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Report of the Working Group on Introductions and Transfers of Marine Organisms (WGITMO)

25–26 March 2004
Cesenatico, Italy

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1 OPENING OF THE MEETING AND INTRODUCTION

The 2004 meeting of the ICES Working Group on Introductions and Transfers of Marine Organisms (WGITMO) was held from March 25 to 26 at the Centro Ricerche Marine in Cesenatico, Italy, hosted by Anna Occhipinti, University degli Studi di Pavia, Sezione Ecologia, Dipartimento di Genetica e Microbiologia, Pavia, Italy and with Stephan Gollasch (Germany) as Chair. In total, 20 participants from Australia, Belgium, Canada, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Poland, Sweden, Russia, United Kingdom, and the United States of America attended the meeting (see Annex 2 List of Participants).

The meeting was opened at 09.00 on Thursday 25 March 2004 with welcoming remarks from the local host Anna Occhipinti and with Stephan Gollasch, as Chair, welcoming participants, particularly new members who had not previously attended WGITMO meetings. The participation of Yasuwo Fukuyo (Japan) representing PICES and the potential for cooperative links between ICES and PICES on matters of interest to WGITMO were highlighted.

The Chair forwarded the very positive feedback from ICES on the progress made at last year's meeting to the Group. This in particular refers to the Alien Species Alert report on the Red King Crab, *Paralithodes camtschaticus,* considered for publication as *ICES Cooperative Research Report,* and the efforts made to the preparation of the WGITMO Vector Handbook. WGITMO participants very much appreciated these positive comments and noted that the long working hours at last years meeting were spent well.

The meeting was arranged in a series of plenary sessions covering all ToRs.

2 TERMS OF REFERENCE, ADOPTION OF AGENDA, SELECTION OF RAPPORTEUR

2.1 Terms of Reference

The terms of reference (ToR) for the 2004 meeting (Annex 3) were reviewed and the Agenda was structured to allow each ToR to be addressed. This required preparation of papers and reports by members for presentation at the meeting, and these are contained in the Annexes of this report. The Chair expressed his thanks to the WGITMO members for preparing these reports and papers for consideration at the meeting. He especially thanked the volunteers I. Wallentinus (Sweden), D. Minchin (Ireland), C. Hewitt (New Zealand), and D. Kieser (Canada) for their efforts when preparing draft material for the summary of National Reports 1992–2002.

2.2 Status of the terms of references

The finalisation of the Summary of WGITMO National Report 1992–2002 and the contribution to REGNS were given the highest priority at the 2004 meeting. However, other objectives could not be achieved in great detail due to time limitations (ToR e).

The status of the Terms of Reference are as follows:

ToR a) finalize the report in 2004 summarizing the ecological impacts of the Red King Crab introduction in Norway that will provide a basis for advice on practical management considerations.

Status: completed (Annex 8)

ToR b) finalize the complete summary of the National Reports from 1992 to 2002 in 2004 (suitable for publication in CD-ROM format).

Status: to be continued intersessionally. Draft material was reviewed at the meeting. It is planned to finalize the draft in 2004 intersessionally and to review the final draft at the 2005 meeting of WGITMO.

ToR c) collate and tabulate information from National Reports and prepare annually for ACME a concise summary report on the ecological significance of any new proposed introductions.

Status: completed for 2004

ToR d) provide a concise synthesis annually for ACME on the ecological impacts of accidental introductions on the receiving environment. These syntheses may result in the production of Special Advisory Reports.

Status: completed for 2004

ToR e) evaluate and report on the rapid response and control options of new invaders with the intention of preparing a discussion paper by 2006.

Status: existing rapid response strategies and recommendations were reviewed. Due to time limitations this ToR was not addressed in great detail at the 2004 meeting. WGITMO suggests ICES to consider this item to be dealt with at next years WGITMO meeting.

ToR f) commence preparation of a report summarising introductions and transfers of marine organisms into the North Sea and their consequences to be input to the 2006 meeting of REGNS and the 2006 Theme Session on Integrated Assessments.

Status: WGITMO suggests ICES to consider this item to be dealt with at next years WGITMO meeting. Intersessional activities will result in draft material to be considered at next years meeting. It is planned to hold drafting sessions on this ToR at next years meeting.

2.3 Adoption of the Agenda

The agenda of the meeting was considered and adopted. The agenda is attached as Annex 1.

2.4 Selection of Rapporteur

As in previous meetings, Dorothee Kieser (Canada) was appointed as rapporteur.

3 REVIEW OF THE 2003 WGITMO REPORT

The group reviewed last year's meeting report intersessionally. Errata to the 2003 WGITMO report were received from Laurence Miossec (France):

- The French National Report refers in 2003 to a lobster (*Homarus americanus*) finding with a carapace length of 155 cm. This is certainly a typing error and should read 155 mm.

Further, the Finish co-author of the National Report 2003 brought the following additional information to the groups attention:

- Glass eels stocked in Finland (almost only into lakes) originate from England but come via Sweden where kept in quarantine. In Finland, *Anguillicola crassus* parasites have, however, not yet been found in any of the lakes eels have been stocked. It was not allowed to import eels into Finland in the eighties, when the parasite spread elsewhere in Europe including Sweden. It is not known from where the ascending eels have got the parasites in Finland. Eels in the other side of the Baltic Sea in the coastal waters of Sweden carry the parasites.

- Imports of *Acipenser sturio* are allowed to be used only for human consumption. He supposed that the idea has been to cultivate the fish to produce caviar. Sturgeon has probably never had a reproductive stock in Finland; just sporadic individuals were fished more than seventy years ago. Thus, there is no reason for restocking. It is different for *Siluris glanis* imports, which are not allowed to be restocked without the acceptance of local fishery authorities. At the moment, individuals of neither of the species imported are allowed to be transported from the farm elsewhere than to slaughtering. Both species are from Germany, however, at the moment he does not know from which farm.

4 DISCUSSION PAPER OF THE EUROPEAN COMMISSION ON COMPREHENSIVE RULES AT EU LEVEL REGARDING INTRODUCTIONS, TRANSFERS AND CONTAINMENT OF AQUATIC ORGANISMS IN AQUACULTURE

A consultation meeting on the intention of Directorate General (DG) Fisheries to propose management rules for the introduction and transfer of non-indigenous species in aquaculture and to propose containment guidelines for farmed fish was held on December 2nd 2003 in Brussels (Annex 9). Several WGITMO members were invited to attend as individual experts neither representing ICES nor WGITMO, namely Stephan Gollasch (Germany); Inger Wallentinus (Sweden); Philippe Goulletquer (France); Anna Occhipinti (Italy); Dan Minchin (Ireland); Ian Laing (UK), and Erkki

Leppäkoski (Finland).

The ICES Working Group on the Introductions of Marine Organisms (WGITMO) has provided advice on the management of introductions and transfers of aquatic species since 1972. Some specific cases have been dealt with by this WG acting as a forum for advice on the introduction of different taxonomic groups, one of these is cited in the most recent ICES Code of Practice 2003 as Appendix F. Cultivation of a fish in confinement on land in a circulating system was also considered by WGITMO. This WG has a wide range of expertise also provided to FAO, PICES and various nations. The biologists attending the meeting were pleased to be approached in this consultation and offered the following comments which were brought to the EUs' attention shortly after the meeting in a written format for consideration in the development of practical legislation. It was clearly stated that the comments made (submitted to EU in December 2003) may not necessarily reflect the view of ICES:

- The ICES Code of Practice 2003 takes into account previous versions of the Code. This Code provides a management recommendation for the introduction of species, not presently existing in the EU, *via* full desk and field assessments and quarantine procedure. The development of several projects has been overseen by the WG which has acted as a scientific forum. It also takes into account matters of trade and their associated biota as well as genetic considerations that include Genetically Modified Organisms.

- Some areas, by virtue of their isolation (i.e., islands and alpine lakes) should be afforded special consideration when considering certain trading/stock movements. Islands on account of their reduced number of diseases, parasites and pests may be considered as centres for the quarantine of species in the application of the Code for aquaculture development with reduced risk and could subsequently form a basis for future industry within the EU. These quarantine centres may act on behalf of other regions, provided other legislation (e.g., shellfish health) are complied with. Furthermore, several case histories have shown that both animals and plants may survive and adapt to climatic conditions quite different from those in their native areas. It is inevitable that "new" species will be considered for cultivation as Europe experiences changes in social preference and climate change. Introduction of those species should follow the principals pointed out in the ICES Code of Practice or similar documents, incl. application of strict quarantine conditions. A proper risk assessment always needs to be undertaken prior to species importations to avoid the introduction of non-target taxa, such as pests, disease agents and associated biota carried by trade in living organisms including their packing material. The target species should also be assessed for its potential as an invasive species which could impact the environment in the area of introduction and beyond (e.g., King crabs in Norway)

- It is strongly recommended that an expert forum is set up that can consider introductions of marine and brackish water species for aquaculture or fisheries development and matters that also consider trade of living biota. ICES experts would be pleased to be considered for an open discussion forum. We recommend further to contact experts from the European Environment Agency and from CIESM.

- It is recommended that products that are cultivated and not utilised for direct human consumption be also considered in legislation to include the aquarium species, species imported as bait, those used for research purposes including biotechnology and organisms imported or transferred for direct human consumption. Although other activities such as shipping may have a direct impact on aquaculture and fisheries it is not recommended that these issues be included in this legislation, but should be acknowledged as important vectors, especially where they overlap with aquaculture and fishery resources.

- Statistics of aquatic movements within the EU to aid in the traceability of events should these occur. Regulation on labelling of consignments that are not to be returned or gain access to natural waters may be considered.

5 PROPOSED NEW INTENTIONAL INTRODUCTION: AN INTER-BASIN TRANSFER OF STURGEONS

The Society to Save the Sturgeon (SSS), a non-profit organisation founded in 1994, aiming at the restoration of the sturgeon populations in Central Europe currently carries out a project for the restoration of sturgeon populations in German waters. The member of the board and project manager, Joern Gessner (Germany), presented a proposal to WGITMO during the Vancouver meeting. The updated approach for the restoration of the sturgeon populations in Central Europe, taking into account the comments made at last years meeting, was, due to funding constraints, contributed to the 2004 meeting of WGITMO by correspondence. Having secured funding, the groups' representative, Joern Gessner, will attend future meetings of WGITMO.

As outlined at the 2003 meeting in Vancouver, based on the genetic and morphological findings on sturgeon identification (Ludwig *et al.* Nature 417, 2002), the Baltic sturgeon resembles the northern Haplotype of the American Atlantic sturgeon which has immigrated into the Baltic approximately 2000 years b.p. Since 1200 b.p., having replaced the *A. sturio* that was present in the area following the post glaciation period, it has been the only sturgeon species present in the Baltic. Based on these results the German Federal Agency for Nature Conservation has carried out an international workshop in June 2002 to discuss the future perspective for the sturgeon restoration efforts in Central Europe. As a result it was recommended to proceed with two remediation programmes in the future, one based on French *A. sturio* for the North Sea tributaries and one using Haplotype A of the American Atlantic sturgeon for the Baltic Sea.

Since rearing and reproduction in North America would be too costly and insecure from a political viewpoint the project proposes the transfer of broodstock into a facility in Germany to allow easy access and close control as well as continuous monitoring in captive conditions.

For this reason, it was suggested to WGITMO that the SSS would apply for support for the measure planned in accordance with the Code of Practice.

5.1 Status report

Initially it was intended to launch a proposal prior to the 2004 meeting of WGITMO in Cesenatico, Italy. Unfortunately, the funding for the transfer of the fish has not yet been granted. Hence the SSS has refrained from submitting a formal proposal to ICES-WGITMO.

The strategy discussed during the WGITMO meeting in Vancouver and subsequently approved by the board of the SSS and the project partners as well as the representative of the funding agency. At a project meeting in May 2003 the following procedure was outlined:

- Upon catch, a one-year period of rearing the wild caught fish, approximately 20 individuals annually designated for subsequent transport, under captive conditions in freshwater in the country of origin will be performed. Thus allowing the close monitoring of the fish for any symptoms of parasite or disease infestation. This time is required too to adapt the fish to captive conditions and weaning to feeding in captivity.

- During transfer, which is to take place via sea-going container by ship, sea water would be used to supply the fish. Only in close vicinity to the shores, the system would be maintained in full recirculation mode.

- After sea transport the fish are to be transferred into a quarantine facility (Regional Research Institute of Mecklenburg-Pomerania), where the fish are to be kept under quarantine conditions. The fish are to be held in brackish water (2-6 ppt) under captive conditions to allow monitoring for parasites and disease agents as well as sterilization of wastes. It is intended to extend the quarantine conditions for a 1-year rearing phase.

- Provided that no clinical signs are evident in the quarantine phase, the fish are to be transferred into a pond system. Rearing under semi natural conditions seems to be of tremendous importance in order to avoid any selection in the brood-stock towards artificial rearing conditions. Subsequently, the fish are used for artificial reproduction to produce stocking material for release into the wild following a genetic reproduction plan.

It is not intended, neither would it be feasible, to discard the brood-stock following the first reproduction (F1 generation). The brood-stock would be too scarce for such a procedure because wild-caught fish due to their limited abundance prohibit supplementing the brood-stock with spawners regularly. The utilization of F1 fish for reproduction is not feasible since the maturation of the fish in captivity can last up to 12 years. Additionally, the rearing of captive brood-stock would most probably result in a reduction of genetic variability due to the adaptation to captive conditions which are highly undesirable for release purposes. Because repeated maturation in captivity can take more than 5 years the fish cannot be transferred when ready to spawn, transfer has to take place in due time to secure future reproduction. Under the current plans, it is intended to build up a brood-stock of 150 individuals to allow sufficient genetic heterogeneity to commence with the reproduction for 10–15 years.

5.2 Monitoring

For the monitoring programme for the adults it is suggested to:

- Identify the parasites associated with the fish upon catch in North America. The identification of other disease agents will be difficult. Internal parasites and organ bound pathogens might be detected in fresh morts only. Although the recent experience indicates that in these fish hardly any pathogens except secondary infections can be isolated. A statistical valid subsampling programme sacrificing broodstock might be impossible due to the low numbers of fish that are included in a yearly permit for catching and rearing. Since these permits are mainly issued based on concerns on the natural stock size an increase in numbers might not be feasible.

- Identify the parasites following the transfer into sea water upon transportation from North America to Germany

- Monitor the parasites during the first year in captivity (fresh or brackish water) in Germany

- Monitor the changes in parasite fauna during the pond rearing phase following the quarantine phase in Germany

For the programme it is intended to morphologically and to genetically identify the parasite species. Thus allowing the monitoring of any shifts in parasites prior and after transport (persistence and newly acquired parasites). This identification protocol is supposed to be covered by a PhD student within the scope of the restoration programme (information on potential additional funding sources would be highly appreciated).

5.3 Need for information

At next year's meeting, SSS intends to ask WGITMO for:

1. its comments on the intended procedure of the transfer;
2. a recommendation how a monitoring should be designed following the quarantine phase;
3. recommendations on the long-term monitoring of the stocking procedure with offspring of the transferred founder generation;
4. input on suggestions for the timing and completion of the proposal, provided that a transport for 2004 is to take place (captive rearing in Canada currently ongoing);
5. any suggestions how to ensure the monitoring of brood-stock and stocked fish (personnel and financial support, national obligations under the planned measures).

WGITMO noted this project with great interest and will follow up future developments focussing on the planned movement of North American sturgeon into European waters. WGITMO further noted with great appreciation that the strategy suggested during the WGITMO meeting in 2003 was subsequently approved by the board of the Society to Save the Sturgeon and the project partners as well as the representative of the funding agency. It is hoped that funding can be secured to send a group representative to next years meeting of WGITMO to allow close cooperation on future developments of the project.

WGITMO also noted the objectives of the "World Sturgeon Conservation Society" (see Annex 10).

6 ICES CODE OF PRACTICE

The Code of Practice was briefly reviewed at the 2004 meeting of WGITMO.

6.1 Changes in APPENDIX F

Minor changes in APPENDIX F *PATINOPECTEN YESSOENSIS* — A CASE STUDY OF A PREVIOUS INTRODUCTION are suggested as follows:

- Section 5. THAT JAPANESE SCALLOPS MAY HYBRIDISE WITH COMMERCIALLY IMPORTANT EUROPEAN SCALLOPS, second paragraph, end of line two add "Minchin, 1992" to the existing reference "Gibson, 1956"
- In the Reference section

- delete: "*ICES, 1990. Mariculture Committee. *Procès-verbal de la Réunion, 1989.* Copenhagen Denmark.",
- delete: "*ICES, 1991. Mariculture Committee. *78th Statutory Meeting 1990. International Council for the Exploration of the Sea,* Copenhagen, Denmark.",
- delete the asterisk in: "*Minchin, D., 1992. Biological observations on young scallops, *Pecten maximus. J. mar. biol. Ass. U.K.,* 72: 807-819." **but keep the reference,**
- delete: "*Misu, K., 1990. *The ecology of brachyura larva in Onagaw Bay.* MS University of Sendai.", and
- delete the asterisk explanation in the very end: "* = References to be deleted if not included in narrative. Also, there are 4 Pers Comms – should they be added to References, with pertinent info?"

6.2 Genetically Modified Organsms (GMOs)

Another comment was received by Philippe Goulletquer, France. He stated the following:

> *"First of all I would like to thank you for your mail and effort in upgrading the ICES Code of Practices. It's now representing a really significant upgrade.*
>
> *I just would like to make an additional comment (based upon my experience as the Chairman of the Ad-hoc expert group on Mariculture Impacts on Biodiversity at the UN Convention on Biodiversity) regarding chromosome manipulated organisms (i.e., polyploids). While the GMO's issues are well addressed, there is nothing regarding those animals. My feeling is that a part should be added between Part IV and V to address that matter. Just an example: the technology now allows to produce tetraploids oysters, which are fertile. Without any regulation and recommendation, transferring those animals may interact directly with local reproductive populations, resulting in 3N (sterile) natural population.....a significant risk! Therefore, the use of tetraploids is strictly restricted to quarantine stations in France.*
>
> *Since this technology is currently expanding very significantly, I think the ICES Code should address the question."*

6.3 Definition of "quarantine"

The current definition in the 2002 Code of Practice states: "The facility and/or process by which live organisms and any of their accompanying organisms can be held or reared in isolation from the surrounding environment including sterilization".

The WG suggests the following revision: "The facility and/or process by which live organisms and any of their accompanying organisms can be held or reared in isolation from the surrounding environment. This may include sterilization procedures".

6.4 Conclusions

- The version submitted in 2002 is still considered up-to-date. However, WGITMO asks ICES to note the comments above.
- WGITMO suggests ICES to consider asking the genetics working within ICES to consider the point on GMOs raised by Philippe Goulletquer above.

6.5 Recommendations

- ICES is invited to consider the changes and deletions as suggested above.

7 ICES ADVISORY REPORT ON RAPANA

WGITMO appreciated very much the prompt publication of the Alien Species Alert report on *Rapana venosa* (veined whelk) as an *ICES Cooperative Research Report*. Copies of this report were distributed at the meeting.

One of the co-authors of this report, Juliana M. Harding (USA), made a multimedia CD ROM entitled "Veneid Rapa Whelks: Aliens in the Chesapeake" available by correspondence. This CD is an information resource for scientists, resource managers, science educators and the general public. The CD and a CD order form was tabled at the meeting. The research on *Rapana* in the Chesapeake Bay continues. In total, 5600 confirmed records of *Rapana* were made until August 2003. More details at http://www.vims.edu/mollusc/research/.

8 ICES NEWSLETTER

WGITMO appreciated the publication of "Aliens invade the Sea" in the ICES NEWSLETTER, September 2003 with reference to WGITMO, WGBOSV and the ICES Code of Practice on the Introductions and Transfers of Marine Organisms. Copies of this report were distributed at the meeting.

9 DISPERSAL VECTORS OF EXOTIC SPECIES

The Directory of Dispersal Vectors (entitled "Vector pathways and the spread of exotic species in the sea") outlines the principal vectors that are likely to result in further spread of non-indigenous species including both introductions and translocations. WGITMO noted with great appreciation that the final draft manuscript was accepted by ICES for publication.

However, WGBOSV (see 2004 meeting report) suggests to slightly modify the body of the report and attached tables to more appropriately address canals as migration pathways. Man-made shipping canals should not be overlooked as important migration pathways for biological invasions. To more appropriately address this issue WGBOSV suggests inserting a paragraph on this matter and to modify the Annex of this account accordingly.

WGITMO appreciated the WGBOSV input and agreed with the suggestions made by WGBOSV. As a result the following changes were made:

- the term "oil platforms" was, for consistency reasons of commonly used terminology, changed to "drilling rigs";
- Laurence Miossec (France) suggested the following changes in section 2.3 Wild fisheries. Second paragraph replace the sentence *"Some species may be spread.....(Goulletquer et al, 2002)"* with the following sentence *"Some species may be spread associated with commercial shellfish imported for trade as may have been the case of the appearance of Rapana venosa in France (Goulletquer et al, 2002)."* The changes were made and the sentence was moved to chapter 2.3 Aquaculture activities;
- The canal section was modified and highlighted to better address this important "vector";
- The new version includes now eight pathways and not seven as before;
- The Tables 1 and 2 were slightly edited to conform with the order of the pathway topic areas. Further minor additions were made. Table 2 was restructured combining pathway items;
- The Appendix was updated.

9.1 Potential hazard of inoculation of invasive species in Europe by decommissioned US Naval vessels; a case for a primary inoculation in Europe. (Dan Minchin and Roger Mann)

Currently there are four decommissioned vessels near Hartlepool, UK. The intention is to dissemble these vessels at a breaking yard at Teesdale, an estuarine region of the North Sea. The vessels are USS *Canisteo*, *Caloosahatchee, Canopus* and *Compass* previously based on the James River in Virginia, USA. Both vessels were decommissioned in December 1998 (www.hazegray.org/worldnav/usa/decom.htm). These vessels were held unused in the James River, Virginia, USA, until their recent transit across the North Atlantic and so are very likely to have accumulated a hull fouling community that reflects the region where the vessels were based. Fouling can be more extensive when the paint biocides have leached from the hull surface, or have become worn. Some invasive organisms, including shellfish diseases, are present on the east-coast of the United States and there is the possibility of a transmission of one or more of these species to Europe with this continued practice. Should further movements of vessels take place from areas where decommissioned vessels are held, or as a result of decommissioning vessels directly from naval bases, such as Norfolk Naval Base on the James River, this hazard increases. There are a further nine vessels that may be destined for Teeside from the James River. Some of these have been decommissioned since September 1992.

There are several invasive species on the east coast of the United States capable of making a crossing, particularly should a voyage avoid water that could result in the heat death of the living organisms on the hull surface (Gollasch, 2002; Minchin and Gollasch, 2003). Further, there is the possibility that the two vessels, now in the Tees Estuary in

Britain, while moored or berthed could have species within their fouling communities reproducing, dropping from the hull surface or become otherwise detached to create a founder population. Should any of these organisms establish themselves their subsequent spread is likely (see: Leppäkoski and others, 2002). Fouling of slow moving craft, without recent fouling management, have been considered as a high risk issue in Northern Europe (see: www.ices.dk/reports/ACME/2003/WGITMO03.pdf) and in the Mediterranean Sea (www.ciesm.org/publications/Istanbul02.pdf).

In the James River the decommissioned vessels are berthed in a region with <10‰ of salinity and with further reductions of salinity in wintertime to <1‰ (Mann and Harding, 2003). However, this range is acceptable to the American oyster *Crassostrea virginica* occurring both upstream and downstream of the decommissioned ship mooring area. Oysters are sufficiently abundant in this region to support commercial fishing. One concern is the transmission of the disease causing parasites *Perkensis marinus,* that can be vertically transmitted, and *Haplosporidium nelsoni* (Bower *et al.,* 1994; Ford, 1999). These can be carried with oysters attaching to the ships' hulls and oysters are frequently found attaching to the hulls of ships' in service. It may be expected that vessels uncleaned over several years carry American oysters. A transfer of vessels during the autumn enhances the possibility of such disease transmission. Although there are no extensive oyster beds in the Tees Estuary there are extensive populations of other bivalves that might serve as susceptible hosts to either parasite. We do not know whether these vessels were cleaned prior to leaving the James River. Even if hull cleaning had taken place some sites on the hull such as the sea chests and thruster (and other) ports are most likely to remain fouled.

