizing all the Northern Adriatic lagoons, having supplanted the native *Ostrea adriatica* (=*edulis* ?) whose populations were already rather scanty. *Tapes philippinarum* in some cases is cultivated in ponds, without control of possible release to the open environment, but in the majority of cases it has been seeded deliberately in open waters. It was first introduced in the year 1983 as an experiment in one island outside Venice and was subsequently seeded over large areas of the main Northern Adriatic Lagoons. The catch of the Japanese clams has since then increased, supplanting the catch of the native clams such as *Tapes decussatus* and *Venerupis aurea*, whose populations had been declining already before the introduction.

Very dense populations have established in many brackish water areas, especially in the Lagoon of Venice and the Po River Delta. Such populations may be highly fluctuating, both under the over-exploitment pressure and due to the anoxic crises experienced in the area. In recent years, and notably in 1999, import of adults or seed has ceased because the natural recruitment in the Italian areas is very strong. The data on the catch of this species are controversial and might be substantially incorrect: yield estimates of 6000 metric tonnes for the years 1995 to 1997 have been made. For the year 1999 yield estimates of 25 000 metric tonne in the lagoon of Venice and 17000 metric tonnes in the area of the Po River Delta have been reported. The catch increment between 1987 and 1997 has been about 150 times.

No mention of parasites has been yet reported, while many parasites such as the platyhelminths *Bacciger* and *Stylochus* and the protozoans *Ancistrocoma* and *Nematopsis* are known for the native clams.

The prawn, *Marsupenaeus japonicus*, was introduced at the end of the 1970s owing to its higher growth rate by comparison with the native *Penaeus kerathurus*. It is reared in many aquaculture plants (estimated production in 1997: 19 tonnes; in diminution with reference to 1989: 34 %), and might become an introduction, being already known from the eastern basin of the Mediterranean, entering from the Suez Canal. In fact, it has been recorded in an open habitat only once. *Penaeus monodon* was introduced for aquaculture at the end of the 1980s, but failed to give the expected results, as it does not adapt to the Mediterranean climate.

2.3 Algae and Higher Plants

No indications have been given of deliberate introductions of marine plants or algae.

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.1 Fish

Twelve species have been reported (8 from the tropical Atlantic region, 3 from the Indo-Pacific and 1 from the American Atlantic region). At present only one species, *Seriola fasciata*, can contribute to fisheries.

3.2 Invertebrates

Many species of invertebrates have been reported as introduced in recent years.

A complete list is in preparation under the project of the International Commission for Exploration of the Mediterranean Sea and the data gathered are available in the checklist of species at: www.ciesm.org/atlas/index.html.

A few species will be commented on here, among those considered by the SIBM group.

The Sabellid Polychaete *Branchiomma luctuosum*, whose origin is probably from the expansion of Red Sea species into the Mediterranean through the Suez Canal (the so-called lessepsian introduction), is common and abundant in harbours and lagoons. Another five species whose putative origin is the lessepsian migration are known.

Among Polychaetes some fouling species have been introduced, the most common being *Spirorbis marioni* and *Pileolaria berkeleyana* that are found both on ship and boat hulls and in hard substrata of harbours.

The mud-inhabiting Sabellidae, *Desdemona ornata* (origin from South Africa and Australia), has been commonly found in brackish environments along the Tyrrhenian coast and later in southern England.

Another three species have been recorded in a survey of a small harbour.

The whelk, *Rapana venosa* (Mollusca Gastropoda), is known since 1973 in the Northern Adriatic. It is widespread along the Northern Adriatic coast (including the lagoon of Venice), both on the Italian side and the Slovenja coast (1997). One specimen has also been found near Elba Island in the Tyrrhenian Sea.

The soft-bottom clam, *Scapharca* (= *Anadara*) *inaequivalvis* (Mollusca Bivalvia), was recorded for the first time in 1969. The means of introduction has probably been through ballast water discharge from ships in the harbours of the Emilia coast. It is very abundant on muddy bottoms of the Northern Adriatic, where it can easily survive to the dystrophic crisis due to high resistance to anoxic conditions (presence of hemoglobin as respiratory pigment in the haemolymph). It is widespread in many North Adriatic Lagoons, including Venice, and has also been caught also in Southern Adriatic (Bari). It is a nuisance for the fishery of edible clams, because it entangles the screens of drums of the turbo-suction devices.

The mussel, *Musculista senhousia* a lessepsian species, found in the Mediterranean for the first time in 1973 along Israel coasts, starting from the 1980s was also found in brackish basins near Ravenna (Northern Adriatic). It is commonly found in association with the native *Mytilus galloprovincialis* cultivated in long lines in the Northern Adriatic Sea. Through the transport of seeds of *Tapes* or *Mytilus* it has spread also in the Tyrrhenian Sea (coasts of Sardinia). Recent unpublished data for the Sacca di Goro (Po River Delta) indicate a patchy distribution on the soft bottom, locally attaining a density of 1000 ind. m^{-2} and therefore competing for space with *T. philippinarum*.

Another eight species of non-indigenous molluscs are known for the Northern Adriatic, including those introduced for aquaculture as commented before. Another 11 species have been recorded in other Italian seas (see Appendix 1.2).

Dreissena polymorpha, widespread in Italian freshwater environments, has been found only occasionally in oligohaline sectors of the Po River Delta.

Tricellaria inopinata (Bryozoa) was recorded in the Lagoon of Venice in 1982 and has been monitored regularly in its invasion of the Lagoon. It has been found also in the Lagoon of Grado and in Southern England.

One other species of Bryozoa has been recorded from the Lagoon of Venice. Another species of Bryozoa has been recorded in a small island near Sicily.

Acartia tonsa (Crustacea, Copepoda) was first found in the plankton of the Lagoon of Scardovari (Northern Adriatic) in 1987 and has since then supplanted the native congeneric *Acartia margalefi* in the lagoons of the Po River Delta and in the Lagoon of Venice. The way of introduction is probably via aquaculture products.

Two other copepods, *Acartia grani* and *Pteriacartia josephinae*, have been reported for the Ligurian Sea in 1997. The latter was first reported in 1974 from the Tyrrhenian Sea.

Dyspanopeus sayi (Crustacea, Decapoda) from the NW Atlantic is the most widespread crab in the Lagoon of Venice, largely exceeding the numbers of the native crabs *Carcinus mediterraneus* and *Pilumnus hirtellus*. It is also known from another Northern Adriatic Lagoon (Marano).

Callinectes sapidus from the NW Atlantic has been repeatedly recorded in the Adriatic and also in other seas.

Rhithropanopeus harrisii has been recorded in the Lagoon of Scardovari (Northern Adriatic).

Pilumnus inermis was found for the first time in 1987, in the Messina Strait. It entered the Mediterranean through Gibraltar and has now a table population in Messina and has been found in other Southern Tyrrhenian locations. In the recent past *Portunus pelagicus* reached the eastern coast of Sicily where for a short time it sustained a local fishery.

Another ten species of decapods have been recorded since 1950 scattered occasions (Appendix 1.2).

The most recent invader is *Percnon gibbesi* found at Linosa Island in summer 1999.

Phytoplankton

Some species of the genus *Alexandrium* have been reported in the Northern Adriatic, that are followed very intensely because they can induce PSP (Paralytic Shellfish Poisoning). They might have been introduced through the discharge of ballast water or introduced with molluscs.

Phytobenthos

Green algae

Caulerpa taxifolia has continued its invasion from the French area of the Ligurian Sea into Italian waters in the years 1991–1992. Since then it has expanded along almost all the coasts of Italy and has recently been found in the Messina Strait. It forms very large populations in the infralittoral fringe.