Should vessels become dispatched from other regions in the United States, known invasive species may be provided with new opportunities. Species likely to be carried from North America include the predatory snail, *Rapana venosa*, an avid feeder of *Mercenaria mercenaria* and other bivalves in Chesapeake Bay (Savini *et al.,* 2002). This snail is abundant in the region of the James River and was first recorded here in 1998 (Harding and Mann, 1999). *Hemigrapsus sanguineus* a North Pacific crab, also a predator and avid consumer of benthic organisms is spreading from its first known locality in New Jersey in 1988.

Decommissioned vessels sent to a different biological province to be dissembled pose a hazard of enabling a primary inoculation of an invasive species to occur and should this take place there could be consequences for living resources and industry.

Supporting information:

Bower, S.M., McGladdery, S.E., and Price, I.M. 1994. Synopsis of infectious diseases and parasites of commercially exploited shellfish. *Annual Review of Fish Diseases* 4: 1-199.

Harding, J.M. & Mann, R. 1999. Observations on the biology of the veined rapa whelk*, Rapana venosa* (Valenciennes, 1846) in the Chesapeake Bay. *Journal of Shellfish Research* 18: 9-17.

Ford, S.E. 1992. Avoiding the transmission of disease in commercial culture of molluscs, with special reference to *Perkensis marinus* (dermo) and *Haplosporidium nelsoni* (MSX*). Journal of Shellfish Research* 11: 539-546.

Gollasch, S., 2002. The importance of ship hull fouling as a vector of species introductions to the North Sea. *Biofouling*, 18: 105-121.

Leppäkoski, E. Gollasch, S., & Olenon, S. 2002. *Invasive Aquatic species of Europe. Distribution, impacts and management. Kluwer Academic Publishers*, 582pp

Mann, R. & Harding, J., 2003. Salinity tolerance of larval *Rapana venosa*: implications for dispersal and establishment of an invading gastropod on the North American Atlantic coast. *Biological Bulletin*, 204: 96-103.

Minchin, D., 2002. Shipping: global changes and management of bioinvasions. In: CIESM, 2002. Alien marine organisms introduced by ships in the Mediterranean and Black seas. CIESM Workshop Monographs No 20, 136pp Monaco www.ciesm.org/publications/Istanbul02.pdf pp 99-102.

Minchin, D. & Gollasch, S. 2003. Fouling and ships' hulls: how changing circumstances and spawning events may result in the spread of exotic species. *Biofouling* 19: 111-122.

Minchin, D., Gollasch, S., Wallentinus, I. 2003. Vector pathways and the spread of exotic species in the sea. *Annex 14. ICES 2003 WGITMO Report*, pp110-133. www.ices.dk/reports/ACME/2003/WGITMO03.pdf

Savini, D., Harding, J.M. & Mann, R., 2002. Rapa whelk *Rapana venosa* (Valenciennes, 1846) predation rates on hard clams *Mercenaria mercenaria* (Linneaus, 1758). *Journal of Shellfish Research* 21: 777-779.

9.2 Conclusions

- To ease the processing of the "Directory of Dispersal Vectors" a new version was provided to ICES addressing all above comments on April 22nd 2004.

9.3 Recommendations

- As outlined in several presentations at WGBOSV 2004 the group noted concern that hull fouling may become a more important vector for species invasions in the future particularly if alternative substances used in antifouling paints after the ban of TBT in 2008 are not as effective as TBT. It is therefore necessary to maintain an overview of ongoing ship-mediated species introductions and to assess the importance of ship hull fouling as an invasion vector.

- ICES Member States should be advised of the risks posed by the movement of ships destined for breakers yards and that the present practice of trans-ocean movements of ships or other structures should be resisted unless acceptable measures for reducing this risk can be demonstrated.

10 DISSEMINATION OF RELEVANT MATERIAL FOR PUBLIC INFORMATION

WGITMO recognized that public awareness is of vital importance to avoid species introductions and to slow down the spread of previously established non-indigenous species. Public awareness material could be made available via the Internet. WGITMO suggests adding links to relevant publications on the WGITMO section within the listing of ICES Working Groups where the meeting reports may be downloaded.

10.1 Conclusions

Using the Internet download section of WGITMO´s meeting reports at www.ices.dk WGITMO recommends to:

- provide background information on WGITMO´s history by making the Summary of National Reports 1991-2001 available in electronic format,
- include a download link to the Code of Practice and its Appendices available here,
- include a link here to the Advisory Report on *Rapana venosa* and future reports as developed (e.g. the Alien Species Alert Report on Red Kind Crab *Paralithodes camtschaticus*),
- include a link to the directory of dispersal vectors entitled: "Vector pathways and the spread of exotic species in the sea".

10.2 Recommendations

- ICES is asked to consider linking the above mentioned material to the download section of WGITMO at www.ices.dk.

11 INTERACTION WITH PICES

Several proposals regarding future ICES-PICES interactions were included in last years WGITMO report. It was suggested that an interaction may support the application of the ICES Code of Practice on Introductions and Transfers of Marine Organisms, especially in non-ICES-member countries. Further, interest to interact with WGBOSV was also expressed.

Yasuwo Fukuyo, Japan was invited to join WGITMO as representative of PICES. He reported that the interaction with WGITMO was primarily for information exchange. So far, the problem of dealing with biological invasions is "only" covered by the PICES working group WG15 on harmful algal blooms. PICES WG 15 on "Ecology of harmful algal blooms in the North Pacific" has completed its terms of reference and was disbanded in October 2003, at PICES XII in Seoul, Korea. Instead of the short-lived Working Group, PICES established a permanent Section on "Harmful algal blooms" under MEQ. Terms of reference for the HAB Section are attached as Annex 12.

He reported further that PICES noted that the global demand for seafood is increasing. As a result aquaculture efforts will likely increase the supply of seafood for human consumption. Progress has been made in evaluating the risk and benefits from aquaculture through the development of standards for aquaculture operations. A relevant session was convened at the 2003 PICES XII Annual Meeting to highlight recent aquaculture developments, especially noting the various stakeholders involved in coastal zone management. At PICES XII, PICES also established a new Working Group on "Mariculture in the 21st century - The interaction between ecology, socio-economics and production" under the direction of MEQ and FIS. Terms of reference for this Working Group are attached as Annex 11.

The 2003 PICES XII Annual Meeting in Seoul, Korea, was drawn attention to. A keynote address was invited by PICES for a session relating to aquaculture development in the open ocean. Formal title for the session was "Aquaculture in the ocean ecosystem". Dan Minchin went in place of Stephan Gollasch, who was unable to attend, and gave a presentation entitled*: Between a rock and a hard place: aquaculture, and challenges posed by invasions*. The abstract of his presentation is included as Annex 7. Drs. Fukuyo and Minchin jointly updated WGITMO on the meeting. Although there was no specific session for invasive species at the PICES meeting it was decided that this would form a useful topic area for a future meetings. An informal discussion then took place and it was decided that a special session, later approved by the PICES council, to have a session entitled '*Natural and Anthropogenic Introduction of Marine Species*'. A one day Topic Session on "Natural and Anthropogenic Introduction of Marine Species" was proposed by MEQ and approved by the PICES Science Board and Governing Council. It was recommended to invite ICES as a co-sponsor for the session. This session will be jointly co-convened by Stephan Gollasch (ICES), Yasuwo Fukuyo (PICES) and William Cochlan (PICES). This is to be held on 20 October 2004 in Honolulu, Hawaii as part of PICES XIII meeting. Two speakers from ICES have been invited: Stephan Gollasch and Dan Minchin. Topic areas to be covered include: What is known about the different transport mechanisms, what is the magnitude of ecological and economic effects arising from the transport of species and what steps can be taken to minimise real or potential effects. It is planned that the session will cover a broad spectrum of organisms from phytoplankton to fish, from the tropics to polar regions, and from estuaries to ocean environments. PICES will ask its members to contribute to this session.

The following steps were discussed at the Seoul meeting to further collaboration between PICES and ICES on marine environmental quality issues:

- Participation of a PICES representative in the annual meetings of the ICES WGITMO and ICES/IOC/IMO WGBOSV in March 2004, Italy. Both WGBOSV and WGITMO very much appreciated that PICES was able to fund Yasuwo Fukuyo (Japan) to attend both meetings.
- Participation of representative(s) of WGITMO (and/or WGBOSV) in the meeting of PICES WG 15 (now HAB Section) and MEQ Topic Session on "Natural and anthropogenic introductions of marine species" to be held at PICES XIII (October 15-23, 2004, Honolulu, USA). Stephan Gollasch and Dan Minchin expressed their interest to attend this meeting representing both WGBOSV and WGITMO and will forwarded an abstract for consideration once funding is secured (see below).
- Consider to prepare an ICES/PICES workshop on scientific issues related to introductions and transfers of marine organisms in 2005 (possibly in conjunction with the annual meetings of WGITMO and WGBOSV).
- A Symposium on Marine Bioinvasions is to be held in 2006, possibly in Boston, USA. PICES Governing Council approved the co-sponsorship for the Symposium and Yasuwo Fukuyo was nominated as a PICES convenor and a member of the Scientific Steering Group.

Y. Fukuyo especially referred to the ICES Code of Practice on Introductions and Transfers of Marine Organisms, noting that no similar code exists within PICES. PICES considers the application of the ICES Code of Practice, especially in Asian PICES Member Countries.

11.1 Conclusions

- The interaction with PICES is seen as essential noting that several invaders already present in ICES-member countries originate from PICES-member countries.
- Mutual benefits may arise due to cooperational activities between ICES and PICES.
- Cooperating with PICES-member countries may result in spreading the knowledge on the Code of Practice further.

11.2 Recommendations

- The PICES representative strongly encouraged that a member of WGITMO attend the 2004 PICES Annual Meeting to be held October 15-23, 2004, in Honolulu, USA. As Chair Stephan Gollasch expressed his interest to attend PICES XIII (October 15-23, 2004, Honolulu, USA) representing both WGBOSV and WGITMO and, once funding is secured, will forward an abstract for consideration. ICES is asked to consider funding for Stephan Gollasch to attend PICES XIII.

- It is recommended that this item should remain on the agenda of WGITMO.

12 4TH INTERNATIONAL BIOINVASIONS CONFERNENCE IN NEW ZEALAND

The 4th International Marine Bioinvasions Conference will be held in Wellington, New Zealand in August 2005, hosted by the New Zealand Ministry of Fisheries and various other authorities. The meeting will be concurrent with the New Zealand Marine Sciences Society (NZMSS) and Australian Marine Sciences Association (AMSA) annual meetings. This conference is of direct interest to WGITMO and WGBOSV. Previous conferences were held in USA.

12.1 Conclusion

- Chad Hewitt (New Zealand) suggested ICES to consider co-sponsoring the meeting.

13 NEW ICES WORKING GROUP ON MARINE SHELLFISH CULTURE (WGMASC)

WGITMO noted with great interest the newly established Working Group on Marine Shellfish Culture (WGMASC), Chair: A. Bodoy, France. The group met in Trondheim, Norway from 13–15 August 2003 to:

a) review national reports of shellfish production and related activities (prepared by members) and provide a synthesis of the current status of shellfish production, trends in production, techniques, and biological and economic events regarding shellfish cultivation, in the ICES area;

b) provide a synthesis on the development of hatcheries, their impact on shellfish production for the different species, on the dissemination of selected or modified strains, and the genetic consequences of reduced broodstocks on natural populations;

c) review the ecophysiological causative factors of abnormal mortalities on cultured populations of molluscs, and ways to avoid them with improved husbandry;

d) review and report on ecological factors affecting shellfish production (carrying capacity, fouling, predation, HAB) and alternative solutions to mitigate effects;

e) develop a work plan to evaluate the current sustainability of shellfish culture and identify options to improve sustainability.

13.1 Recommendations

- WGITMO suggests that ICES may consider to draw the group's attention to the ICES Code of Practice on the Introductions and Transfers of Marine Organisms 2003 and to follow its provisions.

- It is further suggested to ask the group to indicate at follow up meetings the use of non-indigenous marine shellfish species being in culture in ICES member countries.

14 ICES ALIEN SPECIES ALERT REPORTS (TOR A)

At last year's meeting the final draft Alien Species Alert Report on Red Kind Crab *Paralithodes camtschaticus* was reviewd by WGITMO. Experts in this field were invited: Lis Jörgensen and Jan Sundet (Norway) as well as Igor Manushin (Russia). This year Sten-Richard Birkely (Norway) took over this task. These experts prepared, with the help of WGITMO, a final draft Alien Species Alert Report on the Red Kind Crab *Paralithodes camtschaticus* intersessionally. The final draft was considered during the meeting and approved by WGITMO with minor additions. The group wishes to express sincere thanks to all four experts who worked long hours preparing the report.

Last year's recommendation to consider the lobster *Homarus americanus* as new candidate species for a future Alien Species Alert Report was questioned at this years meeting. WGITMO noted that a project on this species is currently underway, funded by the Nordic Council of Ministers. It is suggested to wait for the outcome of this project and possible to jointly prepare an Alien Species Alert Report together with the project organizers.

14.1 Conclusions

- The Alien Species Alert Report on Red Kind Crab *Paralithodes camtschaticus* (attached as Annex 8), was finalised at this years meeting.
- ICES is invited to consider the publication of an Alien Species Alert Report on the Red Kind Crab *Paralithodes camtschaticus* as printed document in the ICES Cooperational Research Report series.

- ICES is further asked to make this report available via the Internet with a link at the download section of WGITMO´s meeting reports.
- Various species (see below) are suggested as new candidates for Alien Species Alert Reports and ICES is invited to consider this as ToR for next years meeting of WGITMO.

14.2 Recommendations

WGITMO suggests the following species as candidates for future Alien Species Alert Reports:

- *Undaria pinnatifida*. This macroalgae was intentionally introduced for aquaculture purposes. However, a comprehensive summary on its current distribution and impact is missing in ICES member countries. Eradication efforts and management options were undertaken and may be included when drafting the report as a summary of these efforts is lacking. Additionally, it is largely unknown which vectors have contributed to the spread of this algae. The alga has an enormous detrimental impact when occurring in high numbers.
- *Hemigrapsus penicillatus* and *H. sanguineus*. Both species occur in various ICES member countries (see National Reports). In Europe *Hemigrapsus penicillatus* is still spreading. Studies on the impact of both species are underway. More records are known from USA. The likely introducing vector is ballast water or hull fouling of ships.
- slipper limpet *Crepidula fornicata*. Although the species has occurred in some ICES Member Countries for some time, it has not reached all potentially suitable habitats yet. In shellfish culture the slipper limpet is known as competitor.

It is hoped that awareness resulting from Alien Species Alert Reports will reduce the risk of further spread of these species.

15 SUMMARY OF NATIONAL REPORTS 1992–2002 (TOR B)

WGITMO took the earlier summary of National Reports as a guiding document, but agreed to restructure its approach for the 1992-2002 summary (see last years meeting report). Summary material was prepared intersessionally and circulated for consideration at this years meeting. Inger Wallentinus (Sweden) focuses on algae, Dan Minchin (Ireland) on fish and Chad Hewitt (New Zealand) and Stephan Gollasch (Germany) dealt with invertebrates. WGITMO discussed including a viruses and pathogens section which Dorothee Kieser (Canada) had volunteered to cover. However, given that the WGPDMO tracks this information, it was decided that this section will included limited narrative material only. Having received the group's comments the volunteers will prepare intersessionally a final draft document until next years meeting.

15.1 Conclusions

- It was agreed by WGITMO that intersessional activities are essential to finalize this ToR at next years meeting.

16 INFORMATION FROM NATIONAL REPORTS (TOR C)

As recommended by ICES, in the future National Reports will be prepared and distributed intersessionally in order to allow maximum time for discussion of other ToRs at the meeting. National reports were received from 12 member countries: Belgium, Canada, Estonia, Finland, France, Germany, Ireland, Norway, Poland, Sweden, the United Kingdom and the United States of America (Annex 4). National Reports were also provided by Australia and New Zealand (affiliate status) (Annex 5) as well as Italy and a Russian statement (guest status) (Annex 6). An overview on introduced species in Japan was given by Yasuwo Fukuyo, who attended the meeting as guest (see Table 7).

National reports were briefly presented on Thursday.

By correspondence a note was received from Juan Juis Rodriguez (Spain). He referred to the LIFE project on alien terrestrial vertebrates and to an action plan to avoid species introductions to the Canary Islands. He further noted that *"some researchers at the Universities of La Laguna and Las Palmas are studying invasive algae transported via hull fouling and ballast water of ships"*.

16.1 Summary and highlights of 2003 National Reports (ICES member countries, countries with observer and guest status)

National Reports contain details of new laws and regulations, deliberate releases, accidental introductions and transfers, live imports, live exports, planned introductions, and meetings.

Australia

- Australia is aiming to introduce a new national system in July 2004 to manage domestic ballast water and other commercial/recreational vectors;
- *Asterias amurensis* has been discovered at Inverloch 110kms south-east of Port Phillip Bay;
- The data gathered as part of the Hastings National Demonstration project suggests that Crassostrea gigas is more prevalent in Australia than previously realised.

Belgium

The major event during 2003 was the discovery and sudden abundance of the pencil-crab, *Hemigrapsus penicillatus* along the coasts of Northern France and Belgium and along the borders of the river Scheldt. The species proved to be very common, predominantly in harbour areas.

The continuing findings of specimens of two warm water barnacles, *Megabalanus tintinnabulum* and *M. coccopoma,* off the Belgian coast indicate that both species are well established in the southern North Sea.

Canada

- Canada's National Code of Introductions and Transfers of Aquatic Organisms has been adopted and can be found at: http://www.dfo-mpo.gc.ca/science/aquaculture/code/prelim_e.htm.
- Previously unreported accidental introductions include: Ontario: grass carp; Quebec: tench, *Codium fragile* spp. *tomentosoides*, an unidentified bryozoan; Prince Edward Island: *Caprella mutica*.
- In general, intentional importations and transfers, as well as exports to other countries, were similar to previous years.
- The aquatic insect, *Eubrychiopsis lecontei*, was introduced as a bio-control organism for Eurasian water milfoil.

Estonia

A new '*Nature conservation act'* has been prepared and submitted to the Government (approval by the Parliament is expected in 2004). In this act, alien species issues are considered under two paragraphs. No new invasions were recorded in 2003. Monitoring of several existing invasions (*Cercopagis pengoi*, *Marenzelleria viridis*, *Dreissena polymorpha* etc.) was continued. Several field and lab experiments were additionally carried out that help to interpret results of field studies. Three documents/databases that contain summaries of the recent activities were made available through the internet: (1) Estonian alien species database (financed from national sources), (2) Estonian marine alien species database (financed by the US State Department) and (3) Project report on 'Alien Invasive Species in the North-East Baltic Sea: Monitoring and Assessment of Environmental Impacts' (financed by the US State Department).

Finland

Deliberate releases into the Baltic Sea included salmon (*Salmo salar*), sea trout (*Salmo trutta* m. *trutta*), and whitefish (*Coregonus lavaretus*).

Two new invertebrate species were reported from the Gulf of Finland in 2003. (1) The North-American amphipod *Gammarus tigrinus*, previously known from the Baltic Sea all the way to the Vistula Lagoon. A likely transport vector for *G. tigrinus* to the Gulf of Finland is the ballast water of ships. (2) The decapod *Palaemon elegans*, native to NE Atlantic, previously recorded in the SW and S Baltic up to the Gulf of Gdansk; vector unknown.

As in previous years, rainbow trout (*Oncorhynchus mykiss*) juveniles and eggs were exported to Russia and Estonia. In addition, whitefish (*Coregonus lavaretus*) juveniles were exported to Sweden (River Tornionjoki) and fertilized eggs of charr (*Salvelinus alpinus*), brown trout (*Salmo trutta*) and grayling (*Thymallus thymallus*) to Austria (inland farms) and fertilized grayling eggs to Germany (inland farm).

France

The special climatic conditions observed in 2003 explained the increase of tropical and subtropical species this year along the Atlantic coasts. The following species were recorded: *Eucampia cornuta* and *Chaetoceros rostratus* (diatoma), *Lagocephalus lagocephalus*, *Mola Mola*, *Dactylopterus volitans* (fish), *Pepanocephala electra* (mammals).

Three French programs (INVABIO, AREVAL and PNEC) contribute to the follow-up of invasive species along the French coasts especially regarding *Crepidula fornicata, Ocinebrellus inornatus* and *Cyclope neritea*.

Germany

No new accidental introductions were reported. Germany reported on the spread of the previously introduced non-indigenous oyster *Crassostrea gigas*. Activities on aquaculture and restocking focused in 2004 on eels, sturgeon and salmon. Ornamental trade is continuing to be popular. For direct human consumption, various crustaceans, blue mussels, common carp, and *Tilapia* species are imported. Live exports to ICES Member Countries focus on *Mytilus edulis* predominantly for the Belgium and Dutch market.

Together with Vadim Panov (Russia), Germany coordinates an initiative to link European working groups in the field of biological invasions (European Research Network on Aquatic Invasive Species (ERNAIS)). At present the network includes 101 experts from 27 countries (http://www.zin.ru/rbic/projects/ernais/)

Aquaculture and ballast water issues become more and more important. It is discussed to take advantage of planned offshore wind park installations to allow colonization with native hard bottom species and establish new maritime users, as e.g. aquaculture sites for oyster and macroalgae cultures (native and non-indigenous species such as the Pacific oyster may be included in the trials). Long-line mussel culture is also discussed.

Ireland

- *Caprella mutica:* Appears at a salmon farm site on the west coast of Ireland for the first time.
- *Dreissena polymorpha*: Now known from 57 Irish lakes and continuing to spread with overland boat movements as well as by some other unknown vector(s).
- *Anguillicola crassus*: Increasing in abundance in the Shannon catchment.
- *Sargassum muticum:* Now known from six Irish localities on all coasts, two more localities since 2002.

Italy

The report updates the findings of NIS in Italian marine waters. New species of fish, invertebrates and algae were added to the list, which needs revision and some amendments, especially for algae. A few already established species continued to expand. Information is also provided on the Manila clam fisheries and on the environmental effects of Tapes philippinarum harvesting. A few research projects are under way.

Japan

Japan presented a report on a large number of non-indigenous species (see Table 7**)**

Netherlands

Not available at time of report preparation.

New Zealand

- New Zealand has a new Biosecurity Strategy.
- The Ministry of Fisheries commissioned baseline surveys of the marine organisms in those ports and marinas where exotic marine species are most likely to arrive. The objective was to identify and record what marine life

presently exists at the ports, including exotic species that have already become established. Monitoring will then be able to detect new introductions of exotic marine species to enable a response if necessary. This information will also be used to measure the effectiveness of our border controls.

- 148 species have been introduced to New Zealand accidentally. Nearly 70% of these are thought to have been introduced as hull fouling organisms (Cranfield *et al.* 1998).
- Species detected since the previous report are listed in New Zealand's report.

Norway

- A number of suspect lobsters have been analyzed, but no American specimens were found (those analyzed were European).
- The population of snow crab (*Chionoecetes opilio*) appears to be growing on the Goose bank, and two specimens were caught in Norwegian waters.
- Continued growth in the population of the red king crab (*Paralithodes camtschaticus*).
- Proposed management for the red king crab: A boundary at "Nordkapp (26°). West of this boundary, fishing efforts aiming at strong reduction in numbers/erradication will be encouraged.
- A continued spread of the red alga *Heterosiphonia japonica* and the brown alga *Sargassum muticum*.
- Norway signed the Int. Convention on Ballast Water Management

Poland

Alien species in the Polish Baltic waters – it's a known phenomenon.

Numerous non-indigenous species in the Polish Baltic waters, occurs especially in its coastal areas. Invertebrates and fish species of Ponto-Caspian origin invade the Vistula and Oder drainage systems and southern Baltic Sea. Some species have another origin : from China, from Mediterranean Sea or have been transfered by reintroduction (as deliberate introduction). Human activities have accelerated the process of introductions of alien species.

Russia

Within the framework of the Ministry of Industry, Science and Technology of the Russian Federation a three-year (2002–2004) project is being conducted to assess the impact of alien species on the ecosystem in the Baltic Sea Basin. The project focusses on field and experimental studies of alien species for the ecosystem impact assessment, predictions of new invasions, the development of a national alien species information system (http://www.zin.ru/rbic/projects/iasnwrussia/), and the development of a scientific basis for state policy regarding biological invasions.

In addition, since early 2003, there is a new national project on biosecurity and the monitoring of biological invasions in aquatic ecosystems of the European part of Russia, funded by the Ministry of Industry, Science and Technology of the Russian Federation. The main goal of the project includes monitoring biological invasions in the eastern Gulf of Finland and the timely incorporation of monitoring data in the open information system with GIS-applications.

Another project deals with biological invasions in Baltic Sea coastal waters and includes studies of the diversity of marine coastal ecosystems under the influence of biotic factors. The main objectives of this project include assessing the impact of alien species on biodiversity and the structural-functional organisation of coastal ecosystems of the Baltic Sea, and the evaluation of the resistance of coastal ecosystems to the impact of invasive alien species.

Sweden

Three introduced red algae where recognized for the first time on the Swedish west coast: The Asiatic *Gracilaria vermiculophylla*, probably a recent ship introduction with patchy distribution in shallow bays in the Göteborg archipelago. The Japanese red alga *Heterosiphonia japonica* (i.e., "*Dasysiphonia* sp." in previous WGITMO reports) found in the Koster archipelago, N Bohuslän, most probably being dispersed from S Norway. *Aglaothamnion halliae*, common on the S coast of Norway, identified for the first time in harbour areas in the N and middle parts of Bohuslän.

The polychaete *Marenzelleria* cf. *viridis*, might have been recorded for the first time from the Swedish west coast.

Cercopagis pengoi has a very patchy distribution along the Swedish east coast and densities are generally low and have decreased. Diet analyses and stable isotope studies showed that the trophic position of herring has changed after the invasion of *Cercopagis*, implying that this invasion has resulted in a general food web change.

United Kingdom

- New EU legislation has been developed that will provide stricter controls on imports of live bivalve molluscs for human consumption.
- Research is being undertaken to determine the frequency and rate of non-native freshwater fish introductions into the UK, initially with regard to the release of ornamental and aquarium fish into the wild.
- Studies are being undertaken in Scotland on the spread and ecological impact of an alien crustacean species (*Caprella mutica*) that is colonising the sea lochs of the west Scottish coast.
- Signal crayfish (*Pacifastacus leniusculus*) continue to spread, but there is an initiative by the Environment Agency across England & Wales, but in particular in the North of England where the native crayfish still has strongholds, to attempt eradication of the alien species.
- Imports of Atlantic salmon eggs are being sourced from the USA for the first time and exports of Atlantic salmon ova were down by nearly one third. The use of triploid brown trout (*Salmo trutta fario*), which may pose an unacceptable risk to wild brown trout populations via genetic change resulting from interbreeding of stocked and wild fish, is the subject of on-going research.
- The UK Department of Environment, Food & Rural Affairs (Defra) is funding research (horizon scanning, development of risk assessment tools, applied environmental biology) on non-native species to understand better their potential social, economic and environmental risks to the UK.
- Investigations have begun to assess the dispersal patterns and risk of expansion of the freshwater fishes pumpkinseed (*Lepomis gibbosus*), wels catfish (*Siluris glanis*) and pikeperch (*Sander lucioperca*), with the latter of particular interest due to its tolerance of elevated salinity levels.
- A series of investigations is underway to assess the environmental biology, environmental risks and impacts of alien freshwater fishes, in particular sunbleak (*Leucaspius delineatus*) and topmouth gudgeon (*Pseudorasbora parva*), which have been spreading through Southern England and now are occurring further north
- The UK Joint Nature Conservation Council (JNCC) has several non-natives policy initiatives in progress, involving the UK Biodiversity Research Advisory Group (BRAG) and the UK WFD Technical Advisory Group (TAG).
- Queens University at Belfast is due to report on the All-Ireland Review of Invasive Alien Species. Both Northern Ireland and the Republic are eager to integrate with future developments in Britain on this issue.

USA

The major focus of intentional introductions in the U.S. is the release of *Crassostrea ariakensis* into the tidal waters of the Chesapeake Bay by the state of Virginia. One million triploid oysters have been distributed to ten locations and will be monitored over the next couple of years before they are harvested. Although the proponents did not request review by WGITMO, they did follow the 1994 Code of Practices. However an independent study by the U.S. National Research Council noted the uncertainty associated with many aspects of this project.

The presence of a tunicate species, currently called *Didemnum lahillei* (formerly *D. vexillum*) has been found on Georges Bank near the continental shelf. It is found in approximately 6 sq miles of prime scallop bed areas, appears to be spreading, and may be dispersed by fishing gear. Its impact on fisheries is unknown.

The U.S. Congress is considering a revision of the Nonindigenous Species Act that addresses federal oversight of intentional introductions (currently individual states can make those decisions), ballast water management, and other issues related to marine and fresh water introductions. In addition, the U.S. Coast Guard has several new rules for mandatory reporting of vessels, including coast wise vessel traffic. Civil penalties of up to $25,000 may be imposed for failure to submit reports. The Coast Guard can make rules independent of Congressional regulations under the current laws.

16.2 New laws and regulations

According to the National Reports submitted for this year’s meeting some countries have made changes or are intending to make changes to their laws and regulations. A brief overview is presented in the Table 16.2.1 below. Additional details can be found in the individual National Reports. Please note that this table is not comprehensive as not all ICES-member countries made National Reports available to WGITMO (Annexes 4–6).

Table 16.2.1. New laws and regulations relevant to species movements and biological invasions (based on information provided in the National Reports).

Country	New laws and regulations
Australia	The Australian National Introduced Marine Pest Coordinating Group (NIMCG), in conjunction with the Coordinating Committee for Introduced Marine Pesr Emergencies (CCIMPE), are in the process of drafting a new National System for the Prevention and Management of Marine Pest Incursions. There will be implementation of the new ballast water arrangements in Australia
Belgium	No new legislation
Canada	Fully adopted National Code of Introductions and Transfers of Aquatic Organisms. Some individual Provinces have enacted new legislation
Estonia	New ‘Nature conservation act’ has been finalised and submitted in early 2004 for final approval
Finland	Introductions of alien species are regulated through the Nature Conservation Act (1096/1996, as amended by 492/1997 and 371/99) and those of fish by the Fishing Act (1982).
France	The council directive 95/70/EC introducing minimum Community measures for the control of certain diseases affecting bivalve molluscs has beeb amended concerning the annex D (Commission decision 2003/83/EC).
Germany	Germany signed the IMO Ballast Water Management Convention at the Diplomatic Conference in February 2004.
Italy	An interministerial trilateral task force for the Adriatic Sea Ballast Water Management was established with representatives of Croatia, Slovenia and Italy
Ireland	No new legislation reported
New Zealand	1) amendment to the Biosecurity Act , 2) The finalisation of the Biosecurity Strategy (2003)
Norway	No new legislation.
Poland	Polish regulation of legislation determines: The Decree of Infrastructure Ministry (21 May 2003) concerning the conditions of collecting, preservation and removing of wastes and sewers from inland sailing ships. The decree determines conditions of collecting, preservation and removing of wastes and sewers from inland sailing ships and the way of prevention of contaminations from transported cargo.
Sweden	The Swedish legislation for release of GMOs is based on National legislation all mainly follow the new EU Directive 2001/18/EG. A regulation prescribing that salmon (*Salmo salar*) and sea-trout (*Salmo trutta*) stocked into the sea should have there adipose fin removed was decided in 2003 New regulations concerning crustaceans, prescribing that imported crustaceans should be kept in closed systems before being placed on the market. The regulations concerning stocking of salmonids in rivers on the Swedish west coast free from the parasite *Gyrodactylus salaris* was enhanced.
United Kingdom	An extended list of species pertaining to the Import of Live Fish (England and Wales) Act (1980) took effect in February 2003.

Country	New laws and regulations
USA	U.S. Congress is considering new laws focused on marine invasions. The U.S. Coast Guard has proposed new rules for reporting of ballast management and discharge by commercial ships operating in U.S. waters These regulations are expected to go into effect by mid-2004. Several states have regulations and programs aimed at ballast water management, in addition to those that exist at the national level. States with such programs include California, Maryland, Michigan, Oregon, Virginia, and Washington. California has the most extensive state program at the current time.

16.2.1 Live imports, live exports, planned introductions and deliberate releases

It has to be noted that the figures and tables in this section of the report do not claim to be fully comprehensive as not all ICES member states submitted National Reports to the meeting. Further, the origin of several importations remains unclear as some countries exhibit a lack of import and/or export documentation. It is interesting to note that on several occasions a country states that a species was imported from another country whereby the exporting country has no mention of this movement in its National Report. This further indicates the patchiness of information available. In general, information on exports appears more difficult to collect than information on imports (Tables 16.2.1.1 and 16.2.1.2).

Table 16.2.1.1. Species exported by ICES-member countries according to the National Reports submitted in 2003 and 2004.

Exporting country	Species
Australia	No information available
Belgium	No information available
Canada	*Salmo salar, Salvelinus alpinus, S. fontinalis, Oncorhynchus mykiss, S. fontinalis x S. alpinus,O. nerka, Placopecten magellanicus,* various invertebrates for aquarium use
Estonia	Various fish
Finland	rainbow trout (*Oncorhynchus mykiss*) whitefish (*Coregonus lavaretus*), charr (*Salvelinus alpinus*), brown trout (*Salmo trutta*), grayling (*Thymallus thymallus*)
France	No information available
Germany	*Mytilus edulis*
Ireland	*Salmo salar, Carassius* sp*, Crassostrea gigas, Haliotus tuberculata, O. mykiss, S. trutta*
Ital;y	No information available
New Zealand	No information available
Norway	No information available
Poland	*Oncorhynchus mykiss*
Sweden	*Oncorhynchus mykiss, Salmo sp., Mytilus* spp. Scallops, eel, ornamentals
United Kingdom	Salmo salar, Crassostrea gigas, Mytilus edulis
USA	No information available

Table 16.2.1.2. Species imported by ICES-member countries according to the National Reports submitted in 2003 and 2004.

Importing Country	**Species**
Australia	*Crassostrea gigas*
Belgium	No information available
Canada	*Tapes philippinarum, Crassostrea gigas, C. sikamea, Mytilus galloprovincialis, M. edulis, Placopecten magellanicus, Ostrea edulis, Crassostrea virginica, Oncorhynchus mykiss, Salmo salar, Oroechromis niloticus, Acipenser transmontanus, Haliotis rufenscens, Homarus americanus, Strongylocentrotus drobachiensis, Crassodoma gigantea, Eubrychiopsis lecontei, Anarhichas minor, Gadus morhua*
Estonia	Various fish including eel (*Anguilla* spp.) *Oncorhynchus*, spp., *Salmo salar* *Hucho hucho*
Finland	Sturgeon eggs Freshwater crayfish
France	No information available
Germany	Various fish including *Cyprinus carpio* (koi) and other carp, several sturgeon species (incl. *Acipenser baeri), Salmo salar, Oncorhynchus mykiss, Mytilus edulis,* various live crustaceans
Ireland	Various aquatic plants, *Crassostrea gigas, Nereis* sp*., Salmo salar, Oncorhynchus mykiss, Psetta maxima,* various ornamental species
Italy	No information available
New Zealand	No information available
Norway	*Hippoglossus hippoglossus, Scopthalmus maximus, Dicentrachus labrax, Aquarium species,Mytilus edulis,* oyster (unspecified) American lobster
Poland	*Acipenser baeri, Salmo salar, Oncorhynchus mykiss* *Lepomis gibbosus, Percottus glenii*
Sweden	*Anguilla anguilla*, Lobster, crab, *Mytilus* spp, oysters (*Ostrea, Crassostrea*) Ornamentals, scallops
United Kingdom	*Salmo salar, Oncorhynchus mykiss,* eels, *Crassostrea gigas, Homarus americanus,* various bivalves
USA	No information available

The following table (Table 16.2.1.3) summarizes live imports and exports of aquatic species according to higher taxa and area of origin based on National Reports considered at the meeting.

Table 16.2.1.3. Summary of live imports and exports of aquatic species (including ornamental trade and imports for containment) according to National Reports submitted to WGITMO 2004. Ornamental trade excluded. (cr = crustacean, fi = fish, mo = molluscs, pl = plants, Arm = Armenia, Aus = Australia, Bel = Belgium, Bra = Brazil, Can = Canada, Col = Columbia, Cze. R = Czech Republic, Den = Denmark, Est = Estonia, Fin = Finland, Fra = France, Ger = Germany, Hon = HongKong, Hun = Hungaria, Ice = Iceland, Ind = Indonesia, Ire = Ireland, Isr = Israel, Ita = Italia, Lat = Latvia, Net = the Netherlands, Nig = Nigeria, Nor = Norway, Pol = Poland, Por = Portugal, Rus = Russia, S. Afr = South Africa, Sin = Singapore, Spa = Spain, Sri = Sri Lanka, Swe = Sweden, Tai = Taiwan, Tha = Thaliand, UK = United Kingdom, USA = the United States of America, Vie = Vietnam).

	Import (limited to ICES member countries)														
Exporting country	**Bel**	**Can**	**Den**	**Est**	**Fin**	**Fra**	**Ger**	**Ire**	**Net**	**Nor**	**Pol**	**Rus**	**Swe**	**UK**	**USA**
Arm													fi		
Aus														fi	
Bel													fi, mo, cr		
Bra													fi		
Can						fi	fi				fi		mo, cr		fi
Col													fi		
Cze. R				fi			fi						fi		
Den				fi	fi		fi, mo	fi		fi	fi		fi, mo, cr	fi	
Est												fi	fi		
Fin				fi			fi					fi	fi		
Fra					fi		fi	mo		fi				fi	
Ger	mo			fi					mo				fi, mo		
Hon													fi		
Hun							fi								
Ice		fi, mo						fi		fi				fi	
Ind													fi		
India													fi		
Ire						fi	fi						mo, cr	mo, fi	
Isr													fi		
Ita				fi			fi								
Lat											fi				
Net							fi						fi, mo, cr	fi	

	Import (limited to ICES member countries)														
Exporting country	**Bel**	**Can**	**Den**	**Est**	**Fin**	**Fra**	**Ger**	**Ire**	**Net**	**Nor**	**Pol**	**Rus**	**Swe**	**UK**	**USA**
Nig													fi		
Nor		fi		fi									fi, mo, cr		
Peru													fi		
Pol							fi								
Por															
Rus							fi				fi				
Spa								pl							
S. Afr.											fi			fi	
Sin				fi									fi		
Sri													fi		
Swe	mo		fi, mo		fi, mo	mo	fi, mo	mo	fi, mo	fi, mo				mo	
Tai				fi											
Tha				fi									fi		
UK		mo		fi				fi, mo					fi, mo, cr		
USA		fi, mo											mo, cr	fi	
Vie													fi		

The country with the highest number of source regions in commercial species imports in 2003 was Sweden (25 source regions) to be followed by Germany with 12. Most other importing countries import species from less than 6 source regions (Table 16.2.1.3). However, it should be noted that the detail level when documenting species varies enormously between certain countries. Several countries refer to source regions as "from various countries" thereby documenting that more detailed information is not available.

As in previous years, the most commonly moved species in 2003 were Atlantic salmon and the Pacific oyster (Tables 16.2.1.4 and 16.2.1.5).

Table 16.2.1.4. Movements of Atlantic salmon, *Salmo salar* (as taken from the National Reports considered at WGITMO 2004).

Donor Country	**Recipient Country**
Australia	UK
Canada	USA
Iceland	Ireland, UK,
Ireland	UK (Scotland, Wales, N. Ireland, England), Greece, France
Latvia	Poland
Norway	Estonia
Sweden	Germany
UK	Chile, EU countries,
USA	Canada, UK

Table 16.2.1.5. Movements of Pacific oysters, *Crassostrea gigas* (as taken from the National reports considered at WGITMO 2004).

Donor Country	**Recipient Country**
USA	Canada,
UK	Ireland, Canada
Ireland	UK, France
Netherland, Denmark, Ireland, USA, Germany	Sweden

16.3 *Hippocampus* cultivation in Ireland

Dan Minchin reported that a project was set-up in 2001 to rear seahorses with the aim of aiding their conservation and also to supply other aquaria and the oriental medicine market. The emphasis over the last year has been on conservation, with only the surplus being used for traditional oriental medicine. Currently there four species are cultivated (*Hippocampus whitei, H. abdominalis, H. fuscus* and *H. kuda*). The most recent species acquisition are several specimens of *H. kuda,* a species native to the Indo-Pacific and acquired *via* London, to act as broodstock. The three other species had previously been obtained *via* a captive breeding unit in Australia and from aquaria in Britain. There are two other species of European origin in culture *H. hippocampus* and *H. guttulatus* imported from Britain and Portugal. This project is affiliated to the Marine Aquarium Council that have specific standards of practice. The facility intends to open as a visitors centre over the coming year.

16.4 Conclusions

- As at last year's meeting, the very detailed information provided by guest and observers was greatly appreciated by WGITMO.
- As in previous years, ICES is asked to urge member countries and other jurisdictions to inform WGITMO of any new record of introduced species or suspected introductions and changes in the distribution and abundance of previously introduced species in their jurisdiction in the form of National Reports.
- WGITMO will consider intersessionally to re-formate the National Report structure with the aim to collate information in a table format and to ease the annual reporting, documentation and synthesis of the spread and impact of introduced species (see the following section). A spreadsheet format is likely to allow a continuous overview of information from National Reports and the annual preparation of a concise summary report on the ecological significance of any new proposed introductions. It is further suggested to use a "rolling format" covering ten years and by doing so to simplify future ten year summaries of National Reports.

16.5 Recommendations

- WGITMO recommends that future annual meetings include an opportunity for the participation from non-ICES countries (e.g., Australia, New Zealand, Mediterranean countries, PICES and other international organizations, such as CIESM) on the basis of their expertise on species that are invasive elsewhere and that may be of concern to ICES-member countries.

- It is recommended that this ToR should remain on the agenda of WGITMO.

17 ECOLOGICAL IMPACTS OF ACCIDENTAL INTRODUCTIONS (TOR D)

Ship-mediated biological invasions were dealt with at the Working Group on Ballast and other Ship Vectors (WGBOSV). The group met back-to-back to WGITMO in Italy. Extended abstracts are available in the WGBOSV meeting report 2004.

Table 17.1 below is a compilation of species listed as accidental introductions and transfers in National Reports including the reports submitted for the 2004 meeting of WGITMO. Please note that further first records of non-indigenous species are provided in the WGBOSV 2004 meeting report and annexes thereto. A comprehensive list of first records of non-indigenous species prior 2003 is attached to the Handbook of Dispersal Vectors as provided with last years meeting report.

Table 17.1. Species listed as accidental introductions and transfers in the National Reports including the 2004 reports.

Reported by:	***Species***
Australia	*Asterias amurensis, Perna viridis, Carcinus maenas, Corbula gibba,Crassostrea gigas* (feral) *Sabella spallazani, Musculista senhousia, Alexandrium catenella, A. minutum, A. tamarense, Gymnodinium catenatum, Undaria pinnatifida*
Belgium	*Crassostrea gigas, Ensis directus, Crepidula fornicata, Elminius modestus, Mytilopsis leucophaeta, Dreissena polymorpha, Cordylophora caspia, Callinectes sapidus, Caprella mutica, Ficopomatus engimatus, Megabalanus tintinnabulum, M. coccopoma, Tricellaria inopinata, Undaria pinnatifida, Hemigrapsus penicillatus*
Canada	*Homarus americanus, Salmo salar, Carcinus maenas, Nuttalia obscurata, Styela clava, Botryllus schlosseri, Ciona intestinalis, Codium fragile, Haplosporidium nelsoni, H. costale, Ctenopharyngodon idella, Tinca tinca, Caprella mutica*
Estonia	*Hypothalmichthys nobilis, Neogobius melanostomus, Maeotias marginata, Cergopagis pengoi, Marenzelleria viridis, Dreissena polymorpha, Eriocheir sinensis,,Balanus improvisus, Mya arenaria*
Finland	European sheatfish virus, *Anguillicola crassus, Gammarus tigrinus, Palaemon elegans*
France	*Crepidula fornicata, Austrovenus stutchburii, Ocinebrellus inornatus, Rapana venosa, Homarus americanus, Caulerpa taxifolia, Corella eumyota, Eucampia cornua, Chaetoceros rostratus, Lagocephalus lagocephalus, Mola mola, Dactylopterus volitans, Pepanocephala electra, Cyclope neritea.*
Germany	*Hemigrapsus penicillatus, Crassostra gigas, Mya arenaria, Anguillicola* sp., *Eriocheir sinensis, Dreissena polymorpha, Portumnus latipes, Teredo navalis, Mastocarpus stellatus*
Japan	*Crepidula onyx, Cuthona perca, Urosalpinx cinerea, Umbonium thomasi, Euspira fortunei, Aglaja* sp., *Stenothyra* sp., *Nessarius (Zeuxis) sinarus, Mytilopsis leucophaeata, Mytilus galloprovincialis, Perna viridis, Xenostrobus securis, Potamocorbula laevis, Potamocurbula* sp., *Ostrea edulis, Ostrea lurida, Crassostrea angulata, Anadara* sp., *Ptericola* sp. *(*cf. *lithophaga), Mytilopsis sallei, Meretrix petechialis, Felaniella sowerbyi, Trapezium liratum, Corbula* spp., *Timarete luxuriosa, Ficopomatus enigmaticus, Hydroides elegans, Balanus amphitrite, B. variegatus, B. venustus, B. glandula, B. eburneus, B. improvisus, Penaeus chinensis, Carcinus aestuarii, Callinectes sapidus, Charybdis lucifera, Eriocheir leptognathus, Pyromaia tuberculata, Pugettia quadridens intermedia, Zoobotyon pellucidum, Bugula californica, Strongylocentrotus undus, Molgula manhattensis, Ciona intestinalis, Polyandrocarpa zorritensis, Gracilaria lemaneiformis, Ulva lactuca.*
Ireland	*Dreissena polymorpha, Ficopomatus enigmatica, Sargassum muticum, Azolla filiculoides, Myriophyllum aquaticum, Lagarosighon major, Crassula helmsii, Hydrocotyle ranunculoides, Elodea nuttalia, Nymphoides peltata, Anguillicola crassus, Pseudodactylogyrus anguillae, P. bini, Bonamia ostrea, Chelicorophium curvispinum, Caprella mutica*