Another species of *Caulerpa, C. racemosa*, of tropical and subtropical origin, has been recorded in various localities along the Italian coasts since 1993. Its rapid expansion has been related to the fishery activities that remove the alga and release it in other zones.

Brown algae

Undaria pinnatifida and *Sargassum muticum* have built large populations in the Lagoon of Venice, starting from 1992. They have been introduced unintentionally, probably via the fouling of ship hulls or the import of cultivated molluscs.

Another 27 species of non-native algae have been recorded (Appendix 1.1).

4 LIVE IMPORTS AND TRANSFERS

4.2 Invertebrates

Worms used as live baits are commonly introduced from tropical areas. They are polychaetes of the family Nereidae from the tropics, especially *Perinereis vancaurica*, or the North American *Glycera dibranchiata*. No new introductions have been yet recorded, but polychaetes have a good potential for spreading, also due to their regenerative capabilities even from body fragments.

Crayfishes: *Homarus americanus* is commonly imported and held in aquaria of traders or restaurants. Less common are *Jasus ialandi* and *Panulirus* spp. from Africa.

Crabs: *Cancer pagurus* is imported and has been occasionally recorded in the environment.

6 PLANNED INTRODUCTIONS AND TRANSFERS

6.2 Invertebrates

The lobster, *Homarus americanus*, is imported live for consumption and held in aquaria until consumption. Requests for using this species for restocking the natural populations of *Palinurus vulgaris* have been repeatedly put forward by fishermen or divers associations.

7 MEETINGS, CONFERENCES, SYMPOSIA OR WORKSHOPS

Selected papers of the Symposium “Ecology of invasions: Patterns and Perspectives” (VII International Congress of Ecology, Florence, July 1998) are currently being printed in an issue of Biological Invasions (Kluwer Press).

The Italian contribution to the CIESM Atlas Series on Exotic Species in the Mediterranean Sea is organized through correspondents who cover all the major taxonomic groups. Moreover three Italian scientists (Carlo Froglia, Gianni Russo, Lidia Relini Orsi) coordinate or take a part in the Scientific Committee regarding Decapods, Molluscs and Fishes (see: www.ciesm.org/atlas/index.html).

The Italian Ministry for the Environment (Inspectorate for the Defence of the Sea) has contracted the Italian Society of Marine Biology as a consultant for preparing the information basis and guidelines for regulatory activities in the field of marine biological invasions. The work will encompass both review of existing information and experimental monitoring (Giulio Relini and Anna Occhipinti).

The study group of the Italian Society of Marine Biology on invasive species has met at Vibo Valentia (Calabria) in June 1999 and has organised the preparation of this report and of the compilation of sheets on the main introduced species.

Two research programmes on fish introductions have been launched in 1999 by ICRAM (Central Institute for Applied Sea Research) having the aim of studying the impact on native fisheries of expanding thermophilous fishes and the risk of hybridization and competition.

APPENDIX 1

Provisional list of non-native marine species in Italian marine environments.

1.1 ALGAE

Acanthophora najadiformis (Delile) Papenfuss +
Acrothamnion preissii (Sonder) E.M. Wollaston ++
Agardhiella subulata (C.Agardh) Kraft et M.J. Wynne
Aglaothamnion feldmanniae Halos
Antithamnion amphigeneum A. Millar
Antithamnion pectinatum (Montagne) Brauner in Athanasiadis et Tittley

Antithamnionella spirographidis (Schiffner) E.M. Wollaston
Asparagopsis armata Harvey ++
Bonnemaisonia hamifera Hariot
Caulerpa taxifolia (Vahl) C. Agardh ++
Caulerpa racemosa (Forsskæl) J. Agardh ++
Caulerpa scalpelliformis (R. Brown ex Turner) C. Agardh +
Chondria pygmaea Garbary et Vandermeulen
Codium fragile (Suringar) Hariot ssp. *tomentosoides* (Goor) P.C. Silva +
Colpomenia peregrina Sauvageau +
Grateloupia doryphora (Montagne) M. Howe +
Griffithsia corallinoides (Linnaeus) Trevisan
Ectocarpus siliculosus (Dillwyn) Lyngb. var. *hiemalis* (Crouan frat. ex Kjellm.) Gallardo
Halophila stipulacea (Forsskæl) Ascherson
Hypnea spinella (C. Agardh) Kützing
Lophocladia lallemandii (Montagne) F. Schmitz ++
Padina boergesenii Allender et Kraft
Plocamium secundatum (Kützing) Kützing
Polysiphonia fucoides (Hudson) Greville +
Punctaria tenuissima (C. Agardh) Grev.
Radicilingua thysanorhizans (Holmes) Papenfuss
Sargassum muticum (Yendo) Fensholt
Solieria filiformis (Kützing) Gabrielson +
Sorocarpus sp.
Undaria pinnatifida (Harvey) Suringar
Womersleyella setacea (Hollenberg) R.E. Norris ++

note: + = species known to be invasive; ++ =highly invasive species.

1.2 INVERTEBRATES

CNIDARIA

Garveia franciscana (Torrey)
Diadumene cincta Stephenson

ANNELIDA, POLYCHAETA

Amphicorina eimeri (Lagerhans)
Branchiomma luctuosum (Grube)
Desdemona ornata Banse
Lumbrineris inflata Moore
Lysidice collaris Grube
Metasychis gotoi (Izuka)
Monticellina dorsobranchialis (Kirkegaard) (=*Tharyx heterochaeta*)
Notomastus aberrans Day
Pileolaria berkeleyana (Rioja)
Rhodine gracilior Tauber (=Rhodine loveni)
Spirorbis marioni Caullery and Mesnil
Streblosoma hesslei (Day)

BRYOZOA

Celleporella carolinensis Ryland
Tricellaria inopinata d'Hondt et Occhipinti
Arachnoidea protecta (Harmer, 1915)

PYCNOGONIDA

A*mmothea hilgendorfi* (Bähm)
Anoplodactylus californicus (Hall, 1912)

CRUSTACEA, PERACARIDA

Paracerceis sculpta (Holmes)
Elasmopus pectenicrus (Bate)
Caprella scaura Templeton

CRUSTACEA, DECAPODA

Callinectes danae Smith, 1869
Callinectes sapidus Rathbun, 1896
Dyspanopeus sayi (Smith, 1869)
Marsupenaeus japonicus (Bate, 1888)
Percnon gibbesi (H. Milne, Edwards, 1853)
Pilumnus inermis A. Milne Edwards and Bouvier, 1894
Portunus pelagicus (Linnaeus, 1758)
Rhithropanopeus harrisii (Gould, 1841)
Scyllarus caparti Holthuis, 1952
Sternodromia spinirostris (Miers, 1881)
Thalamita gloriensis Crosnier, 1962

MOLLUSCA, BIVALVIA

Anadara inaequivalvis (Bruguire, 1789)
Brachidontes pharaonis (Fisher, 1870)
Crassostrea gigas (Thunberg, 1793)
Eastonia rugosa (Helbling, 1779)
Musculista senhousia (Bensor in Cantor, 1842)
Perna picta (Von Born, 1778)
Pinctada radiata (Leach, 1814)
Saccostrea cucullata (Born, 1778)
Tapes philippinarum (Adams and Reeve, 1850)
Xenostrobus securis (Lamarck, 1819)

MOLLUSCA, GASTROPODA

Bursatella leachii De Blainville, 1817
Cerithium scabridum Philipppi, 1848
Chromodoris quadricolor (Rueppell and Leuckart, 1828)
Crepidula fornicata (Linnaeus, 1758)
Hipponix conicus (Schumacher, 1817)
Odostomia (Megastomia) cfr. *sicula* Philippi, 1851
Polycerella emertoni Verrill, 1881
Rapana venosa (Valenciennes, 1846)
Rissoina spirata (Sowerby, 1820)
Sclerodoris cfr. *tuberculata* Eliot, 1904

TUNICATA

Botrylloides violaceus Oka, 1927

1.3 FISHES

Abudefduf vaigiensis (Quoyand Gaimard)
Beryx splendens Lowe
Chaunax pictus (Howe)
Diodon hystrix (L.)
Pinguipes brasilianus Cuvier and Valenciennes
Pomadasys stridens (Forsskæl)
Pristis pectinata Latham
Rhizoprionodon acutus (Rüppel)
Seriola fasciata (Bloch)
Sphoeroides pachygaster (Muller and Troshel)
Sphyrna mokarran (Rüppel)
Synagrops japonicus (Doderlein)

NATIONAL REPORT FOR THE NETHERLANDS

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.1 Fish

In November 1998, a North American striped bass *Morone saxatilis*, length 29 cm, was caught in a fyke net near the Afsluitdijk (the dike separating the Dutch Wadden Sea from Lake IJssel) in Lake IJssel during an investigation on migrating, non-commercialy fished species in Lake IJssel.