Reported by:	***Species***
Italy	*Tapes philippinarum, Seriola rivoliana, Clytia hummelinki, Leiochrides australis, Ophryotrocha japonica, Chrisallida fisheri, Aplysia dactylomela, Anadara inaequivalvis, A. demiri, Musculista senhousia, Percnon gibbesi, Ceramium bisporum, Batophora sp., Hypnea cornuta, Caulerpa racemosa, C. taxifolia, Fistularia commersoni, Brachidontes pharaonis, Melibe viridis, Haminea callidegenita, Aplysia parvula, Polyandrocarpa zorritensis, Asterodininium gracile,Osteropsis siamensis, O. ovata, O. lenticularis, Coolia monotis, Prorocentrum mexicanum*
New Zealand	*Arenigobius bifrenatus, Favonigobius exquisites, Acentrogobius pflaumi, Parioglossus marginalis, Charybdis japonica, Didemnium vexillum, Paracorophium brisbanensis, Codium fragile, Undaria pinnatifida, Caulerpa taxifolia, Gymnodinium catenatum, Dasys* spp., *Griffithsia crassiuscula, Polysiphonia subtilissima, Codium fragile, Omobranchus anolis, Parioglossus maginalis, Favonigobius exquisites, Cancer gibbulosus, Biflustra grandicella, Dictyota furcellata*
Norway	*Crepidula fornicata, Chionoecetes opilio, Caprella mutica, Homarus americanus, Sargassum muticum, Heterosiphonia japonica*
Poland	*Palaemon elegans, Obesogammarus crassus,Pontogammarus robustoides, Dikerogammarus haemobaphes, D. villosus,Chaetogammarus ischnus*, *Chelicorophium curvispinum*, *Atyaephyra desmaresi, Hemimysis anomala, Gammarus tigrinus, Orconectes limosus, Eriocheir sinensis, Rhithropanopeus harrisii tridentatus, Cercopagis pengoi, Marenzelleria viridis, Anguillicola crassus, Hypophtalmichthys molitrix, Aristichthys nobilis, Ctenopharyngodon idella, Acipenser guldenstaedti, A.. baeri, A. .ruthenus, Salmo gairdneri, Neogobius melanostomus, Prorocentrum minimum*
Russia	No information
Sweden	*Acipenser baeri, A. gueldenstaedti, A. ruthenus, Huso huso, Ctenopharyngodon idella, Cyprinus carpio, Hypophthalmichthys molitrix, H. nobilis, Hucho hucho, Oncorhyncus clarki, O. gorbuscha, O. kisutch, O. mykiss, O. nerka, Salvelinus fontinalis, S. namaycush, Micropterus dolomieu, M. salmoides, Gyrodactylus salaris, Cerogagis pengoi, Marenzelleria viridis, Eriocheir sinensis, Anguillicola crassus, Coscinodiscus wailesii, Fucus evanescence, Sargassum muticum, Bonnemaissonia hamifera, Dasya baillouviana, Colpomenia peregrina, Codium fragile, Gracilaria vermiculophylla, Heterosiphonia japonica, Aglaothamnion hallidae, Dissodinium pseudocalani, Oxytoxum ariophilum, Chattonella* sp., *Alexandium pseudogonuaulax,* rhabdovirus of eel.
United Kingdom	*Pseudoraspora parva, Acipenser ruthenus, Leucapius delineatus, Stizostedion lucioperca, Silurus glamis, Crepidula fornicata, Perophora japonica, Alexandrium minutum, Sargassum muticum, Eriocheir sinensis,* Spring viraemia of Carp virus*Regalecus glesne, Acipenser* sp*, Sander lucioperca, Pseudorasbora parva, Leucaspius deliniatus, Caprella mutica, Pacifastacus leniusculus*
USA	*Alcyonidium sp, Didemnium sp, Undaria pinnatifida, Caulerpa taxifolia, Porphyra suborbiculata, Perna viridis, Phyllorhiza punctata, Caprella mutica, Ficopomatus ushakovi, Hydroides diramphus, Littorina littorea, Hydroides diramphus, Ascophyllum nodosum*

17.1 *Bonamia* sp. in Crassostrea *ariakensis* in USA

WGITMO, through its Code of Practice, has highlighted the possibility of introduction of disease agents and pests through the introduction of target species. Another possibility is the enhancement of an endemic pathogen through the introduction of a new host species. This possibility was highlighted in the WGPDMO which was made available to WGITMO and which states: *Bonamia* sp. in *C. ariakensis* – A new species of *Bonamia* (based on rDNA sequence analysis) was found in the Suminoe oyster (*C. ariakensis*) in Bogue Sound, a high salinity site in North Carolina, USA, where the oysters were being evaluated for possible introduction. The oysters, hatchery produced triploids reared following the ICES protocols, had experienced heavy mortality during the summer of 2003. *Bonamia* sp. was subsequently found in up to 60% of live *C. ariakensis* at this site. It has not been found in members of the same cohorts being tested at lower salinity sites in North Carolina or in the Chesapeake Bay, nor was it found in histological sampling of an earlier cohort tested in Chesapeake Bay and high salinity areas of coastal Virginia. The parasite is considered to be enzootic, rather than introduced, and a search for the local reservoir host is underway. This finding is of direct relevance to the proposal reported in the US National Report to allow the use of *Crassostrea ariakensis* in Chesapeake Bay.

The significance of the impact of non-indigenous species was discussed in great detail using the case history of *Paralithodes camtschaticus, Rapana venosa* and information provided in National Reports. Details of the discussion are reflected in the Advisory Report on *Rapana venosa*, the Alien Species Alert Report on Red Kind Crab *Paralithodes camtschaticus* (see Annex 8) and in the summary of National Reports (see Section 16 above).

17.2 Zebra mussels continue their expansion to Irish lakes (Dan Minchin)

Zebra mussels first arrived in Ireland about 1993/4 are though to have arrived attached to the hulls of used leisure craft from Britain. This evidence is supported with craft arriving from Britain with living mussels attached to hulls and a genetic similarity of the established population in Ireland with those from Britain (Pollux *et al.,* 2003). The spread through most of the inland navigation was with movements of leisure craft from Lough Derg to other interconnected navigable waters (Minchin *et al*., 2003). In 2003 twenty additional lakes were found to be colonised. The total number of lakes known to be infested is now fifty-seven, this includes lakes west of the Shannon River (Minchin, 2003). Some of these lakes are important for angling. It is likely other lakes, not identified in the 2003 survey, have become infested.

The mode of dispersal to the twenty new lakes will have included boating activities, but anglers, deliberate introductions, flooding to upstream lakes and downstream larval dispersal may also be involved in colonisation processes.

The biomass of zebra mussels in lakes has declined at some site over previous years. Impacts include an apparent increase in water clarity, lacerations to the feet of bathers and boardsailers. Boat hulls do not appear to be as fouled as in previous years. One municipal plant avoids fouling of its abstraction system because of the build-up of a maerl slime making it unsuitable for attachment by zebra mussels.

According to Juhel, *et al*. (2003) females spawn, at a size from <6mm shell length, from March to August and do so over a longer duration than males. However, on navigable waterways larvae first appear in May and remain in the plankton up to October.

Juhel, G., Culloty, S.C., O'Riordan, R.M., O'Connor, J., de Faoite, L. & McNamara, R. 2003. A histological study of the gametogenic cycle of the freshwater mussel *Dreissena polymorpha* (Pallas, 1771) in Lough Derg, Ireland. *Journal of Molluscan Studies*, **69**: 365-373.

Minchin, D., 2003. The zebra mussel *Dreissena polymorp*ha (Pallas) extends its range westwards in Ireland. *Bulletin of the Irish Biogeographical Societ*y **27**: 176-182.

Minchin, D., Maguire, C. & Rosell, R., 2003. The zebra mussel (*Dreissena polymorpha*) Pallas invades Ireland: Human-mediated vectors and the potential for rapid international dispersal. *Biology & Environment. Biology and Environment: Proceedings of the Royal Irish Academy*, **103B** No 1 23-30

Pollux, B., Minchin, D., Van der Velde, G., Van Allen, T., Moon-Van der Staay, S.Y. & Hackstein, J. Zebra mussels (*Dreissena polymorpha*) in Ireland, AFLP- fingerprinting and boat traffic both suggest an origin from Britain. *Freshwater Biology* **48**: 1127-1138.

17.3 Impact of non-native species according to National Reports provided

National Reports generally only list the species recently recognized as NIS. In most cases work on impacts is difficult to undertake and takes time and considerable funding to research. However several countries reported impacts for some of the invasive species studied in their area:

Canada

During the 2003 WGITMO meeting, Canada reported MSX disease in oysters (*Crassostrea virginica*) for the first time. On several leases, oyster mortalities associated with the parasite, *Haplosporidium nelsoni*, exceeded 90%.

The new finding of *Caprella mutica* on natural reefs and artificial structures in estuaries of the east end of PEI raises concerns because the species is seen as a pest for aquaculture since it can form a thick layer over top of the mussels.

Estonia

Laboratory experiments on feeding habits of *Cercopagis pengoi* could be summarised as: (1) *Cercopagis*, both adult and newly born young stages, are able to consume other prey than small sized cladocerans (*Bosmina*); (2) the newly born youngs are unable to prey on adult copepods, presumably due to size problems; (3) feeding intensity of *Cercopagis* is higher for the prey with limited escape response (e.g., *Balanus* larvae an copepod *nauplii*) than for more evasive prey (adult copepods); (4) copepod *nauplii* are more preferred prey than adult copepods and *Balanus* larvae; (5) *Cercopagis* may cause reductions of food resource for larval fish that may, in turn, result in declined year-class abundances of many commercial fish species.

Since the introduction of *Marenzelleria viridis* in 1985 the species has quickly spread and became established throughout the sea. Following its introduction the densities of the amphipod *Monoporeia affinis* and the polychaete *Hediste diversicolor* have dropped considerably.

France

Two species of Diatoma, *Eucampia cornuta* and *Chaetoceros rostratus*, were first recorded along the Atlantic coast of West Brittany (Finistère) last autumn. These diatoma are warm water species. Together with other warm water diatoma, previously recorded in this area (*Asteromphalus sarcophagus* and *Chaetoceros peruvianus)*. These species could be harmful for marine fauna especially in periods of unusually warm water.

A 2003 report emphasises the insidious threat due to the proliferation of *Crepidula fornicata* on Maerl-forming species (mainly *Lithothamnion corallioides* and *Phymatolithon calcareum*) habitats in Brittany.

Germany

Crassostrea gigas is spreading southwards and competes with native *Mytilus edulis* for habitat and food. It was documented at certain sites that the oysters have (partly) overgrown mussel beds at increasing density.

Ireland

*The nematode parasite, Anguillicola crassu*s, has increased in its level of infestation in silver eels captured descending in the winter 2003/04 within the Shannon catchment, with up to 70% of examined eels being infested, an increase from the 11.5% observed the previous winter.

Norway

The introduced red king crab *Paralithodes camtschaticus* is continuously spreading in the southern Barents sea and is now common in Norwegian waters west to about Hammerfest. To date there are no reports or indications of any impact of the crab on the ecosystem. However, the Institute of Marine Research implemented in 2003 a comprehensive research program to study dispersal and ecosystem-effects of the crab.

Poland

There is no round goby fishery, however there may be considerable, unwanted by-catch, especially in the shallow water fyke-nets catches. Because of the scarcity of large fish in the shallow water of the Gulf of Gdansk, round goby is not consumed in big quantities by predatory fishes. Instead it serves as food for cormorants, from the middle of 1990s. Information on gobies being a food supply for other birds – herons, has been collected.

Sweden

Fish diet analyses have shown that the NIS, *Cercopagis pengoi* is readily consumed by herring and sprat, within their size ranges commonly found during August-September, i.e. 5-15 cm for sprat and 5-25 cm for herring. Large fish exhibit clear positive selectivity for *Cercopagis*. As suggested by diet analyses and stable isotope studies, the trophic position of herring has changed after the invasion of *Cercopagis*. With the central role of this species in the pelagic food web, this implies that the invasion by *Cercopagis* has resulted in a general food web change.

United Kingdom

The large-scale stocking of rivers and streams with farm-reared fertile brown trout (*Salmo trutta*) may pose an unacceptable risk to wild brown trout populations via genetic change resulting from interbreeding of stocked and wild fish. All-female triploid brown trout have been available commercially for some 5 years and, being essentially sterile, they offer a means of substantially reducing or avoiding genetic risks to wild stocks whilst maintaining the fishery benefits of stocking in “native trout” waters. However, insufficient information is available on whether there would be any detrimental impacts, which could be competition for food and habitat.

17.4 Conclusions

- First records of non-indigenous aquatic species were again reported from ICES-member countries (Annexes 4 – 6). In this year's report the number of new invaders is reported from several ICES member countries. Please note that this summary does not intend to be fully comprehensive as not all ICES-member countries made National Reports available to WGITMO. Further, previous case histories have shown that a timelag occurs when reporting new invaders. Therefore, a trend analysis cannot be drawn from these data at this stage.
- The identification of trends is difficult to carry out on a yearly basis. WGITMO will include a relevant section into the summary of National Reports 1992 to 2002 (ToR b). Since 2002 this information was summarized in table format.
- Several countries listed impacts of introduced or accidentally transferred species.

17.5 Recommendations

- It is recommended that this ToR remain on the agenda of WGITMO as new invaders are likely to occur in ICES-member countries in the future.
- WGITMO suggests to consider the listed candidate species for new Alien Species Alert Reports (see also Section 14).
- WGITMO recommends that member countries include information on impacts of non-indigenous species where available

18 RAPID RESPONSE AND CONTROL OPTIONS OF INVADERS (TOR E)

Discussions at the meeting revealed the lack of rapid response strategies when new species are recorded. However, the following document, published in 2001 by CSIRO Marine Research, Australia, was considered at the meeting:

McEnnulty, F.R., Bax, N.J., Schaffelke, B. & M. L. Campbell (2001): A Review of Rapid Response Options for the Control of ABWMAC Listed Introduced Marine Pest Species and Related Taxa in Australian Waters.Technical ReportNo. 23. CSIRO Marine Research, Hobart, Tasmania. 101 pp.

This report is considered as a very valuable account when addressing this ToR. WGITMO suggests preparing a discussion paper until 2006 to consider rapid response and control options of new invaders and may include eradication strategies, monitoring advice and international cooperation, i.e. notification of neighbouring countries and joint efforts.

18.1 Conclusions

- The above mentioned CSIRO report will intersessionally be considered and taken as a starting point to prepare the relevant discussion paper.
- WGITMO suggests to address the following issues when preparing the report:
  - early detection is of vital importance
  - whom to approach for early response
  - legal framework – are legislations already in place?
  - requirements for action
  - capacity (including funding) to act
  - cost/benefit issues. WGITMO believes that although rapid response measures (e.g. eradication efforts) may be costly money will be saved in the long run. This is especially the case when newly recorded species are successfully eradicated.
  - WGITMO discussed having a format for risk assessment to identify options that appear possible to take action or if the "do-nothing" option may be prefereable in the individual circumstance. Hence a risk assessment of control options, their effectiveness, validity and environment impacts is needed. WGITMO suggests to develop the framework for such an assessment.

18.2 Recommendations

- It is recommended that this ToR remain on the agenda of WGITMO. The group will deliver a final draft discussion paper by 2006.

19 REGIONAL ECOSYSTEM STUDY GROUP FOR THE NORTH SEA (REGNS)

The preparation of a report summarising introductions and transfers of marine organisms into the North Sea and their consequences are to be considered at the 2006 meeting of REGNS and the 2006 Theme Session on Integrated Assessments. The guidance letter received by Andy Kenny, Bill Turrell and Hein-Rune Skjoldal was circulated at the meeting. Some key points were highlighted:

- Apologies addressed to ICES scientists from outside the North Sea area were received. The task is focused on the North Sea, as it is a contained, discrete ecosystem with defined concerns regarding fisheries, eutrophication, climate change and other environmental issues. However, this does not indicate than any other such ecosystem in the ICES area is of less importance. Once the principles are established, they will be applicable to all ICES ecosystems.
- This initiative is to provide, possibly for the first time, an integrated, holistic assessment of the state of one of the ecosystems within its area. This requires the combined expert assessments from chemists, oceanographers, planktologists, fish biologists, fishery assessment scientists, benthic biologists, seabird and marine mammal scientists. In fact, the combined expert knowledge of much of the ICES system.
- Global societal wishes have been expressed in conventions such as Agenda 21, the Straddling Stocks Agreement, the Convention on Biological Diversity, and the FAO Code of Conduct for Responsible Fisheries. The underlying desire for ecosystem-based ocean governance has been reiterated at meetings such as Rio de Janerio (1992), Johannesburg (2002), and the Køge Stakeholder Meeting (2002). Such concepts have been adopted by the highest level by all our Governments. The desire to manage the world, and humankind's impact on it, in a more ecosystem-friendly way is now slowly filtering down through the legislative and statutory tools which govern our day-to-day work. For the North Sea, these ideas have been clarified in the Bergen Declaration (2002), which all North Sea states signed. From a scientific point of view, many scientists have already taken up the banner of the ecosystem approach, and it is very much at the core of the new ICES Strategic Plan.
- The issue of integrated assessment has been discussed in REGNS and ACE and it has been considered that the best way to learn is by actually performing an integrated assessment for the North Sea as a pilot area within ICES.
- WG meetings in 2004 are asked to consider this request, give feedback on how sensible it is, and start specifying and collecting the various data needed to fulfill the task.
- Each WG is asked to nominate a person to act as the chief contact point for this work.

19.1 Conclusions

- WGITMO considered the above outline.
- Stephan Gollasch, as Chair, volunteered as chief contact point for this work.
- WGITMO suggests to take the following summary of non-indigenous species in the North Sea as a starting point: Reise, K., Gollasch, S. & W. J. Wolff (1999): Introduced marine species of the North Sea coasts. Helgoländer Meeresunters. 52, 219-234. This volume of *Helgoländer Meeresuntersuchungen* includes additional information relevant to this ToR.
- Together with a contact from IOC, Inger Wallentinus, Sweden volunteered to contribute data on introduced algae. Dan Minchin, Ireland volunteered to cover fish and Stephan Gollasch, Germany will prepare input on invertebrates. It was suggested that WGITMO will not cover pathogens as these are dealt with by another ICES working group.
- To document the impact of selected introduced species it is suggested to note the following publication, being a result of the EU Concerted Action "Introductions with Ships": Gollasch, S., Minchin, D., Rosenthal H. & Voigt, M. (eds.) (1999): Exotics Across the Ocean. Case histories on introduced species: their general biology, distribution, range expansion and impact. Logos Verlag, Berlin. 78 pp. ISBN 3-89722-248-5.

19.2 Recommendations

- It is recommended that this ToR remain on the agenda of WGITMO. The group will work towards a first draft report at the 2005 meeting of WGITMO.
- The report for consideration at the 2006 meeting of REGNS and the 2006 Theme Session on Integrated Assessments needs substantial and comprehensive work. It is therefore anticipated that this ToR should be given very high priority at the next years meeting of WGITMO.

20 RECOMMENDATIONS TO ICES COUNCIL

The recommendations from this year's meeting to the ICES Council were discussed in detail, approved by WGITMO and are provided in Annex 13 of this report.

21 PLANNING OF NEXT YEAR'S MEETING

The invitation of Norway to host next years meeting of WGITMO was much appreciated by the group. The group suggested meeting in Norway for at least 2 days during the week beginning March 14, 2005 in conjunction with WGBOSV.

22 FINAL DISCUSSION AND ADJOURNMENT OF THE MEETING

The Working Group provides support to ICES and its existing and new clients (e.g., NGOs, CBD) through evaluation of existing and new introductions (intentional and un-intentional), their impacts (through biological, social and economic evaluation) and assessment of management and control options on the marine environment, with the aim to reduce the adverse impact on fisheries, mariculture, biodiversity and ecosystem function. As such, WGITMO provides the following services, specifically:

a) an early warning system of new invaders and their spread within and between regions (forecasting), identification of natural versus anthropogenic processes in aiding spread, and information on status and trends.
b) identification of impacts of individual species, and synergies of impacts between species
c) identification of eradication, incursion response, control tools and or methods that have proven to be useful
d) information for public awareness activities targeted at authorities, industries, and the public.

The need for support is expected to increase as aquaculture and other endeavour request the transfer/introduction of species and as species are moved unintentionally.

To carry out this task as efficiently as possible, WGITMO members have agreed to intersessionally develop a standardized template for the collection of information for National Reports. The purpose of the template is to allow capture of information on invasive species in a rolling format to ease analysis of the information. This information will, in the future, be made available to members prior to the annual meeting. Through discussion and evaluation of the information by the joint expertise available at the annual meetings, WGITMO will develop practical applications stated above.

The 2004 meeting of WGITMO was closed on Friday, March 26 at 5.30 pm. Stephan Gollasch, as Chair, thanked the host Anna Occhipinti, Italy, the hosting organization, the Centro Ricerche Marine in Cesenatico, Italy, all participants and the rapporteur Dorothee Kieser (Canada) as well as all other helping hands that worked very hard during the meeting and spent endless hours to prepare the meeting.

ANNEX 1: AGENDA

Agenda
Thursday, March 25th
9.00 am

- Welcoming remarks and housekeeping issues
- Review of the Terms of Reference
- Review and Adoption of the Agenda
- Introduction of Participants
- Status of WGITMO/ICES Publications 1
    - ICES Code of Practice - Updates, corrections etc.
    - Rapana Report
    - Vector Handbook
    - ICES Newsletter 40
    - Finalization of King Crab Report **(ToR a)**
- ICES/PICES Collaboration (D. Minchin, Ireland; Yasuwo Fukuyo, Japan)
    - PICES Annual Meeting in Seoul (Fall 2003)
    - Planned meetings
    - Relevant PICES Working Groups

10.50 am – 11.10 am Coffee break

- National Reports, **Highlights**
    - Special emphasis on annual summary report on the ecological significance of any new proposed introductions during your oral introduction of the National Report **(ToR c)**
    - Is the ICES Code of Practice well known in your country and followed when introducing/importing species in e.g. current commercial practice?
    - Include a concise annually synthesis on the ecological impacts of accidental introductions on the receiving environment **(ToR d)**
    - Reference to new projects relevant to WGITMO ToRs in your national Report (including progress reports of ongoing initiatives)
        - Australia
        - Belgium
        - Canada
        - Estonia
        - Finland
        - France
        - Germany
        - (Japan)
        - Ireland
        - Italy
        - (Netherlands)
        - New Zealand

        - Norway
        - Poland
        - Sweden
        - United Kingdom
        - USA

1.00 pm – 2.30 pm Lunch

- National Reports, **Highlights**, continued

4.00 pm – 4.30 pm Coffee Break

- Status of WGITMO/ICES Publications 2
    - Summary of National Reports 1992-2002 **(ToR b)**
        - Distribution of CD ROM with related information
        - Distribution of draft material for National Report Summary
- Suggestions on candidate species for future Special Advisory Reports **(ToR d)**
- Update on the Sturgeon restocking project in Europe and ICES Code of Practice (H. Rosenthal, & J. Gessner, Germany – by correspondence)

6.00 pm Adjourn of day 1

Friday, March 26th

8.30 am

- Rapid response and control options of new invaders **(ToR e)**
- Any other business
    - Prediction of effect of global warming/climate change on aquatic biological invasions and their consequences
    - Databases, their structure, tools and implementation – the current landscape
    - The ICES Code of Practice and the planned EU legislation of live species introductions
    - Restructuring of National Reports

10.45 am – 11.15 am Coffee break

- Preparation of a report summarizing introductions and transfers of marine organisms into the North Sea and their consequences to be input to the 2006 meeting of REGNS (Regional Ecosystem Study Group for the North Sea) and the 2006 Theme Session on Integrated Assessments (**ToR f)**.

1.00 pm – 2.30 pm Lunch

- Review of draft material for Summary of National Reports 1992-2002
    - Pathogens
    - Fish
    - Invertebrates
    - Algae

4.00 pm – 4.30 pm Coffee Break

- Group Discussion on WGITMO Recommendations
- Concluding Remarks
- Planning of next meeting

5.30 pm Adjournment of the 26th Meeting of WGITMO

ANNEX 2: LIST OF PARTICIPANTS

List of participants at the meeting (in alphabetical order):

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ANNEX 3: TERMS OF REFERENCE

2ACME05 The Working Group on Introductions and Transfers of Marine Organisms [WGITMO] (Chair S. Gollasch, Germany) will meet in Cesenatico, Italy from 25–26 March 2004 to:

a) finalize the report in 2004 summarizing the ecological impacts of the Red King Crab introduction in Norway that will provide a basis for advice on practical management considerations;

b) finalize the complete summary of the National Reports from 1992 to 2002 in 2004 (suitable for publication in CD-ROM format);

c) collate and tabulate information from National Reports and prepare annually for ACME a concise summary report on the ecological significance of any new proposed introductions;

d) provide a concise synthesis annually for ACME on the ecological impacts of accidental introductions on the receiving environment. These syntheses may result in the production of Special Advisory Reports;

e) evaluate and report on the rapid response and control options of new invaders with the intention of preparing a discussion paper by 2006;

f) commence preparation of a report summarising introductions and transfers of marine organisms into the North Sea and their consequences to be input to the 2006 meeting of REGNS and the 2006 Theme Session on Integrated Assessments.