3.2 Invertebrates

In this and the following section, reference is made many times to different water bodies in the Delta area in SW Netherlands. Of these water bodies, Lake Grevelingen is a stagnant saltwater lake, flushed once a year with North Sea water, the Oosterschelde is a marine tidal basin and Lake Veere is a stagnant brackish lake with some exchange with the Oosterschelde.

After the first record in 1983 of the North American polychaete *Marenzelleria* cf. *wireni* in the Ems-Dollard estuary (NE Netherlands) mean annual biomass increased steadily during 6 years and then remained fairly constant (10–12 g AFDW m^{-2}) during another period of six years. Since 1995, however, mean annual biomass of *Marenzelleria* cf. *wireni* in the Ems-Dollard has been decreasing at about the same rate as populations were built up during the 1980s; in 1998 mean annual biomass was 2 g AFDW m^{-2}.

The first records of *Marenzelleria* cf. *wireni* in the western Dutch Wadden Sea date from 1989 and in 1998 mean annual biomass was estimated to be 12 g AFDW m^{-2}. In SW Netherlands *Marenzelleria* cf. *wireni* was found in 1995 in the Voordelta andin the Westerschelde estuary and in 1997 in the Rotterdam Waterway. Interestingly, there was an observation in 1993 of one specimen in the channel connecting the seaport IJmuiden with Amsterdam, in time and geographically just between the first observations in the western Wadden Sea and in southwestern Netherlands (David Tempelman (Aquasense, Amsterdam), pers. comm.).

Between 1995 and 1999 the Japanese oyster, *Crassostrea gigas*, was found in at least 8 localities in the Dutch Wadden Sea. In October 1998/March 1999 populations near Texel and in the Ems estuary were most probably 4 years old. In southwestern Netherlands, *Crassostrea gigas* was imported by fishermen during the 1960s. Wild grown *Crassostrea gigas*, however, became very abundant in Lake Grevelingen, in the Oosterschelde and in the Westerschelde. Recently, fishermen becameconcerned at the explosive rate of growth. In Lake Grevelingen *Crassostrea gigas* may become a competitor for food for the native flat oyster, *Ostrea edulis*, and the blue mussel, *Mytilus edulis*, both commercially cultured in this lake.

After its introduction and spread during theearly eighties in Dutch coastal waters the American razor clam *Ensis directus* continues to be an abundant species in the DutchWadden Sea and coastal waters. Perhaps less known is the establishment of *Ensis directus* in Lake Grevelingen, in the Oosterschelde and in themouth and more saline parts of the Westerschelde Estuary. In general, densities in the last mentioned areas are between 50 and 900 animals m^{-2}. Nowadays, *Ensis directus*, is used as a food item by oystercatchers and gulls. Since 1986 *Ensis directus* is commercially fished on a small scale in thecoastal zone between Hoek van Holland and Belgium.

During the last century, the hard-shell clam *Mercenaria mercenaria* was introduced for commercial purposes into various places in Europe and in 1954 also into the Oosterschelde. In December 1995 live *Mercenaria mercenaria* were found in the eastern part of the Oosterschelde (Hoge Kraayer) when testing a lugworm excavator. Measured dimensions (greatest length) were 80, 94, 105, 110, and 111 mm. There are no recordings of juveniles from this or other areas in The Netherlands. Very probably the clams in the Oosterschelde were remains of this original introduction.

Since December 1996 fresh looking shells (paired and single valves) of the common basket-shell *Corbula gibba* have been found on the beaches of the province of Zeeland (SW Netherlands). More to the north more than 2000 fresh-looking shells (paired and single valves) of *Corbula gibba* were collected at the Maasvlakte near Rotterdam during the period September 1998 to September 1999. In 1998 a fresh-lookingjuvenile pair of *Corbula gibba* shells was found at the beach of Heist and in the port of Zeebrugge approximately 10 live specimens of *Corbula gibba* were found (both locations in Belgium). And there are more observations, also from offshore. Less well known is the presence of *Corbula gibba* since 1990 in Lake Grevelingen, in the northern branch of the Oosterschelde and in Lake Veere. Despite intensive zoobenthos surveys during the period 1959–1986 this bivalve was never found in these areas. Since 1990 densities have been between 50 and 1000 animals m^{-2}, but values of several thousands (maximum 6400) animals m^{-2} also regularly occur.

In 1999 at least 4 blue crabs *Callinectes sapidus* were caught in The Netherlands. In August 1999 two blue crabs were caught in fyke nets near the port area of Terneuzen: one female (carapace 165 mm) at Hoek and one male (carapace 195 mm) at Griete. The female was carrying eggs and, as far as known, this is the second observation of an egg-carrying female inThe Netherlands. In October of the same year fishermen caught one blue crab in coastal waters between Ouddorp and Hoek van Holland and 1 blue crab at Hoek van Holland. Almost certainly also blue crabs (and Chinese mitten crabs) were caught in fyke nets in the Rotterdam Waterway area.

3.3 Algae and Higher Plants

The number of newly arrived algae in SW Netherlands is steadily increasing. All first recordings of the species described in this section were done by Dr H. Stegenga (National Herbarium, Leiden, The Netherlands). Only species that are more or less classified as alien are mentioned here.

In March 1999 approximately 15 sporophytes of the Japanese kelp *Undaria pinnatifida* (Phaeophyta) with a length of approximately 60 cm were found in former oyster ponds near Yerseke, attached to shells. In May of the same year, one sporophyte with a length of approximately 50 cm was found at a depth of 4 m near Strijenham. Both locations are situated in the Oosterschelde. These are the first finds of *Undaria pinnatifida* in The Netherlands.

The NW Pacific *Leathesia verruculiformis* (Phaeophyta) has been found every year since 1994 in Lake Grevelingen and also in the Oosterschelde, as an epibiont on thee stablished brown alga *Sargassum muticum*.

Asperococcus scaber (Phaeophyta), a species described for the Adriatic Sea, was recorded in 1998 in Lake Grevelingen.

Acrochaetium balticum (Rhodophyta), originally described for the Baltic and later also reported from the west coast of Norway, was found in 1998 in brackish Lake Veere.

Since its discovery in 1993 the NE Pacific *Polysiphonia senticulosa* (Rhodophyta) has spread over the entire Oosterschelde and in 1998 this species was one of the aspect—determining species at location Strijenham. Until now the Oosterschelde is the only known location in Europe where *Polysiphonia senticulosa* has been found.

In December 1998 *Agardhiella subulata* (Rhodophyta), a North American species, was discovered in the Oosterschelde at Yerseke, attached to shells.

Submitted by: L.P.M.J. Wetsteyn

NATIONAL REPORT FOR NORWAY

1 LAWS AND REGULATIONS

No new laws or regulations regarding matters relevant to WGITMO have been proposed or passed in 1999.

2 DELIBERATE INTRODUCTIONS AND TRANSFERS

2.2 Invertebrates

130 000 microtagged lobster (*Homarus gammarus*) juveniles were released around the Kvitsøy islands from 1990 to 1995. The recapture through 1999 represents 5 % of the released lobsters, the highest recapture number ever recorded for lobster releases of this magnitude. Some of the later cohorts are still under the minimum legal size (25 cm) and will enter the recapture fraction in the years to come. In 1999, more than 75 % of the captured lobsters below minimum size were from the released stock.

According to capture trial records, the population of the introduced Red King crab (*Paralithodes camtschatica*) in the northern Norwegian coastal area east of the Varangerfjord is still growing considerably. A trial catch of 75 000 specimens is equally divided between a limited number of Russian and Norwegian fishermen. The core area is still east of Nordkapp, but some westward migration has been reported. Studies of biological impacts are planned, but the most apparent impact is considerable damage to the nets of fishermen fishing for other species (Jan Sundet (Univ. of Tromsø), pers. comm.).

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.2 Invertebrates

No signs of further migration from the Kvitsøy area of the slipper limpet *Crepidula fornicata* have been reported.

No further information on catches of the snow crab (*Chionoecetes opilio*) has been obtained.

A caprellid not previously observed in Norway was found by a German student: Stefan Heilscher, in Austevoll in August 1999. Dense populations were observed on the nets of several salmon farms. The collected specimens were identified as *Caprella mutica* Schurin 1935, by Dr Ichiro Tacheuci, Otsushi Marine Research Center, Univ. of Tokyo. *C. mutica* is a species naturally belonging to the North Pacific. These specimens were also similar to previously collected specimens from the Netherlands described as *Caprella macho* nov. spec. (Platvoet *et al*., 1995). The particular appearance of *C. mutica* corresponds very well with the observations of the red algae *Dasysiphonia* sp. (Section 3.3).

Two specimens of either American lobster (*Homarus americanus*) or a hybrid of the former and European lobster (*Homarus gammarus*) were found last year in Oslofjorden. White muscle of one of the collected specimens (and European lobster as a control) was analyzed by starch gel electrophoresis for enzyme loci for 6 genetic systems: sMEP*, IDHP*, GPI-1*,GPI-2*, PGM-1* and PGM-2. Both in the GPI-2* and the PGM-2* systems, the sample was homozygous for an allele which has previously not been found in the European lobster. The two new alleles GPI-2*111 and the PGM-2*109, are probably identical with the most frequent alleles for these two loci in the American lobster, as reported by Tracey *et al.* (1975). New samples of the specimen will be conducted and the genetic mapping of European lobster will be facilitated through a largeEC project. In the project, both enzyme systems, mDNA and microsatellite DNA will be analysed (K. Jørstad (IMR), pers. comm.).

3.3 Algae and Higher Plants

Sargassum muticum is well established in the southern part of the Norwegian coast (Skagerrak). Recently, the alga has also been found in large quantities on the western coast in Rogaland and Hordaland. The northern movement in the establishment of the species is suggested by new observations on the northern side of Sognefjord (T.E. Lein (Univ. of Bergen), pers. comm.), indicating that the algae has the potential to spread even further. No reports of further northward migration have been obtained.

A novel species for Norwegian waters, the red alga, *Dasysiphonia* sp. (Dasyaceae, Rhodophyta), was found in 1996 and reported last year (Lein, 1999, Sarsia 84(1): 85–88). The alga occurs naturally in the Pacific, but was found in the Netherlands in 1994, (Stenega *et al.*, 1997). The alga has very likely arrived either in ballast water, or as an epibiont on a ship's hull. During recent years, the alga has seemingly established itself in many areas around Bergen and is now fairly common (T.E. Lein, pers. comm.).

4 LIVE IMPORTS AND TRANSFERS

4.1 Fish

Species	Numbers	Country of origin
Halibut (*Hippoglossus hippoglossus*)	70 litre eggs (2.8 mill)	Iceland
Turbot (*Scophthalmus maximus*)	1200 juveniles	France
Turbot (*Scophthalmus maximus*)	600 juveniles	Iceland
Sea bass (*Dicentrarchus labrax*)	1000 juveniles	?
Sea bass (*Dicentrarchus labrax*)	1500 juveniles	France
Sea bass (*Dicentrarchus labrax*)	5	Malta
Sea bream (*Sparus aurata*)	5	Malta

It is possible that an import of fertilized eggs of the Atlantic halibut occurred from Iceland to Norway.

4.2 Invertebrates

Species	Numbers	Country of origen
"Crab" (non-specified species)	20	Sweden

One of the possible explanations for the discovered American (or hybrid) lobster (Section 3.2) is an alleged release of imported live American lobsters from a fish market in Oslo.

5 LIVE EXPORTS TO ICES MEMBER COUNTRIES

5.1 Fish

Species	Numbers	Recipient country
Atlantic salmon (*Salmo salar*)	Unknown amount	Chile

6 MEETINGS, CONFERENCES, SYMPOSIA OR WORKSHOPS

Several meetings in the EU Concerted Action Testing monitoring systems for Risk Assessment of Harmful Introductions by Ships in European Waters were held, and H. Botnen (Univ. of Bergen) participated.

Representatives from the Directorate for Nature Management, Environmental Department and Directorate for Shipping participated in the IMO MEPC (Marine Environmental Protection Committee) meeting in London, where the Norwegian views on ballast water issues were pressented.

Two papers were presented at the 9th Int. Zebra Mussel and Aquatic Nuisance Species Conference, 26–29 May 1999, Duluth, Minnesota (Jelmert, 1999a, 1999b).

Submitted by: A. Jelmert

NATIONAL REPORT FOR POLAND

1 LAWS AND REGULATIONS

Polish regulations on fish and fish products are being continuously adjusted to the rules, which are in force in European Union countries.

2 DELIBERATE INTRODUCTIONS AND TRANSFERS

2.1 Fish

368 708 salmon (*Salmo salar*) smolts and 1 119 602 smolts and 650 000 fry of sea trout (*Salmo trutta* morpha *trutta*) were released into the natural environment (as an enhancement of wild stocks).

A total of 190 000 juvenile whitefish (*Coregonus lavaretus*), origin of Pomeranian Bay stock, were released into Puck Bay as a part of programme of reintroduction of whitefish, which has been carried out since 1991. Also 1 400 000 fry of whitefish were released in Szczecin Lagoon to enhance existing wild stock.

381 000 and 436 000 juvenile pike (*Esox lucius*) were released in Szczecin Lagoon and Vistula Lagoon, respectively.

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.1 Fish

The round goby (*Neogobius melanostomus*) has recently been spreading up to the east of the Polish coast. In 1999 the first specimen was found in Vistula Lagoon (Borowski, pers. comm.). This fish which lived in the mouth of the Vistula River, recently has moved up the river. A few specimens were found on the coast of Rügen Island, western Baltic. New settlements of round goby in the west Baltic are probably the effect of its introduction by means of ballast waters, because, at the moment, there are no other samples from west Baltic waters. If this theory is true, it means that the anthropogenic spreading of the round goby has no limitations, except habitat conditions. The round goby has become a stable element of the trophic chain in the Gulf of Gdansk. Cod frequently eat it during feeding in coastal areas. Birds (e.g., cormorants) also eat it (Skora, pers. comm.).

One specimen of *Polyodon spathula* was found in the southern part of Szczecin Lagoon (Krzykawski and Wiecaszek, 1999).