ANNEX 4: NATIONAL REPORTS (ICES MEMBER COUNTRIES)

Belgium
(prepared by F. Kerckhof)

Highlights
The major event during 2003 was the discovery and sudden abundance of the pencil-crab, *Hemigrapsus penicillatus* along the coasts of Northern France and Belgium and along the borders of the river Scheldt. The species proved to be very common, predominantly in harbour areas.

The continuing findings of specimens of two warm water barnacles, *Megabalanus tintinnabulum* and *M. coccopoma,* off the Belgian coast indicate that both species are well established in the southern North Sea.

1.0 Laws and regulations

There is no new legislation to report.

2.0 Deliberate releases

2.1 Fish

During 2003, the Sea Fisheries Department (CLO-SFD, Oostende, Belgium) has only used turbot *Scophtalmus rhombus,* offspring from fish from the French Atlantic coast, in a restocking project.

3.0 Accidental Introductions and transfers

Several non-indigenous species like *Crassostrea gigas*, *Ensis directus*, *Crepidula fornicata*, *Elminius modestus* constitute now an important, and in some cases even a dominant, part of the Belgian marine fauna. Their success is for a great deal due to the alterations made by man to the environment, chiefly beamtrawling and the construction of artificial hard substrates. In man-made environments such as harbours, the overall presence of non-indigenous species is even more obvious (Kerckhof and Houziaux, 2003).

3.2 Invertebrates

Mytilopsis leucophaeata (=*Congeria cochleata*): This species is present in the harbour of Antwerpen, causing nuisance by the obstruction of water intake pipes of some chemical plants. A Ph.D. study is ongoing at the University of Gent, with the aim to find a possible biological control of the problems caused by these species

Caprella mutica: This species has been first recorded in 1998 when it was present on several buoys marking the entrance to the harbour of Zeebrugge. Also recorded from the marina of Zeebrugge. On these locations the species is still present. In 2003 specimens of *C. mutica* were present on buoys lying in the entrance to the harbour of Blankenberge.

Ficopomatus enigmaticus: As in 2002, this species was in 2003 again very abundant in the harbour of Oostende, forming reef like structures on several submerged substrates.

Megabalanus tintinnabulum: this cosmopolitan warm water barnacle has been recorded in 1998 for the first time autochthonous in the southern North Sea, on buoys off the Belgian coast (Kerckhof and Cattrijsse 2002). As in previous years, also in 2003, specimens have been found, in low numbers but regularly, on buoys off the Belgian coast and on buoys close to the coast. The species was also present on experimental rafts used for the offshore cultivation of mussels and, for the first time, the species was now also present on floating objects, stranded on the Belgian beaches.

Megabalanus coccopoma: This species proved to be already present on buoys off the Dutch coast in 1976 and 1977 but was apparently not properly recognised. During a survey of 56 buoys off the Belgian coast between 1997 and 1999 (Kerckhof and Cattrijsse 2002) this species has been found on several occasions. Like in previous years, also in 2003 specimens of *M. coccopoma* were present on buoys off the Belgian coast and on buoys close to the coast and on experimental rafts used for the cultivation of mussels. The species was also present, and this for the first time, on several floating objects stranded on Belgians beaches. Additionally one specimen has been found on a groin in the littoral environment.

Both species of warm water barnacles clearly took advantage of the warm summer of 2003 but the ongoing findings, especially those in nearshore waters, indicate that both species – although not really common – are well established in the southern North Sea.

Tricellaria inopinata: this species was first observed in 2000, in the marinas of Oostende and Blankenberge. After the first observations in Belgium this species is still present and apparently spreading in the Dutch Delta.

Hemigrapsus penicillatus: This species is now recorded for the first time from the coasts of Belgium and Northern France. After the first indications of its presence, in August 2003, the species has been searched for on various locations along the Belgian and northern French coast and along the left bank borders of the river Scheldt (Dumoulin, 2004).

The species was present in various sheltered locations along the coasts of Zeeuws-Vlaanderen (The Netherlands), Belgium and Northern France (dép. Nord and Pas-de-Calais). The southernmost find was Calais in France. More to the west, in the harbour of Boulogne, *Hemigrapsus* has not been observed. On the left bank of the river Western Scheldt the crab has been found upstream till the nature reserve 'Verdronken land van Saeftinge'. The pencil-crab was not yet present in the Belgian part of the Scheldt (Prosperhaven, Lillo Fort and Doel).

H. penicillatus was very abundant in suitable habitats, mostly in harbour environments, living for instance amongst reefs of pacific oysters, *Crassostrea gigas.* There *Hemigrapsus* occupies the same niche as the indigenous (young) green crab *Carcinus maenas*. Along the eastern part of the Belgian coast the species (mainly juveniles <6 mm) has been discovered on groins, an exposed habitat. It is doubtful if the crab will be able to develop stable populations on such locations. At Oostende, Zeebrugge and Dunkerque *Hemigrapsus* was also present in non-tidal inner biotopes. Along the borders of the river Scheldt more stream up e.g. Doel, it may reach the same habitats were *Rhithropanopeus harrisii* and *Eriocheir sinensis* are common.

The abundance and the many locations on which *H. penicillatus* proved to be present from summer on 2003 is rather surprisingly because in previous years the species has not been reported (but only routinely looked for). However the sudden presence in high numbers of the species in 2003 indicates that the species might have been present for one or two years already in the area prior to detection.

It is presumed that the introduction of *Hemigrapsus* in the investigated area happened mainly via ship traffic (coastal trade and yachts) originating from the Dutch Delta-area. Locally the crab could have dispersed on a natural way via larvae in the water-column. On the other hand it is not impossible that the introduction in Dunkerque originates from the French Atlantic coast or the population in the English Channel harbour of Le Havre where a large population occurs.

Hemigrapsus sanguineus: During the search for *H. penicellatus, H. sanguineus* has not been found.

3.3 Algae and higher plants

Undaria pinnatifida: After the first record in 2000, this species is still present in de marina of Zeebrugge, but apparently not spreading due to predating of Coots *Fulica atra*.

4.0 Live Imports

In Belgium there is a lot of (uncontrolled) import and export of a wide variety of marine and fresh water species, for research, human consumption, aquaculture and aquariums. It is almost impossible to obtain figures on quantities or on origin.

8.0 Bibliography

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Kerckhof F. & Houziaux J. S. 2003. Biodiversity of the Belgian marine areas. Pp 350-385 in Peeters M.; Franklin A.; Van Goethem J. (Eds.): *Biodiversity in Belgium.* Royal Belgian Institute of Natural Sciences: Brussels, Belgium.

Canada
(prepared by D. Kieser)

Highlights

- Canada's National Code of Introductions and Transfers of Aquatic Organisms has been adopted and can be found at http://www.dfo-mpo.gc.ca/science/aquaculture/code/prelim_e.htm.
- Previously unreported accidental introductions include: Ontario: grass carp; Quebec: tench, *Codium fragile* spp. *tomentosoides*, an unidentified bryozoan; Prince Edward Island: *Caprella mutica*.
- In general, intentional importations and transfers, as well as exports to other countries, were similar to previous years.
- The aquatic insect, *Eubrychiopsis lecontei*, was introduced as a bio-control organism for Eurasian water milfoil.

1.0 Laws and reulations

National:

The Standing Committee on Fisheries and Oceans of the House of Parliament commissioned a report, entitled *Aquatic Invasive Species: Uninvited Guests*, which was completed in May 2003. The committee has charged the departments of Fisheries and Oceans, Environment and Transport to take action on a number of issues to effectively eliminate the threat to the Canadian aquatic environment posed by invasive species. A National Plan to Address the Threat of Non-Native Aquatic Invasive Species will be provided to the Canadian Council of Fisheries and Aquaculture Ministers in September

2004.

Canada has now fully adopted its National Code of Introductions and Transfers of Aquatic Organisms. The code, subsequent to an 18-month review period after which some changes were made, can be found at http://www.dfo-mpo.gc.ca/science/aquaculture/code/prelim_e.htm.

Provincial Regulations, Policies and Guidelines:

New Brunswick (NB)

Policy and procedural guidelines specific to New Brunswick have been developed, including: 1) Procedural Guide of Private Sector Involvement In enhancement Of the Public Fisheries Salmonid Resources, 2) Standards for Containment of Introduced or Transferred of Fish in New Brunswick, 3) Protocols for Regulating the Introductions and /or transfers of salmonids in New Brunswick, and, 4) Protocols for the Transfer or Shellfish within the Atlantic Provinces (draft, implementation in 2004).

Ontario

The Ministry of Natural Resources is preparing a proposal for the Environmental Bill of Rights Registry (EBR) that would prohibit the buying and selling of live bighead, black, silver and grass carp as well as 28 species of snakehead and two species of goby. The proposal applies to live sales only and includes a ban on selling these species for aquarium use.

Quebec

Quebec has adopted a marine *« Guide d'évaluation des demandes d'introduction et transfert d'organismes aquatiques »* based on Canada's National Code. A freshwater guide will follow.

Newfoundland

A Code of containment was developed by the Province of Newfoundland and Labrador and is endorsed by the Department of Fisheries and Oceans and the aquaculture industry.

2.0 Deliberate releases and planned introductions

Planned Introductions of Finfish and Shellfish

Pacific

Aquaculture companies in British Columbia (BC) are importing Atlantic salmon eggs from Iceland in 2004. Otherwise, the pattern of importations is expected to remain similar to previous years.

Deliberate Releases

2.1 Finfish

Pacific Region

Under the Canada-US Transboundary agreement, 5.1 million sockeye (*Oncorhynchus nerka*) fry were returned to the Taku and Stikine River systems in Canada after initial incubation in an isolation unit at an Alaskan Hatchery.

Quebec

Glass eels (*Anguilla rostrata*) were transferred from the Bay of Fundy to Lake Champlain.

Newfoundland

The following Genetically Modified Organisms and Hybrids were imported into land-based quarantined research facilities in Newfoundland:

- 12,000 transgenic X wild hybrid Arctic charr (*Salvelinus alpinus*)eggs
- 12,000 transgenic X wild hybrid rainbow trout (*Oncorhynchus mykiss*) eggs
- 500 transgenic Atlantic salmon (*Salmo salar*)

2.2 Invertebrates

22.1 Pacific Region

As in previous years, the BC shellfish industry imported seed for the main culture species: *Tapes philippinarum*, *Crassostrea gigas*, *C. sikamea* and *Mytilus galloprovincialis* and *M. edulis* for aquaculture. Lesser amounts of seed for C. *sikamea, C. virginica, Ostrea edulis* and the purple-hinge scallop, *Crassodoma gigantea* were also imported. With the exception of the scallops, which are grown in nets, these molluscs are primarily used for beach seeding and grow-out on open water structures. All imports originate from health certified facilities.

Quebec

An aquatic insect (*Eubrychiopsis lecontei*) was introduced from USA sources as a natural predator to control the Eurasian water milfoil, *Myriophyllum spicatum* in a lake in the Mont-Tremblant Region.

Maritime Region (Prince Edward Island, New Brunswick and Nova Scotia)

Limited activities are undertaken by private and provincial (NB, PEI) shellfish hatcheries with Giant Sea Scallops (enhancement), Soft- and Hard shell Clams (enhancement)

Newfoundland

2,000 kg of green sea urchins (*Strongylocentrotus droebachiensis*) were transferred to areas previously over-harvested in Bonavista Bay as part of a sea urchin growth experiment.

3.0 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.1 Fish

Pacific Region

Atlantic salmon continue to be introduced into British Columbia for aquaculture. From 2001 to 2003 Fisheries and Oceans Canada partnered with coastal First Nations to mount the most extensive survey for Atlantic salmon in freshwater ever in BC. Only one juvenile Atlantic salmon has been discovered during those surveys. Even with the dramatically increased survey effort of the last three years, the counts of adult Atlantic salmon in freshwater have declined from 131 in 2000 to 40 in 2002 to 24 (preliminary data) in 2003. Further indication that the abundance of Atlantic salmon in BC is more likely related to the number which escape rather than those produced by natural propagation.

Great Lakes area (Central and Arctic Region)

A grass carp *Ctenopharyngodon idella* was captured at the mouth of a river flowing into Toronto Harbour, Lake Ontario in October 2003. Intensive surveys of the area by DFO and provincial agencies failed to recover any additional specimens. It is believed that this was an isolated incident resulting from an un-authorized release of a fish from one of the many live food fish markets in the area. To our knowledge there have been no other deliberate or planned introductions of non-native species to natural waters in the Central and Arctic Region. Several non-native species of fish, including bighead and grass carp, are imported live into Canada in large numbers from aquaculture facilities in the southern U.S. This is a growing industry in Canada. Concern centers around the possibility that customers will buy and release live fish into natural waters or that there may be accidental releases from transporters or wholesalers or that non-native pathogens, parasites and disease organisms may be released with untreated transit water. It has been estimated that more than 2 million kg of live freshwater fish are sold annually in the Greater Toronto market area alone. A multi-agency task group is currently examining various options to eliminate the risks of introduction of non-native species posed by this pathway.

Quebec

The tench *Tinca tinca* was first observed in 2001. Tench have now been captured in the commercial fisheries in large numbers and a range of sizes indicating natural production in the Haute Richeliue area and possibly in Lake Champlain. The species was also found in a lake (Lac des Deux Montagnes) where they are thought to have been introduced by a former owner of the lake. This lake was successfully poisoned in November 2002.

New Brunswick

In 2003 there was an increased incidence of Atlantic salmon smolts in the Magaguadavic watershed. This fish have been identified as hatchery stock which have escaped or been deliberately releases into the watershed from hatcheries. In 2003, a total of 517 smolts were captured leaving the Magaguadivic River. Of these smolts, 98.3 % were hatchery escapees, 1.4 were wild, and for 0.3 % the smolt origins could not be determined. These are the only confirmed accidental releases documented in the area.

3.2 Invertebrates

Pacific Region

A map showing the distribution of green crab is shown in the appendix. In all cases there were only single or limited numbers of individuals detected and there is no indication that they spread from one area in BC to another. A single male green crab (*Carcinus maenas*), found during 2002, died in an experimental holding tank in November 2003.

No additional information is available on the mussel, *Musculista senhousia* or the Varnish clam (*Nuttalia obscurata)*

Atlantic Coast

Updates to last year's invasive species report:

- Green crabs, *Carcinus maenas*, have been spreading west and have been recorded in Baie Verte.

- *Styela clava* has been moved to new sites through aquaculture operations. The industry is looking into harvesting the tunicate for the ethnic food market.
- An as-yet unidentified bryozoan has been detected in the Magdalen Islands. Specimens have been sent out for identification to Scotland.
- Caprella mutica has been identified on natural reefs and artificial structures in estuaries of the east end of PEI. Identification was made in 2003. Through examination of archived samples it was found it going back to 2000. There were noticeable increases in 2002 and 2003 in the south-eastern PEI estuaries. While it is too soon to say if this will cause any major problems, there is concern because the species is seen as a pest for aquaculture since it can form a thick layer over top of the mussels. To our knowledge, this is the first occurrence of this species in Canada.
- The sea squirt Didemnum lahillei, while not yet recorded in Canada, is expected to reach Canada in the near future. It has been spreading in New England. Details on this species can be viewed at http://woodshole.er.usgs.gov/project-pages/stellwagen/didemnum/htm/page28.htm

3.3 Algae and higher plants

Quebec

Codium fragile spp *tomentosoides* has been found for the first time in Quebec in 2003 (Isle de la Madeleine/Magdalen Islands). Various possible vectors have been considered (cargo ships, boats, accidental and deliberate introductions. In particular there is a possibility that it was introduced with a transfer of oysters from New Brunswick.

Prince Edward Island (PEI)

Codium fragile subspecies *tomentosoides* in spreading. This species is of Pacific origin. There is a possibility that the European subspecies *C.f. atlanticum* may be present in the Malpeque area of Prince Edward Island. If molecular testing proves this finding correct, it will be the first record of this subspecies in Canada.

Atlantic Region

Eelgrass beds in Eastern Canada (except Newfoundland) have been collapsing. The collapse was first noted in the eastern part of the St. Lawrence. There has been some debate on possible linkage to the appearance of green crab. However the distribution of the crab is more limited than the area of collapse. No other invasive species or any infectious agent appears to be associated with this occurrence.

3.4 Pathogens and Parasites

Maritime area

***Haplosporidium nelsoni* (MSX)** in ***Crassostrea virginica* –** This agent was reported for the first time in Canada in October 2002, associated with mortalities > 90 % on several leases in Cape Breton, Nova Scotia. To date, infections remain restricted to the Bras d'Or Lakes area of Cape Breton. Active surveillance of a buffer zone around Cape Breton and oysters in the southern Gulf of St. Lawrence is ongoing. No evidence found to date of presence of *H. nelsoni* (or *H. costale*) in historic samples, however, resources have been focussed on new sample processing over 2003. The eradication of infected oyster beds is still not considered a viable option

***Haplosporidium costale* (SSO)** in ***Crassostrea virginica* –** Infections remain low with no associated mortality or clinical proliferation in Atlantic Canadian oysters.

***Haplosporidium* sp.** in ***Mytilus edulis* –** No new infections have been detected, since a single mussel infection was reported in 2002. Extensive surveillance of mussels is undertaken routinely for other infections.

Quahog Parasite X (QPX) in ***Mercenaria mercenaria* –** No disease outbreaks reported from Atlantic Canada

4.0 LIVE IMPORTS AND TRANSFERS (Primarily for aquaculture, not for establishment)

4.1 Finfish

Pacific Region

Finfish imports by the aquaculture industry

Common name	Genus and species	Source Country
Rainbow trout	*Oncorhynchus mykiss*	Other Canadian Provinces
Proposed for 2004: Atlantic salmon	*Salmo salar*	Iceland
White sturgeon	*Acipenser transmontanus*	USA

Quebec

Common name	Genus and species	Source Country/Province
Rainbow trout	*Oncorhynchus mykiss**	various
Cod	*Gadus morrhua*	Nova Scotia
Arctic Char	*Salvelinus alpinus*	PEI
Spotted wolffish	*Anarhichas minor*	Norway

* Including triploid and all female stock

Maritime Region

Common Name	Genus and species	Source Country
Haddock	Melanogrammus aeglefinus	*
Halibut	*Hippoglossus hippoglossus*	*
Cod	*Gadus morrhua*	USA and other Maritime provinces
Atlantic wolf fish	*Anarhichas lupus*	*
Winter flounder	*Pseudopleuronectes americanus*	*
Arctic Charr	*Salvelinus alpinus*	*
Rainbow trout	*Oncorhynchus mykiss*	USA and *
Atlantic salmon	*Salmo salar*	USA and *
Speckled/brook charr	*Salvelinus fontinalis*	*
Brown trout	*Salmo trutta*	*
Sturgeon	*Acipenser brevistrum*	*
Lake charr	*Salvelinus namaycush*	*

*Transfers from other Maritime Provinces

Newfoundland:

The following aquatic organisms were imported for aquaculture or aquaculture research purposes:

Fish

- 1,000 Nile tilapia(*Oreochromis niloticus*)
- 60,000 triploid rainbow trout eggs
- 2,215,000 rainbow trout from Atlantic Canadian hatcheries were authorized for importation
- 1,200,000 million Atlantic salmon eggs were authorized for importation
- 640,000 Atlantic salmon smolts were authorized for importation
- 10 litres of Atlantic cod (*Gadus morhua*) eggs from research broodstock fish from the NAFO Division 4X cod stock

4.2 Invertebrates

Pacific Region

Shellfish Imports by the aquaculture industry

Common name	Genus and species	Source Country
Manila clam	*Tapes philippinarum*	USA
Mussel	*Mytilus edulis*	USA
Mussel	*M. galloprovincialis*	USA
Pacific Oyster	*Crassostrea gigas*	USA Guernsey Channel Islands
Eastern oyster	*C. virginica*	USA
European oyster	*Ostrea edulis*	USA
Kumamoto oyster	*C. sikamea*	USA
Purple Hinge scallop	*Crassodoma gigantea*	USA

Pacific Region: Other imports (research, etc into closed containment systems)

Common name	Genus and species	Source country
Tunicate	*Ciona intestinalis*	USA
Crayfish	*Procambarus clarkii*	USA

Quebec

Quebec has processed numerous applications for the transfer of quahog, mussels, Icelandic scallops and giant scallops within its area. Mussels were obtained from New Brunswick.