3.2 Invertebrates

A mass invasion of the Ponto-Caspian cladoceran *Cercopagis pengoi* was observed in Vistula Lagoon in 1999. Due to good environmental conditions in summer (high temperature, shallow water and calm weather) its population spread very fast and covered nets with a dense layer, making them less catchable. The presence of that cladoceran was noted earlier in some places of the Gulf of Gdansk (Skora, pers. comm.).

The amphipods *Pontogammarus robustoides* and *Gammarus tigrinus* have been present since 1988 in the western part of the Baltic and in Szczecin Lagoon but recently both species were recorded in the eastern part of the Polish coast; *Gammarus tigrinus* was found in Vistula Lagoon, *Pontogammarus robustoides* was found in the estuary of the Vistula River (Gruszka, pers. comm.) and *Dicerogammarus* in Szczecin Lagoon.

The polychaete *Marenzelleria viridis* colonised the Szczecin Lagoon in the early 1990s and now its population is growing. The mass appearance (up to 1 million ind. m^{-3}) in November indicates autumn as the peak of the polychaetes reproduction (Gruszka 1999).

4 LIVE IMPORTS AND TRANSFERS

4.1 Fish

Eggs of *Oncorhynchus mykiss* - Denmark, Republic of South Africa,

Eggs of *Salmo salar* - Latvia,

Eel fingerlings - Denmark,

Eggs of sturgeon *Acipenser baeri* Russia.

Poland also imports approximately 3 tonnes of live marine ornamental fish and approximatelly 30 tonnes of freshwater live ornamentals. The main countries of origin: Thailand, Singapore, and Indonesia.

4.2 Invertebrates

Imports of crustaceans and other marine organisms for aquaria continued in 1999 but no detailed data are available at present.

5 LIVE EXPORTS TO ICES MEMBER COUNTRIES

Rainbow trout (*Oncorhynchus mykiss*) - Germany.

6 PLANNED INTRODUCTIONS AND TRANSFERS

As in previous years, in 2000 Poland will continue restocking of salmon and sea trout at the level at least as in 1999. Also the programme of reintroduction of whitefish in Puck Bay will be continued with emphasis given to assessing the share of wild and reared populations. The assessment will be done on the basis of mass markings with fluorescent external markers.

Experiments with rearing of Siberian sturgeon (*Acipenser baeri)* in salt water with crossbreeding with Sakhalin sturgeon (*A. medirostris*) were conducted, as a part of research programme at the University of Gdansk for the purpose of reinstating *Acipenser sturio* in the Baltic (Skora, pers. comm.).

7 MEETINGS, CONFERENCES, SYMPOSIA OR WORKSHOPS

The paper "Reproduction of *Marenzelleria viridis* (Polychaeta, Spionidae) in the River Odra estuary, with a particular reference to the occurrence of planktonic developmental stages" by P. Gruszka was presented at the 16th BMB Symposium 21–26 June 1999 in Klaipeda, Lithuania.

Submitted by: W. Pelczarski

NATIONAL REPORT FOR SWEDEN

1 LAWS AND REGULATIONS

In response to the EU directive 98/81/EC, new regulations to work with GMMs (genetically modified microorganisms, including micro-algae) in enclosed systems are to be enforced in Sweden in 2000. To prevent the spread of the parasite *Gyrodactylus salaris,* which occurs on Atlantic salmon, a new regulation was enforced during 1999. There are now restrictions to transfer fish belonging to the family Salmonidae between rivers situated on the Swedish west coast. During 2000 a new law has been proposed to regulate the import of live freshwater crayfish from countries outside EU. Accidental introduction of crayfish is a serious problem especially for Swedish inland waters.

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.1 Finfish

There are still no reports of *Neogobius melanostomus* from Swedish coastal waters, despite its common occurrence in the Bay of Gdansk.

3.2 Invertebrates

The polychaete *Marenzelleria viridis*, known in Swedish waters since 1990, continues to increase somewhat in the northern part of the Bothnian Sea, now occurring as far north as on the western side of Holmoarna (east of the city of Umeå) as well as east of these islands and continues to spread further south in the Bothnian Sea (K. Leonardsson,Umeå Univ., pers. comm.). In the Askö-Landsort area, northern Baltic proper, the species was found in 1999 for the first time both west of Landsort and east of Askö, the size and number of the individuals on one site indicating it had been there for a few years (H. Cederwall (Stockholm Univ.), pers. comm.). The species is still not present in high abundance in the southern Baltic (L-E. Persson (Kalmar Univ.), pers. comm.). There are no reports of *Marenzelleria* from the Swedish west coast.

American lobster *Homarus americanus* that was caught in the Oslofjord (H. Botnen (Univ. of Bergen), pers. comm.) during 1999 has not been reported from the Swedish west coast.

3.3 Algae and Higher Plants

Phytoplankton

The raphidophyte *Chattonella* cf. *verruculosa* (occurring in two morphological forms) was for the first time seen in the northern Kattegat, the Skagerrak and adjacent parts of the North Sea in 1998 and formed blooms (Aure *et al.*, 2000; Backe-Hansen *et al.*, 2000). It is not known if the species has been introduced or previously been overlooked. No blooms were formed in 1999, but the species occurred in small amounts on the Swedish west coast in the spring of 1999 (Informations-centralen, Länsstyrelsen Göteborg). In February and March 2000 the same species of *Chattonella* with two forms were reported from the Hevring Bugt, eastern Jutland, Denmark (see for example, http://www.dmu.dk/marineecologyandmicrobiology/alger/mar2000.htm). In mid-March it was also found outside the Swedish west coast (province of Halland, B. Karlson (Göteborg Univ.), pers. comm.).

Macroalgae

Very large specimens of the red alga *Dasya baillouviana* (considered introduced into northern Europe, Munro *et al*., 1999) were seen in 1999 in the discharge water from the nuclear power plant at Ringhals, in the northern province of Halland, eastern Kattegat (J. Karlsson (Göteborg Univ.), pers. comm.). The species most probably thrives well in the strong currents with warmer water. This is the southernmost record of the species in Sweden, previously seen in the middle and northern parts of the province of Bohuslän, eastern Skagerrak, since the 1950s.

Chara connivens, a stonewort thought to have been introduced with solid ballast in the Baltic Sea during the 19th century, has been listed as a threatened species among Swedish macroalgae and was rarely seen. During the last years, several records were made at the Baltic coast of the province of Uppland (P. Snoeijs (Uppsala Univ.), pers. comm.).

No major changes have been reported for the distribution of the Japanese brown alga *Sargassum muticum* along the Swedish west coast, and the southernmost record of attached plants is still from the middle part of the province of Halland, while drifting plants have been seen further south including at the island of Hallands Vadero (Karlsson and Loo, 1999). Some areas of the Swedish northern Kattegat coast, however, still lack *Sargassum*. On the Danish Jutland coast the species has been recorded further south in the Kattegat outside the eastern mouth of the Limfjord (J. Karlsson (Göteborg Univ.), pers. comm.).

The red alga *Dasysiphonia*, reported from Norway in 1999, has not been recorded in Sweden.

4.1 LIVE IMPORTS AND TRANSFERS

4.1 Fish for consumption/processing

	Eel in metric tonnes	**Carp in metric tonnes**
Norway	84	
The Netherlands		40
UK	1	
Germany	3	
		22
Lithuania	5	
Denmark	no data on amounts	

4.2 Invertebrates for consumption/ processing

	Lobsters in metric tonnes	**Edible crab in metric tonnes**
Canada	163	
Norway	12	54
USA	17	
UK	7	
Ireland	1	409
Denmark	2	1

	Scallops metric tonnes	**Oysters in metric tonnes**
Norway	86	no data on amounts
USA		6
UK	3	
Canada	2	
Denmark	2	14
Netherlands	2	4
France	no data on amounts	
	***Mytilus* spp., *Perna* spp. in metric tonnes**	
Norway	18	
The Netherlands	6	
Denmark	1	

5.0 LIVE EXPORTS TO ICES MEMBERCOUNTRIES

5.1 Fish for consumption/processing

	Rainbow trout/trout in metric tonnes	**Eel in metric tonnes**
Finland	22	no data on amounts
Estonia	10	
Norway	2	no data on amounts
Germany		405
Netherlands		64
Belgium/Luxembourg		29
Denmark		1330

5.1 Invertebrates for consumption/processing

	Lobsters in metric tonnes	**Scallops in metric tonnes**
Italy		40
Belgium/Luxembourg		18
Spain	11	
The Netherlands	10	
Norway	5	
Denmark	no data on amounts	no data on amounts
Russia		no data on amounts
Germany		no data on amounts
Greece		no data on amounts
France		no data on amounts
Finland	1	1
	***Mytilus* spp., *Perna* spp. to: Metric tonnes**	
Norway	46	
The Netherlands	177	
Belgium/Luxembourg	2	
Finland	33	
Spain	no data on amounts	
Denmark	1	

Submitted by: I. Wallentinus and E.Sparrevik

NATIONAL REPORT FOR UK (ENGLAND AND WALES)

2 DELIBERATE INTRODUCTIONS AND TRANSFERS

2.2 Invertebrates

Deliberate releases of Pacific oysters and Manila clams continued at the same level as reported in previous years.

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.2 Invertebrates

Eriocheir sinensis, the Chinese mitten crab, is well established in the Thames and is also present in other estuaries along the east coast of England.

Ensis directus has become established in the Wash on the east coast of England and represents around 95 % of the razor clam population in that area. It is an example of a non-native species that is present (? and subject to conservation) within a Special Area of Conservation (SAC).

The ascidian *Perophora japonica* Oka, native to Japan/Korea and reported from northern France about fifteen years ago, has been found in a marina in Plymouth Sound. Several colonies were found over a 140 m stretch of pontoon last summer/autumn. The species has apparently over-wintered successfully.

3.3 Algae and Higher Plants

Sargassum muticum is becoming established on the southwest coast of Wales and has been found on the island of Lundy. This represents a further extension of its range to that reported last year. Local organisations have been alerted to the occurrence of *Sargassum* and it's potential to spread further. It is unlikely that further spread will be prevented since all attempts to prevent the further spread and establishment of *Sargassum* in Strangford Lough, Northern Ireland appear to be failing.

ASP has prevented the commercial fishing of scallops along a large stretch of the western coast of Scotland. This was the most intense and extensive algal bloom (*Pseudonitzschia*) to date.

3.4 Parasites, Pathogens and Other Disease Agents

The confirmation of ISA (infectious salmon anemia) in farmed salmon in Scotland has had a significant impact on the salmon industry due to enforced restrictions on movements of fish. (For a short time there was an economic impact on shellfish farming too because movements of bivalves were also restricted.) The legislation required that salmon on sites where ISA was confirmed were slaughtered either for disposal by an approved method, or for harvest if of market size and not showing clinical signs of disease.

4 LIVE IMPORTS AND TRANSFERS

4.1 Fish

Normal trade continued in importation of rainbow trout eggs (around 60 million) from disease-free sources within ICES boundaries including Denmark, Northern Ireland, and the Isle of Man, as well as from further afield (South Africa and Tasmania). The trade in ornamentals is primarily freshwater speciesal though several species of ornamental marine fish, soft corals, molluscs and crustacea are imported/exported on a regular basis. There was increasing interest in imports of more unusual species of fish for the ethnic restaurant trade.

4.2 Invertebrates

The import of live Canadian lobsters and oysters (the latter primarily from Europe) for immediate consumption was continued. Many of the imported animals are held in tanks before consumption and there are unconfirmed verbal reports that the incidence of live Canadian lobsters being caught in the wild has grown over the years. (Also, Section 4.1).

5 LIVE EXPORTS TO ICES MEMBER COUNTRIES

5.1 Fish

The export of turbot juveniles to European ICES Member Countries for on-growing has decreased even further because hatcheries in France and Spain are now producing their own. Around 2.4 million glass eels were exported to Estonia. There is also a regular annual trade to other European countries such as Sweden.

5.2 Invertebrates

In 1999, UK bivalve hatcheries increased their production of Pacific oyster (*C. gigas*) seed anticipating an increase in sales to France where it was reported that there could be inadequate quantities of seed from natural settlement to sustain the industry. Increased sales to France did not materialize but Pacific oyster seed were produced and eighty consignments were exported to Ireland, three to Guernsey and three to Jersey. Two shipments of *Ostrea edulis* seed were exported to Ireland and seven consignments of *Mytilus edulis* to Guernsey.

GMOs

Research that was being carried out on improving the growth rate of salmon and reported on in previous annual reports appears to have been stopped after the initial trials were completed. This was in part as a result of public perception and concerns over GM foods. Some experimental work on zebrafish, etc. continues at Southampton University but there appears to be very little interest elsewhere or with marine species. Research on GMOs for aquaculture is mainly in the development of vaccines.

Submitted by: S. Utting

NATIONAL REPORT FOR THE UNITED STATES

1 LAWS AND REGULATIONS

Two significant developments occurred in 1999 with respect to USA bioinvasion regulations:

1) As of 1 July 1999 (see attached documents from the *Federal Register*) all ships from foreign waters calling in U.S. ports are requested to exchange their ballast water on the high seas when it is safe to do so. file a reporting form detailing the ships ballasting operations (whether water was exchanged or not) is mandatory. These forms—approximately 50 per day—are received by the National Ballast Water Clearinghouse (NBWCH) located at the Smithsonian Environmental Research Center (SERC) in Edgewater, Maryland (approximately 1 hour from Washington, D.C.). As of this report, this voluntary program is thus 9 months old. A very large amount of data has been accumulated to date.
2) As of 1999–2000, the federal Invasive Species Council has been formed (see attached Presidential Document and corresponding material from the *Federal Register*) and is becoming active. An *Invasive Species Advisory Committee*, of selected scientists and managers, to advise the Council, has also been formed as of winter-spring 2000. The purpose of the Council (and its advisory committee) is to help coordinate multiple federal agencies in the prevention, control, and management of exotic species invasions, in terrestrial, freshwater, and marine environments.

2 DELIBERATE RELEASES

2.3 Algae

Porphyra yezoensis in the Gulf of Maine, USA

The program for the outplantings of the cultured Asian red alga (nori) *Porphyra yezoensis* has, after 8 years, come to a conclusion. Reference is made to a separate final report filed by Coastal Plantations, Inc. The report is reviewed as a separate agenda item.

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.2 Invertebrates

The Japanese Oyster Crassostrea ariakensis in Chesapeake Bay, USA

On Tuesday March 28, 2000, the Virginia Marine Resources Commission (VMRC) will hear a request from a Virginia oyster industry group to undertake an experimental study with the Japanese oyster *Crassostrea ariakensis.* These will be individually certified triploids from F_1 ICES-protocol parents which were quarantined in the Virginia Institute of Marine Sciences (VIMS) hatchery at Gloucester Point, Virginia. This will be a time-limited trial if permission is granted, with a lengthy list of prerequisites and protocols to be followed.