Maritime Region

The following importations and inter and intra provincial transfers took place:

Common Name	Genus and species	Exporting country
American oysters	*Crassostrea virginica*	*
European oyster	*Ostrea edulis*	*
Blue mussels	*Mytilus edulis*	*
Quahog	*Mercenaria mercenaria*	USA
Lobster	*Homarus americanus*	*
Sea scallop	*Placopecten magellanicus*	USA
Bay scallop	*Aequipecten irradians concentricus*	*
Surf clam	*Spisula solidissima*	*
Red Abalone	*Haliotis rufescens*	Iceland
Cuttlefish	*Sepia officinalis*	USA (Texas), UK**
Sea scallop	*Placopecten magellanicus*	USA (Massachusetts)

*= intra-Maritime Provinces transfers, **= for research in closed containment

5.0 LIVE EXPORTS TO OTHER COUNTRIES

Finfish and invertebrates

Pacific Region
Aquaculture or enhancement use:

Common name	Genus and species	Recipient country
Arctic Charr	*Salvelinus alpinus*	Austria Slovenia France Germany USA China
Kokanee	*Oncorhynchus nerka*	USA

Aquarium use:

Common name	Genus and species	Recipient country
Striped perch	*Embiotica lateralis*	France
Pacific Octopus	*Enteroctopus dofleini*	Portugal
Buffalo sculpin	*Enophrys bison*	Portugal
Red Irish Lord	*Hemilepidottus hemilepidottus*	Portugal
Sailfin sculpin	*Nautichthys oculofasciatus*	Portugal
Silverspot sculpin	*Blepsias cirrhosus*	Portugal
Grunt sculpin	*Rhamphocottus richardsoni*	Portugal
Pacific Octopus	*Enteroctopus dofleini*	Portugal
Fish eating anemone	*Urticina piscivora*	Portugal
Sand rose anemone	*Urticina columbiana*	Portugal
Red sea urchin	*Strongylocentrotus franciscanus*	Portugal
Purple sea urchin	*Strongylocentrotus purpuratus*	Portugal
Hermit crab	*Paguridae sp*	Portugal
Bat star	*Asterina miniata*	Portugal
Painted star	*Orthasterias koehleri*	Portugal
White cap limpet	*Acmacea mitra*	Portugal
Pink star	*Pisaster brevispinus*	Portugal

Maritime Region and Quebec

Aquaculture use

Common Name	Genus and species	Importing Country
Atlantic salmon	*Salmo salar*	USA
Brook trout	*Salvelinus fontinalis*	USA, Germany, France
Rainbow trout	*Oncorhynchus mykiss*	USA
Arctic charr	*Salvelinus alpinus*	USA, Germany, France, Poland
Brook trout X Arctic charr	hybrid	Germany
Giant scallop	*Placopecten magellanicus*	France- St Pierre & Miquelon

6.0 WORKSHOPS/SYMPOSIA ETC.

Johannsson, O.E. Panelist for the DFO Invasive Species Network Discussion. DFO National Science Workshop, St. John NFLD Nov 20 2003

Johannsson, O.E. 2003. Direct and Potential Indirect Impacts of *Bythotrephes* on Aquatic Food Webs. Bythotrephes Workshop. Leslie Frost Centre, Dorset ON. April 14-15. (Invited)

Wright, D.G. Session Chair 12th Aquatic Invasive Species Conference, June 9-12th 2003, Windsor, Ontario, Canada

Dermott, R. Session Chair 12th Aquatic Invasive Species Conference, June 9-12th 2003, Windsor, Ontario, Canada

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Dumont, P., N. Vachon, J. Leclerc, et A. Guibert. 2002. Introduire délibérément un poisson au Canada peut être facile : l'exemple de l'implantation de la tanche dans le sud du Québec. P. 169-177 in R. Claudi, P. Nantel et E. Muckle-Jeffs (eds.) Envahisseurs exotiques des eaux, milieux humides et forêts du Canada, Service canadien des forêts, Ressources Naturelles Canada

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Appendix to Canadian National Report

Figure 1. Map of findings of *Carcinus maenas* along the coast of British Columbia

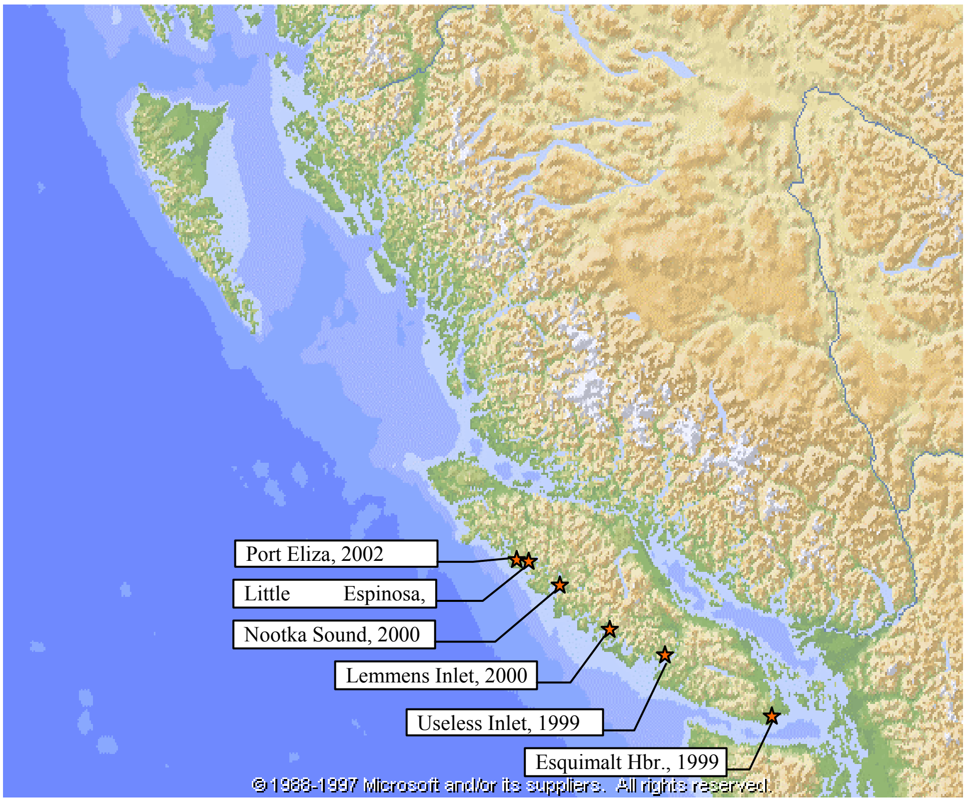

Table 1. Details of *Carcinus maenas* findings along the British Columbia Coast.

Location	**Date**	**Sex**	**Size (mm) pt. to pt.**
Barkley Sound, Useless Inlet, BC	17 June, 1999	female	58.4
	29 June, 1999	male	74.5
	13 July, 1999	male	Unknown
	13 July, 1999	female	Unknown
	13 July, 1999	unknown	escaped
Esquimalt Harbour, BC	8 August, 1999	male	65
Clayoquot Sound, Lemmens Inlet, BC	11 May 2000	male	67.8
	11 May 2000	male	55.2
Nootka Sound, Bligh Island, BC	20 July 2000	male	61
Little Espinosa, Esperanza Inlet	15 August, 2001	male	72.8
	15 August, 2001	male	79.3
	15 August, 2001	male	80.6
Port Eliza, Esperanza Inlet	June, 2002	male	67
Klitsis Beach, Little Espinosa (others seen but not collected)	11 July, 2003	male	64

Estonia
(prepared by H. Ojaveer and J. Kotta)

1.0 LAWS AND REGULATIONS

New '*Nature conservation act'* has been finalised and submitted in early 2004 by the government to the Parliament for final approval. In this act, alien species are considered in paragraphs 57 and 58 following (unofficial translation):

§ 57 Alien species

(1) Release of living specimen of alien species, planting and sowing of alien plant species into nature is prohibited.
(2) The Minister of the Environment shall establish the list of alien species that endanger natural balance, the import of living specimen of which for growing in artificial conditions is prohibited.
(3) Regulation of the number of an alien species that have escaped into the wild shall be organised by the environmental authority of a county of the Ministry of the Environment
(4) Captive-bred specimen of an alien species can be re-inhabited into a new captive-bred conditions with the permission of the environmental authority where animals are taken for re-inhabiting and that of the destination place.
(5) Captive-breeding of specimen of alien species that endanger the natural balance is prohibited, except scientifically justified cases with the permission of the Minister of the Environment

§ 58 Re-inhabiting and Taking from the Wild

(1) Re-inhabiting of the wild with imported living specimen of native species is prohibited, except scientifically justified re-inhabiting with the permission of the Minister of the Environment.
(2) Animals of a native species can be re-inhabited into a new place with the permission of the environmental authority where animals are taken for re-inhabiting and that of the destination place.
(3) Release into the wild of captive-bred specimen of a native animal species, except for release of animals that have been kept in captivity with the purpose of curing their injuries or restoring their vitality, shall be carried out only on the basis of the Action Plan specified in the section 49.

2.0 DELIBERATE RELEASES

Official data on fish releases into the sea and rivers of Estonia discharging into the sea for 2002 (in thousands)

Salmon (*Salmo salar*) in total 364.7, incl.

0-group individuals 178.8
1-year old fish 145.6
2-year old and 2+ individuals 40.3

Whitefish (*Coregonus lavaretus*) 0-group individuals 150.2

Sea trout (*Salmo trutta trutta*) 0-group individuals 83.7
2-year old and 2+ individuals 30.2 th

Pike (*Esox lucius*) larval stage – 764

Pikeperch (*Stizostedion lucioperca*) 0-group individuals 21.6

Data for 2003 were not available by the time of compilation of the report.

3.0 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.2. Invertebrates

Laboratory studies on gamogenetic and parthenogenetic modes of reproduction (hatching of resting eggs and release of embryos) of *Cercopagis* confirm that despite of high morphological variability, there exist only one *Cercopagis* species in the Baltic Sea: ***Cercopagis pengoi***. The preliminary results of lab experiments on feeding habits of *Cercopagis* could be summarised as: (1) *Cercopagis*, both adult and newly born young stages, are able to consume other prey than small sized cladocerans (*Bosmina*); (2) the newly born youngs are unable to prey on adult copepods, presumably due to size problems; (3) feeding intensity of *Cercopagis* is higher for the prey with limited escape response (e.g., *Balanus* larvae an copepod *nauplii*) than for more evasive prey (adult copepods); (4) copepod *nauplii* are more preferred prey than adult copepods and *Balanus* larvae; (5) *Cercopagis* may cause reductions of food resource for larval fish that may, in turn, result in declined year-class abundances of many commercial fish species.

Functional relationships between ambient temperature, salinity, phytoplankton biomass and the biodeposition rates of ***Dreissena polymorpha*** was estimated in the northern Baltic Sea. The biodeposition rates of the bivalves increased with ambient temperature. In more eutrophicated regions biodeposition rate increased curvlinearly with ambient concentration of chlorophyll *a* and levelled off at high food concentration. In less eutrophicated conditions a linear model gave the best fit suggesting that saturation level was not obtained. The population of filter-feeders filtered daily on average from 3 to 2426% of overlaying water in the littoral area constituting an important sink for primary production.

The revision on the introduction success and effects of the North-American polychaete ***Marenzelleria viridis*** was done. Since its introduction in 1985 the species has quickly spread and became established throughout the sea. In the northern Baltic the establishment has been more successful either in eutrophied regions (low salinity) or in areas with uniform habitats (deeper waters). In the shallower areas success of establishment increased with the number of macrozoobenthic species in the community whereas at deeper sites the relationship was insignificant. Since this invasion, the densities of the amphipod *Monoporeia affinis* and the polychaete *Hediste diversicolor* have dropped considerably. Field experiments combining natural densities of native species and the introduced polychaete showed that *M. viridis* enhanced the content of sediment chlorophyll *a* and reduced growth and survival of *H. diversicolor* and growth of *M. affinis*. *Marenzellaria viridis* was negatively affected by the adult specimens of the bivalve *Macoma balthica*. Competitive interactions between *M. viridis* and *M. balthica* appear a key factor limiting the further expansion of *M. viridis* in the area.

Based on the long-term records (commercial gillnet fishing at the southern coast of the Gulf of Finland) since 1991 it could be concluded that catch index of the Chinese mitten crab ***Eriocheir sinensis*** was dramatically higher in 2002 and 2003 compared to all the previous years studied. Higher catch indexes were observed in May and October-December compared to other months. Telephone surveys on findings of the species in Estonian waters suggests that the species is common all over the coastal sea but perhaps more abundantly present at the western coast of the country (eastern Baltic Proper).

Macrozoobenthos was sampled in **Muuga Harbour** and **Port of Pärnu** regularly (once per month) during the ice-free season of 2003. The sampling was done with bottom grabs (Lenz or Petersen types) and benthic sledge. Field surveys of Muuga Bay indicated that the benthic communities in the port area significantly distinguished from the sites in the adjacent sea. Adjacent to the port area very strong water currents were measured. Strong currents were generated by very high wave energy input to the system. Hence, there was a clear relationship between depth and species composition, abundance and biomass of macrozoobenthos. Shallowest sites had low species number, abundance and biomass values. Deeper down the diversity, abundance and biomass of macrozoobenthos gradually increased. On the other hand, sedimentation processes are very active in the port area. The concentration of food particles were significantly higher in such accumulation areas, hence, abundance and biomass values of benthic invertebrates were much higher in port areas as compared to any coastal site of the Gulf of Finland. These diverse and dense macrozoobenthic communities (150-550 g wet weight m^2) supported the presence of three nonindigeneous species – the cirriped *Balanus improvisus*, the bivalve *Mya arenaria* and *Potamopyrgus antipodarum*. However, their share to the total abundance and biomass values was relatively low (< 10%). It is likely, however, that owing to moderate disturbance and favourable feeding conditions the risk of establishment is very high for the most estuarine species in the port of Muuga.

The macrobenthic communities in the port of Pärnu were characterised as moderately disturbed due to municipal pollution of Pärnu Town and wave exposure. The abundance and biomass of macrozoobenthos in the port area are slightly lower than in the adjacent sea. However, due to high nutrient input to Pärnu Bay in general, the values exceeded those in the most Estonian coastal sea areas. The abundance and biomass of macrozoobenthos ranged between 2900-4200 ind m^{-2} and 135-185 g wet weight m^{-2}. The following alen species were found in the study site: *Marenzelleria viridis, Balanus improvisus, Mya arenaria and Dreissena polymorpha.* The relative share of alien species in the invertebrate communities was moderate.

4.0 LIVE IMPORTS

Country	*Fish*	*Quantity (kg)*
China	ornamental freshwater fish	14.0
Czech Republic	ornamental freshwater fish	128,0
Denmark	unidentified fish	25.0
Finland	ornamental freshwater fish	5.0
Germany	ornamental freshwater fish	8.2
Italy	eel (*Anguilla spp.*)	2750.0
Norway	*Oncorhynchus, spp., Salmo salar*	
	Hucho hucho	1121.5
Singapore	ornamental freshwater fish	144.0
Singapore	ornamental marine fish	110.0
Taiwan	ornamental freshwater fish	70.0
Thailand	ornamental freshwater fish	35.0
United Kingdom	ornamental freshwater fish	30.0

5.0 LIVE EXPORTS to ICES member countries

Country	*Fish*	*Quantity (kg)*
Russian Federation	ornamental freshwater fish	10.0
Sweden	unidentified fish	13.9

Live exports to other countries

Country	*Fish*	*Quantity (kg)*
Antigua and Barbuda	unidentified fish	10.0
Cyprus	unidentified fish	32.1
Liberia	unidentified fish	5.3
Switzerland	ornamental freshwater fish	388.0

7.0 MEETINGS, Conferences, Symposia or Workshops on Introductions and Transfers

- As an outcome of the workshop organised by Ministry of the Environment of Estonia, the US Embassy in Tallinn and Global Invasive Species Program and held in Tallinn in 2002, the nominated working group prepared a project proposal on 'The Nordic/Baltic Network on Invasive Alien Species'. The project proposal was submitted for consideration of financing to several potential money donors. The Nordic Council of Ministers decided to finance the project (acronym NOBANIS). The first workshop on implementation of project took place in March 5-7th 2004 in Jurmala, Latvia. The aim of the NOBANIS project is to develop a distributed and integrated network of common databases encompassing national and regional specialist databases in the Nordic/Baltic countries into a common portal, with the objective of harmonizing IAS-related data, information and knowledge in the region. Additional info about the project is available in the web: http://www.sns.dk/nobanis/project.htm

- EU Ichthyological Society Congress, Sept. 6-10 2004, Tallin, including an exotic fish session.

Presentations at international conferences

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Finland
(prepared by E. Leppäkoski and L. Urho)

1.0 LAWS AND REGULATIONS:

Introductions of alien species are regulated through the Nature Conservation Act (1096/1996, as amended by 492/1997 and 371/99) and those of fish by the Fishing Act (1982).

2.0 DELIBERATE RELEASES:

2.1 Fish

Deliberate releases into the Baltic Sea were (including rivers draining into the Baltic) for fisheries and fish stock enhancement purposes in 2002 (2003 data not yet available) as follows:

0.1 million newly hatched and 3.1 million older salmon (*Salmo salar*), and 0.02 million newly hatched and 1.3 million older sea trout (*Salmo trutta* m. *trutta*), 41.5 million newlyhatched and 8.7 million older whitefish (*Coregonus lavaretus*).

3.0 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.2 Invertebrates

Two new species reported from the Gulf of Finland. (1) The North-American amphipod *Gammarus tigrinus* Sexton, 1939, was recorded in August, 2003 in the Port of Hamina, SE coast of Finland, and from Turku area, SW Finland. Before this, *G. tigrinus* is established in the inland waters of Central Europe since the 1950s and is spread along the southern coast of the Baltic Sea all the way to the Vistula Lagoon. A probable transport vector for G. tigrinus to the Gulf of Finland is the ballast water of ships. (2) The decapod *Palaemon elegans* Rathke, 1837 was found at Tvärminne, the entrance area of the Gulf of Finland. The species has been recorded in the SW and S Baltic up to the Gulf of Gdansk.

The eel namotode *Anguillicola crassus* was found once in 2003.

4.0 LIVE IMPORTS

4.1 Fish

Sturgeon eggs were imported from France to inland area and live rainbow trout from Denmark to Åland Islands.

4.2 Invertebrates

Freshwater crayfish (*Astacus* sp.) were imported to inland area for cooking and ongrowing.

5.0 LIVE EXPORTS to ICES Member Countries

5.1 Fish

As in previous years, rainbow trout (*Oncorhynchus mykiss*) juveniles and eggs were exported to Russia and Estonia. In addition, whitefish (*Coregonus lavaretus*) juveniles were exported to Sweden (River Tornionjoki) and fertilized eggs of charr (*Salvelinus alpinus*), brown trout (*Salmo trutta*) and grayling (*Thymallus thymallus*) to Austria (Inland farms) and fertilized grayling eggs to Germany (Inland farm).

6.0 PLANNED INTRODUCTIONS OF NEW SPECIES

7.0 MEETINGS, Conferences, Symposia or Workshops on Introductions and Transfers

- BMB (Baltic Marine Biologists) Workshop on Alien Species 25-26 August, 2003, Helsinki, Finland

- Ongoing research project: Biological Integrity of the Baltic Sea Threatened by Invasive Non-native Species (BITIS), funded by the Academy of Finland and the Ministry of Communications 2003-2005.
- 29th Congress of the International Association of Limnology (SIL), in Lahti, Finland, August 8-14 2004.

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France
(prepared by L. Miossec)

Summary: The special climatic conditions observed in 2003 explained the increase of tropical and subtropical species this year along the Atlantic coasts. The following species were recorded : *Eucampia cornuta* and *Chaetoceros rostratus* (diatoma), *Lagocephalus lagocephalus*, *Mola Mola*, *Dactylopterus volitans* (fish), *Pepanocephala electra* (mammals).

Three French programs (INVABIO, AREVAL and PNEC) contribute to the follow-up of invasive species along the French coasts especially regarding *Crepidula fornicata, Ocinebrellus inornatus* and *Cyclope neritea*.

1.0 Laws and regulations

The council directive 95/70/EC introducing minimum Community measures for the control of certain diseases affecting bivalve molluscs has beeb amended concerning the annex D (Commission decision 2003/83/EC). The pathogen *Perkinsus olseni/atlanticus* regarding two clams susceptible host species *Ruditapes philippinarum* and *Ruditapes decussatus* has been added, as well as *Candidatus Xenohaliotis californiensis* regarding some members of the genus Haliotis as susceptible host species. The Oyster Velar Virus with *Crassostrea gigas* as a sensitive species has been suppressed.

2.0 Deliberate releases

3.0 Accidental introductions and transfers

3. 1 Algae

Diatoma

Two species of Diatoma, *Eucampia cornuta* and *Chaetoceros rostratus*, were first recorded along the Atlantic coast of West Brittany (Finistère) last Autumn. These diatoma are warm water species. These observations could be related to the elevated sea water temperatures registered last year. Other warm water diatoma, previously recorded in this area, were specially abundant in 2003 as *Asteromphalus sarcophagus* and *Chaetoceros peruvianus* with concentrations between 10^3 and 10^4 cell/litre. These species could be harmful for marine fauna.

3.2 Polychaetes

An on-going research program has listed the different species of polydora (spionids) present along the coast of Normandy. In addition to *Polydora ciliata* and *Polydora hoplura*, two species belonging to warm water ecosystem have been observed. A south hemisphere species, *Boccardia polybranchia*, is now abundant in limestone substrate of the Calvados coast. *Boccardia semibranchiata*, originated from the Mediterranean sea, was recently (2000) described in the bay des Veys area where these spionids are abundant but not in expansion. This species has been previously observed in the Prevost lagoon and the Berre lagoon (on the French Mediterranean coast), then in Arcachon basin (on the south Atlantic French coast).

3.3 Molluscan

Crepidula fornicata

The INVABIO program emphasises the high capacity of *Crepidula fornicata* to scatter and colonise new areas, due to a long pelagic larval life and a nearly continued reproduction all along the year. No genetic differences were found between the Golfe Normano-Breton population and the bay of Seine population, except for a small population situated in the St Brieuc bay (in INVABIO temporary results, Bachelet G., 2003).

Several campaigns of slipper limpet dredging were realised with industrial suction barges to eradicate this invasive species from the Bay of St Brieuc (AREVAL project). At the same time, the biomass of *Crepidula fornicata* as the benthic ecosystem was evaluated. The first results emphasised that this harvesting effort had a limited efficiency because the recruitment of this species was high, especially in 2003. Moreover, the fishing gears favoured the dispersion of this gastropod.

A research program, part of the French National Coastal Environment program (PNEC) was started in 2002 to assess the trophic balances between the cultivated bivalves and wild molluscs (native and invasive as Crepidula fornicata) in the Baie of Mont Saint Michel. In 2003, the Crepidula fornicata biomass was evaluated using acoustic and video methods and ecophysiological experiments were developed to study the feeding comportment of this species.

Grall and Hall-Spencer (2003) emphasise the insidious threat due to the proliferation of *Crepidula fornicata* on Maerl-forming species (mainly *Lithothamnion corallioides* and *Phymatolithon calcareum*) habitats in Brittany.

Ocinebrellus inornatus

The last results collected in the INVABIO program confirm that the native population of this invasive species in France should be located in the USA. Its biological faculties (growth rate and reproductive strategy) facilitate its settlement and expansion comparing to the biological capacities of the native species *Ocenebra erinacea.* Moreover, the movements of oysters fluxes between shellfish growing areas boost this invasion ((in INVABIO temporary results, Bachelet G., 2003).

Cyclope neritea

A new study was developed in the INVABIO program, regarding the history of *Cyclope neritae* settlement and expansion along the French Atlantic coast. A new population was observed in the bay of Morlaix (West English Channel) in spring 2003 which probably represents the northern expansion limit along the French coasts (in INVABIO temporary results, Bachelet G., 2003).

Rapana venosa

Five specimens were collected in south Brittany (Morbihan) during 2003:

- three animals were dredged (on an oyster bed near clam beds) at the entrance of the Golfe of Morbihan as a first record of this location, two adults (first one 525 g weight at the end of March; the second collected dead at the beginning of April) and a juvenile (30.7 g weight, 63.3 mm long and 43 mm large in the mid of September).
- One adult was caught in The bay of Quiberon at the beginning of July ; no additional data was available.
- An empty shell (400 g weight) was found in December.

Moreover, no spawn was observed in this area, and no reproduction was obtained under laboratory conditions this year. The juvenile was dredged on an oyster bed, very closed to a clam bed. So we suspected this young Rapana could have been introduced with imported Manila clams.

Ruditapes philippinarum

A comparative study on the pathogen infection of 4 species of bivalves (*Ruditapes philippinarum, Ruditapes decussatus, Paphia aurea* and *Cerastoderma edule*) has demonstrated that *Ruditapes philippinarum* was the less infected species regarding the number of parasitic species, the prevalence and infection load (in INVABIO temporary results, Bachelet G., 2003).

3.4 Crustacea

A blue crab (*Callinectes sapidus*) was caught by a fisherman 5 miles up to Courseulles-sur mer (Calvados, Normandy) at the beginning of September 2003. It was a male with a 90 mm long and 200 mm large carapace. This crustacean has been currently observed in this area since it was caught for the first time in 1975 in the Bay of Seine. This species was probably introduced with ballast waters in Le Havre harbour. There, it found good environmental conditions for its settlement in waters warmed by electrical power station in the back site of this seaport. Only male specimens have been caught in sea water along the Normandy coast (Vincent, 1986).

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A mitten crab specimen *Eriocheir sinensis* was fished as a sport-caught in the Charente estuary by a sportfisher during recreational activities at the end of October 2003. It was a male with an approximately 65 mm large carapace. This species was first recorded along the French Atlantic coast in 1954, in Gironde estuary where it was simultaneously caught with the green crab *Carcinus maenas* (André, 1954). Since then, it has been rarely observed. This new capture could point out a new extension of this species.

André M. (1954). Présence de l'*Ericheir sinensis* H. M-Edw. Sur la côte atlantique sud française. *Bull. Mus*., 2è série, t. XXVI, n°3.

3. 5 Fish

Few specimen of warm water fish were observed along the Atlantic coast, probably related to the special climatic conditions observed in 2003:

- An oceanic puffer (*Lagocephalus lagocephalus*) was found, driven ashore, in the Bay of Quiberon, south Brittany, in mid October 2003. No additional data was available.
- An Ocean sunfish (*Mola mola*) and a flying gurnard (*Dactylopterus volitans*) at the end of September along the Morbihan coast.

3.6 Mammals

Two specimens of Melon-headed whale (*Peponocephala electra*) were found on a beach of Oleron Island (Atlantic Ocean) at the end of August. This pantropical species has been never observed before in France.

4.0 Live imports

5.0 Live exports to ICES Member countries

6.0 Planned introductions and transfers

The "Barnier" law (n° 95-101, 2 February 1995) concerning the strengthening of the environment protection, stipulates that all introductions of non indigenous or non cultivated species into the French natural environment are strictly forbidden. Nevertheless, some exceptions regarding specific purposes (agriculture, aquaculture or forestry) could be authorised by the administrative authority (The French Ministry of Environment) after consequence assessment.