The Japanese Carnivorous Whelk (Snail) Rapana venosa in Chesapeake Bay, USA

The current number of specimens of the large Asian whelk (snail) *Rapana venosa* known from Chesapeake Bay, USA, is, as of March 2000, over 800. The distribution center in the lower Bay remains about the same as in the previous two years, with little expansion; a few animals have been found within a 10 km expansion of the range reported in 1999, but this is within the fishermens' sampling area. As the water warms in the spring of 2000, the Chesapeake Bay crab fishing fleet is moving back into one of the "hot spots" of *Rapana* concentration, and about 30–40 individuals are now being

caught per day (late March, 2000). Considerable numbers of "smaller" individuals are being caught (60–90 mm, as opposed to the 120+ mm individuals from early collections). This may be evidence of breeding; there are also limited local collections of egg masses. Despite considerable searching, individuals snails of < 40 mm have not been found in the field, but potential vertical hard substrate where juveniles may be still needs to be adequately searched. In the laboratory, broodstock animals of *Rapana* at the Virginia Institute of Marine Sciences (Gloucester Point, Virginia) laid 530 egg masses between May and August 1999. The majority of these were subsequently cultured through to hatching. Hatching to metamorphosis varied from 2–6 weeks from the same brood. Metamorphosis has been observed on a number of bryozoans and attached megafauna, suggesting little if any specificity for metamorphosis. Juveniles (in excess of 400 individuals cultured to this stage) have been observed to prey on a range of local macrofauna including bryozoa, barnacles, mussels, oysters (*Crassostrea virginica*) and soft clams (*Mya arenaria*). Larger individuals prey on hard clams (*Mercenaria mercenaria*). Individuals settled around August 1, 1999 now exceed 35 mm. (submitted by Roger Mann, 23 March 2000). *Rapana* is a probable ballast water introduction to the USA.

The European flatworm Convoluta convoluta in Canada and the USA

A remarkable new invasion, only recently reported, although first discovered in 1995 in Nova Scotia, is the small European marine flatworm *Convoluta convoluta* (see Rivest *et al*., 1999). These flatworms were first, coincidentally, on the introduced green alga *Codium fragile tomentosoides*. Their southernmost range is now Massachusetts. While they can occur by the millions, their ecological impact is not yet known. It is a probable ballast-water introduction.

The Asian green mussel Perna viridis in Florida

The Asian mussel *Perna viridis* continues to move east, and in 1999 was first discovered on the west coast of Florida in Tampa Bay. A note from a popular newsletter is appended here as an example of the current notoriety of the species in southern U.S. waters. It is a potentially major fouling organism. It was introduced either in ships' hull fouling, in ships' sea chests, or by ballast water.

Submitted by: J.T. Carlton

ANNEX 4: BIBLIOGRAPHY

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ANNEX 5: JOINT MEETING OF WGITMO AND THE BMB WORKING GROUP ON NON-INDIGENOUS ESTUARINE AND MARINE ORGANISMS (WGNEMOs)

1 OPENING OF THE MEETING AND INTRODUCTION

This meeting was opened by the Co-Chairs Dr J.T. Carlton and Dr E. Leppäkoski, the respective Chairs of the ICES and BMB Groups.

2 HISTORY AND PERSPECTIVE OF THE GROUPS

2.1 ICES and the WGITMO

Dr J.T. Carlton gave a brief introduction.

2.2 The BMB

The Baltic Marine Biologists (BMB) is an international non-governmental scientific organisation whose aim is to promote studies on the biological diversity, structure, function and sustainable management of the ecosystems of the Baltic Sea Area (the Baltic Sea, Belt Seas, Øresund and Kattegat)[http://www.baltic-region.net/partners/bmb/index.htm]

Goals of BMB:

- to facilitate contacts between marine biologists working in the Baltic Sea Area;
- to facilitate the incorporation of young scientists into the scientific society;
- to encourage joint international investigations;
- to develop and disseminate scientific knowledge on the biology of the Baltic Sea Area.

Activities of BMB:

- scientific networking in the field of marine biology;
- arranging the Baltic marine biological symposia;
- maintaining and disseminating a list of Baltic marine biologists with their field of expertise;
- establishing working groups on important issues of marine biology;
- arranging advanced courses, workshops or other activities in marine biology;
- cooperating with other international bodies working in the Baltic Sea Area.

Participating countries

The member countries of BMB are the nine countries that have a coast bordering the Baltic Sea area. These are: Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, and Sweden. Each country has three representatives on the BMB Committee.

Membership

Membership in BMB is individual and open for all who are involved in scientific marine biological research, management or education in the Baltic Sea Area. Membership is free of charge and can be obtained or cancelled any time by contacting the General Secretary by mail or e-mail (using your personal e-mail address). Members are included in the BMB List of Baltic marine biologists and are entitled to the BMB networking services, such as receiving electronic newsletters, reports from the Committee Meetings, calls for symposia, workshops and other BMB activities.

History of BMB

BMB, founded in 1968, is one of the oldest non-governmental organizations working in the Baltic Sea area. For many years BMB has been an important international scientific link between East and West by providing a platform for scientists to meet in an atmosphere of academic freedom. During the first 32 years of the existence of BMB, 16 symposia have been held, in which more than 1400 scientific papers were presented, and 15 symposium proceedings

volumes have been published. During the same time, 22 books and other publications on different aspects of marine biology were published, mainly methodological recommendations and identification keys. The knowledge gathered by BMB greatly contributes to the modern understanding of the structure and function of the Baltic Sea ecosystem. The publications have had as substantial influence on the implementation and development of marine biological work in the Baltic Sea, including monitoring activities. In recognition of its important achievements, BMB was awarded a prestigious Prize from the Åland Fund for the Future of the Baltic Sea in 1995.

List of BMB Publications (from 1975 to present)

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2.3 The BMB NEMOs

This Working Group was started in 1994. Much of its emphasis is on training of students and a number of workshops have been organised. A database on invasive species in the Baltic (including the Kattegat) is maintained at Klaipeda University. At present there are already 99 invasive species on this database.

3 NATIONAL REPORTS

3.1 Russia

Dr V. Panov spoke of the Group on Aquatic Alien Species (GAAS) and encouraged ICES WGITMO members to disseminate information on the work that this Group is doing in establishing an international database of invasive species as well as encouraging other scientists to contribute information. This initiative, called ERNAIS (European Research Network on Aquatic Invasive Species), will focus on marine, freshwater and terrestrial species. At least 23 institutes from the Baltic and Caspian Seas areas are involved so far.

He went on to explain that there are currently no regulations on ballast water management in Russia but there is interest in ballast water studies.

The red king crab, *Paralithodes camtschatica*, that was introduced intentionally is now animportant part of the commercial fishery (see also National Report for Norway).

After the *Cercopagis* invasion and spread in the Gulf of Finland, catches of bream have decreased.

Two new amphipods have been found near St. Petersburg.

Abstracts of presentations of a scientific seminar held in Murmansk (27–28 January, 2000) on introductions into the Caspian Sea, the Black Sea, the Sea of Azov, the Baltic, the White Sea and the Barents Sea have been published in “Species Introductions in the European Seas in Russia”.

4 RESULTS OF INTERNATIONAL PROJECTS

4.1 The EU Concerted Action

Dr S. Gollasch presented information on this project (for further information, see Section 11.1 of the WGITMO report).

Dr S. Olenin told the groups about his participation in the EUCA project with Dr S. Gollasch when he had been involved in the Ocean Going Workshop on a Russian hydrographic vessel sailing from St. Petersburg to Lisbon and back again. Fifty young international students took part in this Workshop sampling ballast water during the voyage. Ballast water was changed four times during the trip and studies on the changes in the community structure and abiotic factors were carried out.

4.2 IMO Workshop in the Black Sea

Dr S. Gollasch reported on this workshop (see Section 7.7 of the National Report for Germany, Annex 3 of WGITMO report).