Although the ICES Code of Practice is well known by the French Authority, the strict application of the "Barnier" law means that today no submitted application regarding exotic species introduction has ever been evaluated.

However France agrees with the step of a new European regulation regarding non native species introduction problems in order to limit distortions of competition between states members and to limit the impact of introductions into European countries which are not ICES members.

Moreover, a French version of the ICES Code of Practice should be available on line very soon.

7.0 Meetings, conferences, symposia or workshops on introductions and transfers

INVABIO meeting Paris, 11-12 March 2003: An assessment of the achieved results has been established during this conference which gathered only the participants of the program. The projects of the second phase of this program were presented. This seminar was not the subject of a specific publication.

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Germany
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Highlights of National Report
No new accidental introductions were reported. Germany reported on the spread of the previously introduced non-indigenous oyster *Crassostrea gigas*. Activities on aquaculture and restocking focused in 2004 on eels, sturgeon and salmon. Ornamental trade is continuing to be popular. For direct human consumption, various crustaceans, blue mussels, common carp, and *Tilapia* species are imported. Live exports to ICES Member Countries focus on *Mytilus edulis* predominantly for the Belgium and Dutch market.

Together with Vadim Panov (Russia), Germany coordinates an initiative to link European working groups in the field of biological invasions (European Research Network on Aquatic Invasive Species (ERNAIS)). At present the network includes 101 experts from 27 countries (http://www.zin.ru/rbic/projects/ernais/)

Aquaculture and ballast water issues become more and more important. It is discussed to take advantage of planned offshore wind park installations to allow colonization with native hard bottom species and establish new maritime users, as e.g. aquaculture sites for oyster and macroalgae cultures (native and non-indigenous species such as the Pacific oyster may be included in the trials). Long-line mussel culture is also discussed.

1 Laws and regulations

Germany signed the IMO Ballast Water Management Convention at the Diplomatic Conference in February 2004.

3 Accidental Introductions and Transfers

No new accidentally introductions were reported from German marine or brackish waters. However, as already pointed out in last year's report, it is assumed that the Asian shore crab *Hemigrapsus penicillatus* will invade German waters in the very near future as records are known from Belgium and the Netherlands indicating its eastwards directed spread into the German Bight.

Status report of earlier introduced species

Crassostrea gigas

The oyster farm located on the island of Sylt in the North Sea is continuing its operation using rack culture and marketing about 1 million oysters in Germany annually. Culturing the Pacific Oysters resulted also in oyster settlement outside the farm. As there is not much hard substrate in the German Wadden Sea to settle mussel beds of *Mytilus edulis* in the adjacent Wadden Sea areas became the first foothold for oyster spat. The oysters showed good growth and have reached maturity. Nowadays *Crassostrea gigas* spreads southwards and compete with native *Mytilus edulis* for habitat and food. It was documented at certain sites that the oysters have (partly) overgrown mussel beds at increasing densities.

Eriocheir sinensis

The Chinese Mitten Crab seems to decline in density after its mass occurrence in the 1990s.

4 Live Imports

4.1 Fish

Aquaculture and powerplants (no major changes to last years National Report)

Several aquaculture facilities are in operation for decades using warm water effluents of powerplants. Species are cultured for the aquarium industry (ornamental species: **koi carp**, **gold fish** and **sterlett**), human consumption (**Asian carp, *Tilapia*** species) and restocking (**glass eels**).

Glass eels are imported from various countries (e.g. France, Italy, Ireland, Netherlands, and Sweden) according to the ICES Code of Practice. With a weight of 25 gr. the individuals are used for restocking German inland waters. This activity has continued in 2003.

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.

The continuous reproduction and import of live sturgeon species for aquaculture and pet-trade has resulted in increased availability of sturgeons on the market. As a consequence the fish have been transferred into many open water bodies of Central and Western Europe. According to fishermen the number of sturgeons caught increase.

The project "Transfer of Atlantic sturgeon (*Acipenser oxyrinchus*) from North America for remediation efforts into Baltic Sea tributaries" is underway. It is planned to follow the ICES Code of Practice on the Introductions and Transfers of Marine Organisms (2003 version) when importing specimens from North America, likely being the first application of the code in Germany. As the life span of sturgeons is relatively long the code cannot be followed completely (see separate report).

Imports of **salmonid species** continued in the year 2003 at a comparable level to previous years. It is extremely difficult to trace the routings and quantities of life fish trade in several regions as there is no mechanism to collect these data. As in previous years, rainbow trouts were imported mainly from Denmark, the Netherlands, Poland, and the Czech Republic. The tonnage of trouts imported overall varied (15,000 and 19,000 tonnes annually during the past few years). Live **Atlantic Salmon** were imported from Sweden for human consumption in an unknown quantity.

Common carp is another species that is regularly imported alive. While during the 1980s the tonnage was gradually declining from about 4,400 tonnes (1980) to 1,400 tonnes (1989), imports increased again (sources: Poland, Hungary, Czech Republic) to 3,150 tonnes (1997) and the level presently is around 5,000 tonnes.

Ornamental trade

Large quantities of marine, brackish water and freshwater organisms were imported from South America, South-East Asia and other regions (inner-European trade) to serve the aquarium and hobby industry. Marine hobby aquariums become more and more popular, possibly due to movie "Finding Nemo". However, aquarists underestimate the efforts to run a marine aquarium and species are often discharged, what is of special concern. Although mostly warm water species are in use some may establish at e.g. warm-water effluents of power plants. It is estimated that several 10,000s German hobbyists run sea water aquariums. Germany is one of the top three importers of live display organisms following USA and Japan. Annually more than 6 million fish are imported predominantly from the Philippines, Indonesia, Thailand, Singapore and Hawaii.

4.2 Invertebrates

Live **Blue Mussels** (*Mytilus edulis*) were imported from Denmark for human consumption in an unknown quantity.

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.

Offshore wind parks

Large scale offshore wind parks are planned off the German Baltic and North Sea coasts. A research programme to test modern aquaculture techniques in conjunction with these wind-mills has been launched. The newly, man-made hard substrates in the North Sea where soft bottom habitats prevail offer the opportunity for aquaculture activities. Further the use of infrastructure (e.g. service platforms) is likely which interested companies otherwise would not be able to afford. It is discussed to establish aquaculture using oysters and macroalgae. Native and non-indigenous species such as the Pacific oyster may be included in the trials although initially mainly native species will be considered. Long-line mussel culture between wind park installations and mussel cage culture is also discussed.

4.3 Plants

Macro-algae for human consumption, advertised as marine vegetables (!), become an increasing business. Currently test cultures are underway using the brown-alga *Laminaria saccharina* and red-alga *Palmaria palmata*.

5 Live exports to ICES Member Countries

The live **Blue Mussel** (*Mytilus edulis*) production is to a large exported to the Belgium and Dutch market.

7 Meetings, Conferences, Symposia or Workshops on Introductions and Transfers

7.1 Meetings

NEOBIOTA group. This new German group on biological invasions (established in 1999) is a research consortium with the objective to co-ordinate responses to the ever increasing problems caused by the invasion of non-native organisms (see last years National Report). The group considers all species introductions, including invasions in terrestrial habitats. The group will meet in Bern, Switzerland from September 30th to October 1st 2004 for the 3rd International NEOBIOTA Conference on Biological Invasions - From Ecology to Control.

Marine Environment Protection Committee (MEPC), International Maritime Organization (IMO), Ballast Water Working Group (BWWG)

The number of submission for consideration of the BWWG remained high indicating the increasing awareness regarding ballast water issues. The Diplomatic Conference on the IMO Ballast Water Management Convention was held in February 2004. Germany signed the Convention during the Diplomatic Conference.

DIN Working Group on Ballast Water Treatment

The Standardization Authority for Ships and Marine Technology (Normenstelle Schiffs- und Meerestechnik, NSMT) as a member of the German Standardization Organisation (Deutsche Industrienorm, DIN) launched a Working Group on Ballast Water Treatment Oct. 22nd 2002 within its Marine Environment Protection Committee (Working Group 2.11.4). The DIN working group was launched with the intention to develop standards on ballast water related issues for the consideration of relevant EN and/or ISO working groups. Close cooperation with IMO is planned.

7.2 European Research Network on Aquatic Invasive Species (ERNAIS)

Vadim Panov, Russia and Stephan Gollasch, Germany co-coordinate ERNAIS. For ERNAIS objectives see earlier National Reports and http://www.zin.ru/rbic/projects/ernais/. At present the network includes 101 experts from 27 countries.

7.3 Ballast Water treatment

As reported in last years National Report the four projects testing ballast water treatment measures continue. All projects are currently testing the biological efficiency of treatment systems at various sites in German coastal and adjacent waters. An update on three projects was given last year (Bremen Ballast Water Project, RWO/Berkefeld Project and the Project of the Hamann AG). Not reported earlier was the TREBAWA Project, located at the TTZ Bremerhaven. The projects key objective is to develop a ballast water treatment plant.

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Ireland
(prepared by D. Minchin)

Highlights of National Report:

- *Caprella mutica:* Appears at a salmon farm site on the west coast of Ireland for the first time.
- *Dreissena polymorpha*: Now known from 57 Irish lakes and continuing to spread with overland boat movements as well as by some other unknown vector(s).
- *Anguillicola crassus*: Increasing in abundance in the Shannon catchment.
- *Sargassum muticum:* Now known from six Irish localities on all coasts, two more localities since 2002.

2.0 DELIBERATE RELEASES

2.2 Invertebrates

The abalone *Haliotus tuberculata*, and *Haliotus discus ha*nnai are hatchery produced in Ireland and are later cultivated in barrels suspended from longlines.

Pacific clam *Venerupis philippinarum* is also based on Irish hatchery seed and no imports are known to take place. Cultivation is on screened trays then later buried in the substratum beneath mesh. Cultivation takes place on all Irish coasts. The Pacific oyster *Crassostrea gigas*, is produced in Irish hatcheries and is supplemented with imports from registered hatcheries in France and the UK (including Guernsey). The industry tends to buy in oysters at a small size to reduce the risk of importing unwanted species associated with consignments.

2.3 Algae and higher plants

The red alga *Asparagopsis armata* was first recorded in Ireland in 1939 having arrived accidentally. Presently the species is cultured on longlines in Ard Bay, on the west coast. It is produced for its volatile halocarbons used in cosmetics and is the only farm where such production takes place. The gametophyte stage is extensively found in the region of the farm in the spring and it is thought that the farm has increased the local abundance of this stage. It is not known to undergo sexual reproduction in Ireland Elsewhere the plant is uncommon.

3.0 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.2 Invertebrates

Dreissena polymorpha: The zebra mussel still is expanding its range in Ireland and is now known from 57 lakes *(see additional account).*

Chelicorophium curvispinum: This species occurs in abundance on the Shannon navigation and has been found in Upper Lough Erne. It is associated with zebra mussel druses (Frances Lucy and others, pers. comm.).

Caprella mutica: The species has been found in abundance associated with a fish farm in Bertraghboy Bay on the west coast of Ireland in July 2003. Following net changes it was not observed in October 2003. Both sexes were present and species can attain 34mm in length (David Tierney, pers. comm.).

3.3 Algae and higher plants

Sargassum muticum: This brown alga was first recorded in Ireland in 1995 from the NE Irish coast in Strangford Lough and was probably present a few years before its discovery. In 2001 a plant fragment of 1.5m was found on the SE coast in the fishing harbour and marina of Kilmore Quay. In 2002 there were notable stands present. In March 2004 plants were found to extend east from Kilmore Quay for 2kms in rock pools and near low water, plants at this time were 10 to 50cms in length (pers. ob.). Also in 2001 the species was found both on the south-west coast in Kenmare Bay where it became locally common in 2002 and on the west coast in Bertraghboy Bay. A new population was recorded from the NW coast in 2002 from Drumcliffe Bay. It is suspected that oyster movements may have been responsible for its establishment on the south and west coasts. Its presence in Kilmore Quay may have been due to natural drift or carried there by leisure craft. Two new locatilites were noted in 2003, the marine reserve at Lough Hyne on the southern coast

(Cynthia Trowbridge, pers. comm.) and a small population in a pool at Fanad Head (Christine Maggs, pers. comm.). Studies on the physiology of the species are being undertaken in the National University of Ireland (Dagmar Stengal).

3.4 Parasites, pathogens and other disease agents

Anguillicola crassus: This nematode parasite of the air bladder has increased in its level of infestation in silver eels captured descending in the winter 2003/04 within the Shannon catchment, with up to 70% of examined eels being infested, and increase from the 11.5% observed the previous winter (M. Blaszkowski, pers. comm.)

4.0 LIVE IMPORTS

4.1 Aquatic plants

Imported plants (consignments)

Species	Numbers of plants	Supplied from
Alternantherna reinckii	10 (1)	Canaries
Anubias barteri	15 (1)	Canaries
Anubias heterophylla	5 (1)	Canaries
Anubias nana	10 (1)	Canaries
Bacopa rotundiflora	30 (3)	Singapore
Caboma aquatica	35 (3)	Singapore
Ceratopteris cornuta	10 (1)	Canaries
Chlorophytum bichetii	3 (1)	Canaries
Cryptocoryne balansae (green)	10 (1)	Canaries
Cryptocoryne becketii	10 (1)	Canaries
Cryptocoryne pontederifolia	35 (3)	Singapore
Cryptocoryne wendii (brown)	10 (1)	Canaries
Echinodorus grisebachii	10 (1)	Canaries
Echinodorus paniculatus	20 (2)	Singapore
Echinodorus rubra	10 (1)	Canaries
Echinodorus x 'rubin'	10 (1)	Canaries
Echinodoris sp.	10 (1)	Singapore
Elodea densa	25 (3)	Singapore
Microsorium pteropus	12 (1)	Canaries
Myriophyllum matogrossense	20 (2)	Singapore
Nymphaea 'red tiger lotus'	10 (1)	Singapore
Rotala macrantha	10 (1)	Singapore
Selaginella wildenowii	20 (2)	Singapore
Syngonium 'white butterfly'	5 (1)	Canaries
Synnema triflorum	30 (3)	Singapore
Valisneria asiatica	20 (2)	Singapore
Vallisneria gigantea americana	20 (1)	Canaries
Vallisneria spiralis	10 (1)	Singapore
Vesicularia dubyana	2 (1)	Canaries

Note: Plants imported from other European Union countries are not normally recorded.

4.2 Invertebrates

Pacific oyster seed continue to be imported from France and the UK. At 0.02 to 20g weight each.

Imports:

Species	Numbers (consignments)	Origin
Crassostrea gigas hatchery	41,796,000 (74)	England
Crassostrea gigas hatchery	4,015,000 (8)	Guernsey
Crassostrea gigas hatchery	19,000,000 (5)	France
Neries sp.		

4.3 Fish

Species	Numbers (consignments)	Origin
Oncorhynchus mykiss eggs	850,000 (5)	Denmark
Oncorhynchus mykiss eggs	700,000 (3)	Northern Ireland
Oncorhynchus mykiss eggs	27,000 (6)	Northern Ireland
Salmo salar eggs	1,483,000 (7)	Iceland
Salmo salar	777,550 (3)	Scotland
Psetta maxima	Unspecified (1)	Isle of Man

Cultivation of perch: The perch *Perca fluviatilis*, an exotic species, has been known in Ireland since the nineteenth century. Presently there are plans for their cultivation in pond culture (L. Watkins, pers. Comm.)

Aquarium species imported from outside of the EU to Ireland in 5 consignments. Aquarium stock most usually imported from another EU country entry port to Ireland for which no records exist in Ireland.

Species		Numbers (consignments)	Origin
Acarichthys heckelii		25	Singapore
Atrax sp.	Colour freshwater sucker	100	Singapore
Betta splendens	Siamese fighting fish	40	Singapore
Botia spp.	Blue botia	60	Singapore
Capoeta tetrazona	Tiger barb	200	Singapore
Carrasius auratus	Red subankin	1000 (2)	Singapore
Carrasius auratus	Black moor (fantail)	100 (2)	Singapore
Colisa lalia	Dwarf gourami	100	Singapore
Geophagus jurupari		25	Singapore
Gyrinocheilus aymonieri	Alga eater	100	Singapore
Hexigrammus caudovittatus	Buenos Aires tetra	100	Singapore
Hymenochirus boettgeri	Frog (amphibian)	200	Singapore
Hyphessorbrycon ulreyi	Black neon	100	Singapore
Hypostomus plecostomus	Plecostomus	200	Singapore
Julidochromis dickfeldi		25	Singapore
Julidochromis regani		25	Singapore
Kryptopterus bichirhis	Thailand glass eel	100	Singapore
Labeotropheus fuelleborni		25	Singapore
Lamprolagus moorrii		25	Singapore
Lamprologus brichardi		25	Singapore
Mastocembelus sp.	Tyre track eel	30	Singapore
Melanochromis exasperatus		25	Singapore
Poecilia reticulata	guppy	400	Singapore
Pseudotrophes auratus		50	Singapore
Pseudotropheus aurora		25	Singapore
Pseudotropheus phindani		25	Singapore
Pseudotropheus zebra		50	Singapore
Pterophyllum scalare	Ghost angel	100	Singapore
Pterophyllum scalare	Leopard angel	100	Singapore
Pterophyllum scalare	Half-blue angel	100	Singapore
Pterophyllum scalare	Mixed veil angel	50	Singapore
Steatocranus casurius		25	Singapore
Tetraodon fluviatilis	Spotted puffer	36	Singapore

5.0 LIVE EXPORTS TO ICES MEMBER COUNTRIES AND OTHER AREAS

Species	Numbers/weight (Consignments)	Destination
Crassostrea gigas	26.45 tonnes	England
Haliotus tuberculata	30,000 individuals 10mm length	

Species		**Numbers (Consignments)**	**Destination**
Salmo salar eggs	Atlantic salmon	7.82 million (10)	Scotland
Salmo salar eggs	Atlantic salmon	750,000 (3)	Northern Ireland
Salmo salar eggs	Atlantic salmon	121,000 (2)	England
Salmo salar eggs	Atlantic salmon	102,000 (2)	Germany
Salmo salar eggs	Atlantic salmon	100,000 (1)	Wales
Salmo salar eggs	Atlantic salmon	10,000 (1)	Greece
Salmo salar <10g	Atlantic salmon	1.857 million (10)	Scotland
Salmo salar <10g	Atlantic salmon	300,000	Northern Ireland
Salmo salar 10-100g	Atlantic salmon	917,000 (10)	Scotland
Salmo salar 10-100g	Atlantic salmon	40,000 (4)	Northern Ireland
Salmo salar 10-100g	Atlantic salmon	240,000 (4)	France *
Salmo salar >100g	Atlantic salmon	30,000	Scotland
Onchorhynchus mykiss 10-100g	Rainbow trout	240,000 (4)	Scotland
Salmo trutta 150g	Brown trout	800 (1)	Northern Ireland
Carassius auratus	Subunkin, goldfish	2	Jersey

*Well boats carried salmon to France (2+ occasions).

7.0 MEETINGS

1. Workshop on Red King Crab Invasion and Management, Tromso, Norway, 11-12 June 2003 (D. Minchin)
2. North Pacific Marine Organisation PICES) Seoul, Korea, 13-16 October 2003 (D. Minchin)
3. European Union, Consultation Meeting on application of the ICES Code of Practice. Bruxelles, Belgium, 1-2 December 2003 (D. Minchin)
4. Environ 2004. Irish Environmental Rearchers Colloquuim, Limerick, Ireland, 30 January –1February 2004 (D. Minchin)
5. 13th International Conference on Aquatic Invasive Species. 19-24 September 2004. Ennis, Co Clare, Ireland. www.aquatic-invasive-species-conference-org

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Report prepared by Dan Minchin with assistance from: M. Blaszkowski, Neil Campbell, Kealan Doyle, Tara Dunne, Fiona Geoghegan, Peter Jones, Stefan Kraan, Frances Lucy, Christine Maggs, Cormac O'Reilly, Maria Lyons-Alcantara, David Tierney, Cynthia Trowbridge, Lucy Watson.

Norway
(prepared by A. Jelmert)

Highlights:

- A number of suspect lobsters have been analyzed, but no American specimens were found (those analyzed were European).
- The population of snow crab (*Chionoecetes opilio*) appears to be growing on the Goose bank, and two specimens were caught in Norwegian waters.
- Continued growth in the population of the red king crab (*Paralithodes camtschaticus*).
- Proposed management for the red king crab: A boundary at "Nordkapp (26°). West of this boundary, fishing efforts aiming at strong reduction in numbers/erradication will be encouraged.
- A continued spread of the red alga *Heterosiphonia japonica* and the brown alga *Sargassum muticum*.
- Norway signed the Int. Convention on Ballast Water Management

1 LAWS AND REGULATIONS

No new national laws or regulations regarding matters relevant to WGITMO has been suggested or passed in 2003. Norway participated in the diplomatic conference for the finalization of the International Convention on Management of Ballast Water, February 2004. A boundary at "Nordkapp (26°) will be suggested in 2004. West of this boundary, fishing efforts aiming at strong reduction in numbers/erradication will be encouraged.

2 DELIBERATE RELEASES

2.2 Invertebrates

Red king crab (*Paralithodes camtschaticus*)

The introduced red king crab is continuously spreading in the southern Barents sea and is now common in Norwegian waters west to about Hammerfest. Norwegian and Russian authorities have agreed on a western border at 26 ^{o} E, for the joint management of this species. This entails that Norwegian authorities will implement an eradication management regime west of that border. East of the border the king crab stock will be managed as sustainable fish stock with an annual TAC. Norwegian quota for 2004 is 280 000 crabs.

We have so far no reports or indications of any impact of the crab on the ecosystem. However, the Institute of Marine Research implemented in 2003 a comprehensive research program to study dispersal and ecosystem-effects of the crab.

(Supplements from Jan Sundet, IMR, Tromsø)

3 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.1 Finfish

No records finfish for 2003. It should be noted that the imported eggs and fry recorded in article 4 is for stocking in land-based systems. While risk for escape is not nil, it is believed to be low.

3.2 Invertebrates

Slipper limpet (*Crepidula fornicata*). No signs of further migration northward from the Kvitsøy area (59° 02', 05°15) of the slipper limpet have been reported.

Snow crab (*Chionoecetes opilio*). Two adults vere caught close to Båtsfjord (70°42', 29°27') at the coast E. of Nordkapp in Northern Norway. Still caught, but relatively rare in 2003 at the Goose bank Russian zone of the Barents Sea. NB! New data obtained in end March 2004 shows significant increase in the catches at the Goose bank (Jan Sundet, I.M.R. Pers. Comm.)

Anecdotal information on further spread of the amphipode *Caprella mutica* Schurin 1935, north of the Ålesund area (62°29, 06°07') but no confirmed cases.

No new confirmed specimens of the American lobster (*Homarus americanus*) were found 2003 leaving the total numbers of confirmed Norwegian specimens at 17. Some collected suspect specimens have not been analyzed.

A public awareness campaign to enhance the collection of suspected specimens of American lobster was launched the summer 2003. A catch of seven small specimens (below sexual maturity) alleged to be hybrids between American lobsters and European lobsters were later confirmed to be European specimens (*Homarus gammarus*). In the process it has been learnt that the physiological variations within both species are large enough to have quite some overlap in habitus characteristics. A thorough genetically analysis seems to be the only appropriate way to distinguish between the species.

An experiment designed to study sexual behavior (preference, dominance, etc) between the two species were conducted and reported in 2003. (Jointly funded by the Dep. of Fisheries and the Directorate for Nature Management). One important result from the experiment was that male *H. americanus* displayed no interest for newly molted (and thus ready-to mate) females of *H. gammarus*. If these experimental results are confirmed (some concerns WRT acclimation periods, etc. has been voiced), the overall risk of hybridization between the two species in nature may be lower than anticipated.