4.3 IMO’s GEF Project

As developing countries are generally unable to fund ballast water control, the IMO is assisting Brazil, China, India, Iran, the Ukraine, and South Africa in developing methods of treating ballast water.

5 FUTURE RESEARCH PRIORITIES

There was a general discussion on where future needs should be directed. Some of the ideas put forward included:

1) More studies should be conducted on the full range of vectors involved and prevention of introductions into Europe from such areas as the Indian and Pacific Oceans, for example. It was noted that taxonomic expertise on species worldwide is at a premium although it was also recognised that more novel genetic tools would become valuable for differentiating between species.
2) A website of "global travellers" should be produced with pictures to assist in alerting and identifying potential invasive species. Along with this, each country should establish what is present along its coasts, in its marine and fresh waters, etc. J.T. Carlton described Rapid Assessment Surveys (RAS) that have been carried out in some regions of the US. This involves a concerted intensive study carried out by experts over a few days to assess the range of species present in a given region/locality.
3) Methods for standardising assessments of ballast water treatment methods need to be established to be able to compare the effectiveness of such methods. Courses and training on ballast water sampling methods will become increasingly important as more studies begin in many other countries.
4) Funding should be made available for ecological studies.

6 ADJOURNMENT

After a brief review of the afternoon's meeting, all participants agreed that it had been an extremely valuable and interesting session. They also agreed that more meetings between the ICES WGITMO and BMB WGNEMOs should be encouraged when opportunities arise.

The meeting was adjourned at 18.00 hrs.

ANNEX 6: RECOMMENDATIONS TO THE COUNCIL

1) WGITMO unanimously recommends that Dr S Gollasch (Germany) be appointed as Chair of the WGITMO as well as Chair of the ICES IOC IMO Study Group on Ballast and Other Ship Vectors (SGBOSV).

2) WGITMO requests advice from the Working Group on Application of Genetics in Fisheries and Mariculture relative to the following: there is the likelihood that the farming of polyploid as opposed to diploid aquatic organisms will be part of the future development of aquaculture. Tetraploid and triploid oysters (particularly *Crassostrea*) are already being tested or used for commercial practices. The WGITMO seeks advice as to assessments that should be carriedout (relative to considerations such as how "sterile" individuals are produced, and whether they maintain their "sterile" state) and any other considerations that should be taken into account before a polyploid can be considered for release to the environment.

3) Noting that the movement of aquatic organisms, and in particular commercial fisheries species, within and between ICES Member Countries can result in the unexpected expression of disease agents, especially when the species are moved to new climatic and other environmental conditions, WGITMO requests that ICES through ACME advise Member Countries that they should consider these to be the same as new introductions and transfers when moved for the first time, and thus always implement a review of any proposed movements using the ICES Code of Practice.

4) Given both the continued spreading of species (such as parasitic eel nematodes and toxic phytoplankton species) by the commercial movement of fisheries products, in particular the introductions and transfers of shellfish and finfish, and given the arrival in ICES Member Countries of new invasions (such as the snails *Rapana* and *Ocinebrellus*), WGITMO urges ICES to alert Member Countries to apply risk assessment and management models to determine when there is the need to monitor consignments of shellfish and finfish moved within and between ICES Member Countries relative to their potential to spread such nuisance species.

5) Noting that the importation and transfer of species intended for such purposes as the aquarium trade, bait industry, or for immediate consumption as live seafood, can result in the release in the wild of such species (such as the American lobster in European waters) and any accompanying organisms including pests, parasites and disease agents, WGITMO urges ICES to alert Member Countries to the need to carry out risk assessments and management reviews for non-native species intentionally imported into their countries for any purpose or by any means.

6) In order to gather and keep track of improved statistical data on species imports and exports, the WGITMO proposes that ICES through ACME facilitates the establishment of an informal network within WGITMO to notify other WGITMO members as to when an export has been permitted from one Member Country to another Member Country. National Reports frequently contain information about a given species exported to another Member Country, whose National Report in turn does not contain or mirror import information on that same species. Thus National Reports appear to be either in complete or contradictory, a situation that could be prevented or ameliorated by internal communication prior to the preparation of the National Reports by WGITMO members. Contacts and timely communication established through such a network could aid in the prevention of introducing or transferring unwanted species.

7) Recognising the potential risk from introductions of aquatic species into the coastal waters, inland seas and waterways of Member Countries through freshwater routes, WGITMO urges ICES to encourage and support joint meetings between ICES WGITMO and EIFAC, in addition to a continued dialogue between WGITMO and BMB.

8) WGITMO (new chair: Dr S. Gollash, Germany) should meet immediately after the meeting of the ICES/IOC/IMO Study Group on Ballast and Other Ship Vectors (26–27 March 2001) in Barcelona, Spain (hosted by Prof M. Ribera, Universitat de Barcelona) from 28 to 30 March 2001, to:

a) prepare materials to support an information brochure on the current issues surrounding exotic species invasions, and the impending potential wave of future invasions, to be distributed to ICES Member Countries and to be offered on the ICES website; these materials could also be distributed in the form of species-specific information bulletins, sheets, or posters, focusing onwide spread and still spreading exotic species (such as *Hemigrapsus, Undaria*, and *Sargassum*) or on exotic species which are less well known to the public (such as the snails *Rapana* and *Ocinebrellus*, and the American lobster). This effort would include a special advisory on *Rapana* as discussed and approved by ICES in 1999;

b) carry out a review of previous National Reports (since 1992) to determine whether the recorded incidents of introduced species, in terms of both their geographic spread and their abundance, reported by some Member Countries, such as the American lobster (*Homarus americanus*) in European waters, the distribution of the ship worm *Teredo navalis* and the tubeworm *Ficopomatus enigmaticus*, have been increasing in recent years;

c) review databases on introduced species that have been developed on a regional basis, such as the databases developed by BMB, CIESM, and any others that are in the process of development, in order to improve communication and the dissemination of informa plaintion within and between ICES Member Countries and to inform other groups such as HELCOM where information on introduced species can be found since ICES does not maintain such a database;

d) report on the current status of fish, shellfish, algal, and other introductions in and between Member Countries, through:

   i) the submission of the National Reports, to further now include information on genetically modified organisms and the use of any biocontrol agents;

   ii) continuing to review the status of selected current invasions, including a) the status of the invasion of the snail *Rapana* in Atlantic America, France, and the Mediterranean, with a focus on producing an "Alert Sheet" to be distributed to ICES Member Countries, b) the continued spread of the kelp *Undaria* in France, Italy, Spain, Belgium, UK, The Netherlands, and other Member Countries, c) the spread of the crabs *Hemigrapsus sanguineus* and *Hemigrapsus penicillatus*, d) the status of the zebra mussel *Dreissena polymorpha* in Ireland and other countries, e) the status of thewater flea *Cercopagis pengoi*, especially any further spread in the Baltic Sea and the Great Lakes, and f) the snail *Ocinebrellus inornatus* in France;

   iii) continuing to review the potential risks from worldwide trade in live aquatic organisms for the food trade, for the aquarium and ornamental trade, and as live bait for recreational fishing;

   iv) discussing the preparation of a new *ICES Cooperative Research Repor*t "1992-2001 Status of Introductions" to summarise the new species introduced both intentionally and unintentionally in the last decade;

   v) reviewing the structure of the National Reports so as to include the full range of vectors involved in introduction and transfer of marine organisms and the possible inclusion of updated summaries of the introduced and transferred species in Member Countries;

   vi) continuing to review the status, availability, and interrelationships between regional databases on introduced species, including those in the Baltic Sea, the Mediterranean, Chesapeake Bay, and elsewhere, especially as they provide critical information to those invasive species already in, or likely to be introduced to, ICES Member Countries.