Algae and higher plants

Sargassum muticum is well established in the southern part of the Norwegian coast (Skagerak, 57°-59°N, 5° - 10° E). It has now also established itself in the inner basin of "Oslofjord"(north of 59°40',10°36'). The alga is found in fairly large quantities along the southwestern coast in Rogaland and Hordaland. *Sargassum muticum* has reached the "Sognefjord" (61° 00', 4°34') but no confirmed reports further north have been obtained. No obvious increase in areas where it has been established, except that it now seems able to grow between the native *Fucus* species. The year-to-year distribution of the alga seems to be a rather dynamic situation, and might reflect some properties in the dominating current system along the Skagerrak (Jan Rueness, Univ. of Oslo, Pers., Comm.).

The red alga "*Heterosiphonia japonica"* has apparently extended its geographical range further during 2003 and is now recorded north of Ålesund (62°29', 06°07') and in the "Kragerø"(58°58', 9°38') area. Genetically analyses have shown species similarity with specimens found several sites in Europe and the Mediterranean as well as in Korea. (Jan Rueness, Univ.of Oslo, Pers. Comm.).

4 LIVE IMPORTS

It should be noted that the managing body for live imports has been reorganized during 2003 so the data presented should be regarded as incomplete. For some of the species it is not distinguished between live and dead organisms. For others, the species is not specified (e.g. the generic term "oyster"). A more comprehensive dataset should be available in searchable databases for the coming years.

4.1 Fish

Halibut fry (*Hippoglossus hippoglossus*) from Iceland: 30 000 specimens.	
Turbot (*Scopthalmus maximus*) from France	750 specimens.
----"---- fry from Spain	45000 specimens.
Halibut eggs from Denmark,	28000, specimens
Halibut eggs from Iceland,	560000 specimens
Sea Bass (*Dicentrarchus labrax*) from France,	1800 specimens.
--------"--------------- fry from USA	600 specimens
Aquarium species from Sweden (origin unknown):	111 specimens
-------"--------- Australia (via Sweden)	10 specimens
--------"--------- Denmark:	31856 specimens
--------"--------- Malawi: (Likely chiclides)	653 specimens

(Apparently there is substantial import from Czech rep. and Singapore, not recorded in the official register)

4.2 Invertebrates

Blue mussel (*Mytilus edulis*) from Sweden >50 metric tonnes

Live oyster from Ireland: 16200 kg

Oyster (not specified) from Ireland: 3477.5 kg

-----------"-------------- from The Netherlands: 3477.5 kg

-----------"-------------- from England: 1500 kg

-----------"-------------- from Frqance : 7852 kg

American Lobster (*Homarus americanus)* from Canada: 26598 kg. (Application for import permission, not necessary import).

5 LIVE EXPORTS

No records for 2003.

7 RESEARCH, MEETINGS, ETC.

The Norwegian Ministry of Fisheries has launched a comprehensive research and surveillance program on the ecological impact of the red king crab in the Barents Sea. A workshop on introduced species with emphasis on the red king crab was held in June 2003 in Tromsø.

Poland
(prepared by A. Szaniawska and A. Dobrzycka-Krahel)

1. LAWS AND REGULATIONS

Polish regulation of legislation determines: The Decree of Infrastructure Ministry (21 May 2003) concerning the conditions of collecting, preservation and removing of wastes and sewers from inland sailing ships.

& 1. The decree determines conditions of collecting, preservation and removing of wastes and sewers from inland sailing ships and the way of prevention of contaminations from transported cargo.

2. DELIBERATE INTRODUCTIONS AND TRANSFERS

2.1. Fish

In 2002, 271 650 salmon *Salmo salar (*Linnaeus, 1758*)* smolts and 90 000 juvenils were released into natural environment. 769 826 smolts and 400 000 fry of sea trout *Salmo trutta morpha trutta* (Linnaeus, 1758) were released into natural environment (as an enhancement of wild stocks). Total of 143 000 juvenile whitefish *Coregonus lavaretus* (Linnaeus, 1758), origin of Pomeranian Bay stock, were released into Puck Bay as a part of program of reintroduction of whitefish, which is carried out since 1991. Also 1 350 000 fry of whitefish was released in Szczecin Lagoon to enhance existing wild stock.

In 2003, 314 703 salmon *S. salar* smolts and 220 000 juveniles were released into natural environment. 823 960 smolts, 933 700 juveniles and 740 930 fry of *S. trutta morpha trutta* were released into natural environment. Total of 203 710 juvenile whitefish *C.lavaretus* and 500 000 fry of whitefish were released into natural environment (Pelczarski, pers.comm.).

3. ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.1. Invertebrates

- *Palaemon elegans* (Rathke, 1837) (Decapoda) in 2002 and 2003 was found in the coastal zone of the Gulf of Gdansk, also near the ports and piers and in Dead Vistula (females with eggs as well as young specimens of were observed) (Janas et al., 2004).

- *Obesogammarus crassus* (G.O.Sars, 1894) (Amphipoda) is a Ponto-Caspian new comer in the River Odra estuary (Gruszka et al., 2003). This species is most recently discovered in Polish waters, namely in the Vistula Lagoon and Dead Vistula in 1998 (Konopacka & Jażdżewski, 2002).

- *Pontogammarus robustoides* (G.O.Sars, 1894) (Amphipoda) is a Ponto-Caspian species occurring in the Vistula Estuary in the late 1990s and in Odra Estuary from the Pomeranian Bay where it was found by Masłowski (pers. comm.) to the Szczecin Lagoon to downstream Odra south of Szczecin (Gruszka et al., 2003).

- *Dikerogammarus haemobaphes* (Eichwald, 1841) (Amphipoda) is also a Ponto-Caspian species. In Poland, the species was first recorded in 1996 in a reservoir on River Vistula. In 1999 *D.haemobaphes* was present in the mid- and downstream sections of the Odra. By 2001 and 2002, it quickly spread into the upper section of the river and the Szczecin Lagoon (Gruszka et al., 2003).

- *Dikerogammarus villosus* (Sowinski, 1894) (Amphipoda) is a Ponto-Caspian species. In 2001 this species reached River Odra. It rapidly spread both up- and downstream, for the first time reaching the Baltic Sea coastal waters (the Szczecin Lagoon) (Gruszka et al., 2003).

- *Chaetogammarus ischnus* (Stebbing, 1899) (Amphipoda) is the species of the Caspian and Black Seas origin. In 1928, it was recorded in River Vistula. Since the 1990s, it has been noted in River Odra. In 2002 the species was recorded from the Odra Estuary (Gruszka et al., 2003).

- *Chelicorophium curvispinum* (G.O.Sars, 1895) (Amphipoda) is the amphipod of Ponto-Caspian origin including in River Odra system, in the beginning of the 20^{th} century this species inhabits Szczecin Lagoon (Gruszka et al., 2003).

- *Atyaephyra desmaresti* (Millet, 1831) (Decapoda) originates from the Mediterranean Sea. It occurs in the Odra Estuary (Gruszka et al., 2003).

- *Hemimysis anomala* (G.O. Sars, 1907) (Mysidacea) is an euryhaline mysid of Ponto-Caspian origin. In 2002 it reached the Baltic Sea in the River Odra Estuary (Gruszka et al., 2003).

- *Gammarus tigrinus* (Sexton, 1939) (Amphipoda) is native for the north-eastern part of North America. Since the late 1980s, it has been common and abundant in the Odra Estuary and since the late 1990s in the River Vistula Estuary (Gruszka et al., 2003). It was caught in the coastal zone of the Puck Bay in summer 2001 and in September 2002. This species was found at the 9 coastal stations of the Puck Bay at the depth of 0.4 m (Szaniawska et al. 2003).

- *Orconectes limosus* (Rafinesque, 1817) (Decapoda) has appeared also in the Polish coastal zone. It has been introduced into the river Odra drainage basin in the end of the 19th century, reported from the River Odra Esuary since at least 1930s (Jażdżewski & Konopacka, 1995), one specimen was found in the coastal zone of the Baltic Sea, near Władysławowo (Skóra, pers. comm.). It occurs in the Vistula Lagoon (Skrzecz & Szaniawska, in preparation).

- *Eriocheir sinensis* (Milne Edwards, 1854) (Decapoda)- a Chinese mitten crab is a newcomer to the Baltic Sea. Since the 1940s single large specimens of this species have been caught annually in Polish waters (especially in the Odra Estuary). Of 186 specimens captured in Lake Dąbie in August 1998 (Normant et al., 2000). In the last few years has been caught in increasing numbers in the Gulf of Gdańsk. The majority of specimens have been netted near the ports in Hel and Kuźnica, on both the open-sea and Puck Bay sides in both shallow coastal waters and deep areas of the sea. Chinese mitten crabs have also been recorded near the pier at Puck (Arciszewski, pers. comm.)

- *Rhithropanopeus harrisii tridentatus* (Gould, 1841) (Decapoda) specimens were collected monthly from May to October 2001 from the Dead Vistula River. Of the 220 specimens collected, 57% were males and 43% were females. Females with eggs on the pleopods were present throughout June, July and August. The depth was approximately 1.5 m and the salinity varied between 1 and 2 psu (Normant et al., in press)

- *Cercopagis pengoi* (Ostroumov, 1891) (Cladocera) – a new predatory cladoceran is a species native to the Ponto-Caspian area and was recorded for the first time in the Baltic Sea in the Gulf of Riga and in the open Gulf of Finland in 1992. The species had never been recorded in the Gulf of Gdańsk prior to 1999. In the shallow coastal area of the western part of the Gulf of Gdańsk the species was recorded on 30 July 1999 at densities of 1369 indiv m^{-3} and on 5 August 1999 at densities of 421 indiv. m^{-3}, when the water temperature was at its maximum in excess of 21,7 °C and 23,9 °C respectively (Bielecka et al., 2000). Ojaveer (Skóra pers. comm.) states that the *C.pengoi* population in the Baltic Sea is more abundant in sheltered locations in open areas and its size depends to a large extent on weather conditions.

- *Marenzelleria viridis (*Verill, 1873*)* (Spionidae) is the new polychaete species, which within 1988-1991 were found in samples collected in the inshore Pomeranian Bay, from the river Świna, and from the littoral in the eastern part of the Szczecin Lagoon (Gruszka, 1999 a).

- *Anguillicola crassus* is the nematode, an eel swimbladder parasite. The nematode was introduced to Europe in the 1980's along with the eel, imported for consumption and stocking. The nematode had been earlier recorded solely in Far East countries (China and Japan). The study of parasitic fauna of the Gulf of Gdańsk eel in September 1997 and in May – October 1998 revealed the presence of the nematode *A. crassus,* not recorded in the area before (Rolbiecki et al., 2000).

3.2. Fish

- *Hypophtalmichthys molitrix* (Valenciennes, 1844)*, Aristichthys nobilis* (Richardson, 1846 and *Ctenopharyngodon idella* (Valenciennes, 1844) — these species were imported to Poland in 60s last century. They occure in aquacultures and in natural waters (Szczerbowski, 1993, Guziur, 1991). Especially many individuals of these species were observed in Odra Estuary near Szczecin in 1997, after flood (Stepanowska, pers.comm.).

Additionally *C. idella* is a new comer species in the Gulf of Gdańsk (Skóra, 2000).

- *Acipenser guldenstaedti (*Brandt, 1833)*, A.baeri (*Brandt, 1833)*, A.ruthenus* (Linnaeus, 1758) – these species the most often occure in Polish aquacultures and they escape to natural waters. In the Gulf of Gdańsk and in the Polish Baltic zone these species are non-indigenous (Skóra, 2000).

- *Salmo gairdneri* (Richardson, 1836) is the new comer species in the Gulf of Gdańsk (Skóra, 2000).

- *Neogobius melanostomus* (Pallas, 1814) – is the new comer species in the Baltic Sea (Skóra, 2000). The round goby population in the shallow water zone of the western part of the Gulf of Gdańsk occupied area over 400 km^2. Most probably all suitable areas in that region were colonized. Currently in the Polish waters round goby populations occur in the Gulf of Gdańsk and in the Vistula Lagoon. Probably, during last two years, colonization of the Szczecin Lagoon has begun. There are no reports from commercial fishery, yet but anglers catch that fish accidentally. The quantity of round gobies in the Gulf of Gdańsk growths consequently from year to year. In 2003, biomass of that fish was preliminary calculated on more than 20 tons. Still, there are no clear signs regarding direct competition between round goby and other fish species in the Gulf of Gdańsk (Corkum et. al.in press, Sapota, in press, Sapota i Skóra , in press).

There is no round goby fishery but sometimes this fish forms big unwanted by-catch, especially in the shallow water fyke-nets catches. Round goby is not consumed in big quantities by predatory fishes due to their scarce in the shallow water zone of the Gulf of Gdańsk. Instead it establishes basic food for cormorants, from the middle of 1990s. During last years, information about the other birds – herons, important feeding on round gobies was collected (Corkum et. al.in press, Sapota, in press, Sapota i Skóra , in press).

3.3. Phytoplancton

Prorocentrum minimum (Pavillard) Schiller 1933 has occured in the Gulf of Gdańsk in low abundance for several years. However, in summer 1997 a significant increase in the numbers of cells was noted. In 1997 a *P. minimum* bloom was recorded for the first time in once of the harbour basins in Gdynia, giving rise to a brown-red coloration of the water (Witek & Pliński, 2000).

4.LIVE IMPORTS AND TRANSFERS

Eggs of sturgeon *Acipenser baeri* – Russia

Eggs of *Salmo salar*- Latvia

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

Lepomis gibbosus, Percottus glenii – came to Poland as freshwater ornamental fish.

5. LIVE EXPORTS TO ICES MEMBER COUNTRIES

Rainbow trout *Oncorhynchus mykiss*- Germany

6. PLANNED INTRODUCTIONS AND TRANSFERS

Poland in 2004 will continue restocking of salmon and sea trout, as in previous years. Also the programme of reintroduction of whitefish in Puck Bay will be continued.

7. MEETINGS, CONFERENCES, SYMPOSIA OR WORKSHOPS

On 28 to 30 of September'2003 in Institute of Oceanography of Gdańsk University was held Meeting regarding alien species in Polish Baltic waters. Meeting has been organized by MAREI (Network of Polish Marine Research Institutes) and BALTDER (Centre of Excellence for Baltic Development, Education and Research).

On 24 to 27 of August'2004 BALTDER – the Centre of Excellence for Baltic Development, Education and Research and Institute of Oceanography of Gdańsk University organize Internationale Conference concerning the problem of non-indigenous species in the Baltic : „Baltic – the Sea of Aliens" .

Appendix 1

List of non-native marine species in Polish Baltic coastal environments.

	Alien species name	Taxon
1	*Acartia tonsa*	Crustacea
2	*Atyaephyra desmaresti*	Crustacea
3	*Balanus improvisus*	Crustacea
4	*Cercopagis pengoi*	Crustacea
5	*Chaetogammarus ischnus*	Crustacea
6	*Chelicorophium curvispinum*	Crustacea
7	*Dikerogammarus haemobaphes*	Crustacea
8	*Dikerogammarus vilosus*	Crustacea
9	*Eriocheir sinensis*	Crustacea
10	*Gammarus tigrinus*	Crustacea
11	*Hemimysis anomala*	Crustacea
12	*Obesogammarus crassus*	Crustacea
13	*Orconectes limosus*	Crustacea
14	*Palaemon elegans*	Crustacea
15	*Pontogammarus robustoides*	Crustacea
16	*Rhithropanopeus harrisii*	Crustacea
17	*Cordylophora caspia*	Hydrozoa
18	*Dreissena polymorpha*	Mollusca
19	*Mya arenaria*	Mollusca
20	*Potamopyrgus antipodarum*	Mollusca
21	*Branchiura sowerbyi*	Oligochaeta
22	*Anguillicola crassus*	Nematoda
23	*Acipenser baeri*	Pisces
24	*Acipenser gueldenstaedti*	Pisces
25	*Acipenser ruthenus*	Pisces
26	*Aristichthys nobilis*	Pisces
27	*Coregonus peled*	Pisces
28	*Ctenopharyngodon idella*	Pisces
29	*Cyprinus carpio*	Pisces
30	*Hypophthalmichthys molitrix*	Pisces
31	*Lepomis gibbosus*	Pisces
32	*Neogobius melanostomus*	Pisces
33	*Oncorhynchus mykiss*	Pisces
34	*Percottus glehni*	Pisces
35	*Marenzelleria* cf. *viridis*	Polychaeta

Submitted by: A. Szaniawska, A. Dobrzycka-Krahel

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Appendix to Polish National Report

Current Zoogeographical Range of the Expansion of *Neogobius melanostomus* in Poland and in Other Regions in Europe. Krzysztof E. Skóra., Hel Marine Station, Institute of Oceanography, Gdańsk University & Centre of Excellence for Baltic Development, Education and Research –BALTDER. Morska 9, 84-150 Hel, Poland, skora@univ.gda.pl

The expansion of *Neogobius melanostomus* was first evidenced in the 1980s when the individuals of the species were found in the Moskva River (Sokolov et al.1989). The species was supposed to have been migrating to the Baltic Sea at that time to reach the Gulf of Gdańsk in the ballast waters of ships shuttling between the Black Sea and the Caspian Sea (Skóra, Stolarski 1993a).

The first specimen of the species was caught near the harbour of Hel in 1990. The age of the fish and the distribution of sites where the fish was reported to have been caught indicate that the species must have reached the area of Gdynia in the Gulf of Gdańsk at least 3 – 4 years prior to it being fished for the first time (Skóra, Stolarski 1993a). In 1994 the fish was reported to be present in almost the whole of the Polish part of the Gulf of Gdańsk, whilst in the next year the first individuals were found outside the Gulf (Grygiel 1995, Kuczyński 1995). At the end of the 1990s, *Neogobius melanostomus* migrated apparently through the estuaries of rivers to the littoral lakes of Łebsko and Gardno in the Słowiński National Park (Ciepielewski and Hornatkiewicz-Żbik, 2003).

Observations of the continually increasing population of *N. melanostomus* (Sapota 2002), also showed that the fish started penetrating the estuary of the Vistula River. At the end of the 1990s, the fish was present in the Motlawa and in the Wisła Śmiała Rivers near Przegalin (Skóra, Kozik unpublished). In 1999, individuals of the species were found for the first time in the Polish part of the Vistula Lagoon (Borowski 1999), and two years later in the Russian zone of the Lagoon (Tylik 2001). According to latest reports, *N. melanostomus* is expanding up the river and its tributaries. The most distant site (i.e. 130 km) from the estuary of the Vistula River in which *N. melanostomus* was found is situated near Świecie (Kostrzewa, Grabowski 2003). The zoogeographic reach of *N. melanostomus* overlaps that of *Neogobius fluviatilis*, another Ponto-Caspian species that is migrating from the south-eastern regions of Europe and has reached the area between Gniew and Tczew. (kol. 9.07.2003. Skóra K.E., unpublished).

Fig. 1 Findings of *Neogobius melanostomus* and *N. fluviatilis* in Polish waters.

Until recently there were no reports of the occurrence of *N. melanostomus* along the middle and western parts of the Polish coastal zone of the Baltic Sea. The only report from the Pomeranian Bay, dated 1996, was not properly evidenced. A reconnaissance held in 2003 helped to collect complementary data. Underwater research and interviews with anglers provided data from a number of new sites. It was determined that *N. melanostomus* was found in the area of coast revetments near Jarosławiec and in the river-mouth channel in Dziwnów. Reports showed that the fish had been first caught by anglers in the Piastowski Channel in Świnoujście (Skóra, Woźniewska unpublished, Wolnomiejski N. and Stepanowska K. pers.com.).

The evidence of *N. melanostomus* in Łeba*,* previously predicted according to reports by Ciepielewski and Hornatkiewicz-Żbik (2003), was confirmed with respect to the harbour basin of Łeba and the estuary of a river flowing from the Łebsko Lake to the Baltic Sea.

Large populations of the fish were also found inhabiting the area of the underwater constructions of the harbour of Władysławowo.

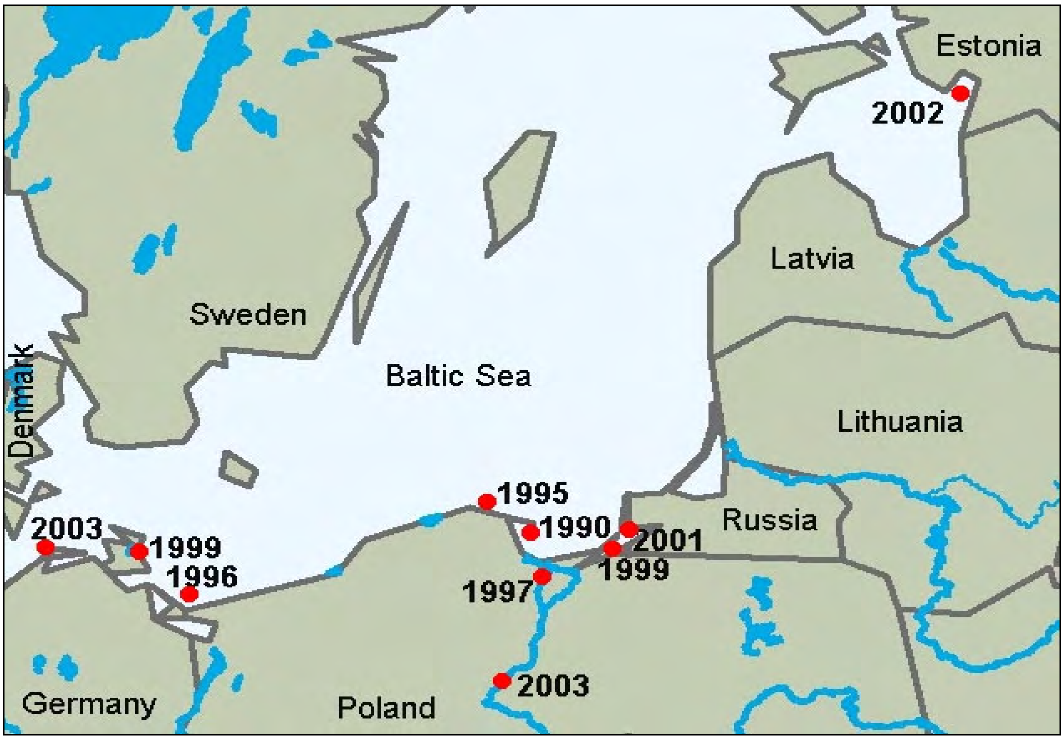

Fig. 2 Findings of *Neogobius melanostomus* in the Baltic Sea.

Reports on single specimens having been fished in the German costal zone in 1999 (H.Winkler unpublished) have been complemented with observations held at Darss Cap on Zingst Island (Skóra 2003). Currently, this is the most distant westerly location where the species has been found in the Baltic Sea.

In the eastern part of the Baltic Sea, *N. melanostomus* was reported to have occurred a year earlier, when a single specimen was caught in the Esthonian Parnu Bay (Ojaveer 2002).

For the time being, there is no evidence that *N.melanostomus* has occurred on the northern coasts of the Baltic Sea. However, the species may be expected to quickly invade that part of the sea because Scandinavian habitats, with their characteristic and natural features, provide optimal living conditions for the species.

It is worth noting that *N. melanostomus* also migrates up the rivers of the Black Sea. According to Simonovic et al. (2001), in 1997 and 1998 individuals of the species were found near Prahovo, former Yugoslavia, 861 km off the estuary of the Danube River. Two year later, the round goby was found as far in as the area of Vienna (Wiesner, 2000).

It seems that it is only a matter of time before *N. melanostomus* will migrate along the route of *N. fluviatilis* and *N. gymnotrachelus,* leading from the Dnieper River, through the Pripet River, the Krolewski Channel to the basin of the

Vistula River (Danilkiewicz 1996 and 1998). The anthropogenic mechanism of the upstream migration of this species is best illustrated by the fact that *N. melanostomus* has penetrated up to Zlobin, Belarus (Guljugin 1998).

Also the water route of the Danube-Men Channel seems open to this species to quickly penetrate up to the North Sea.

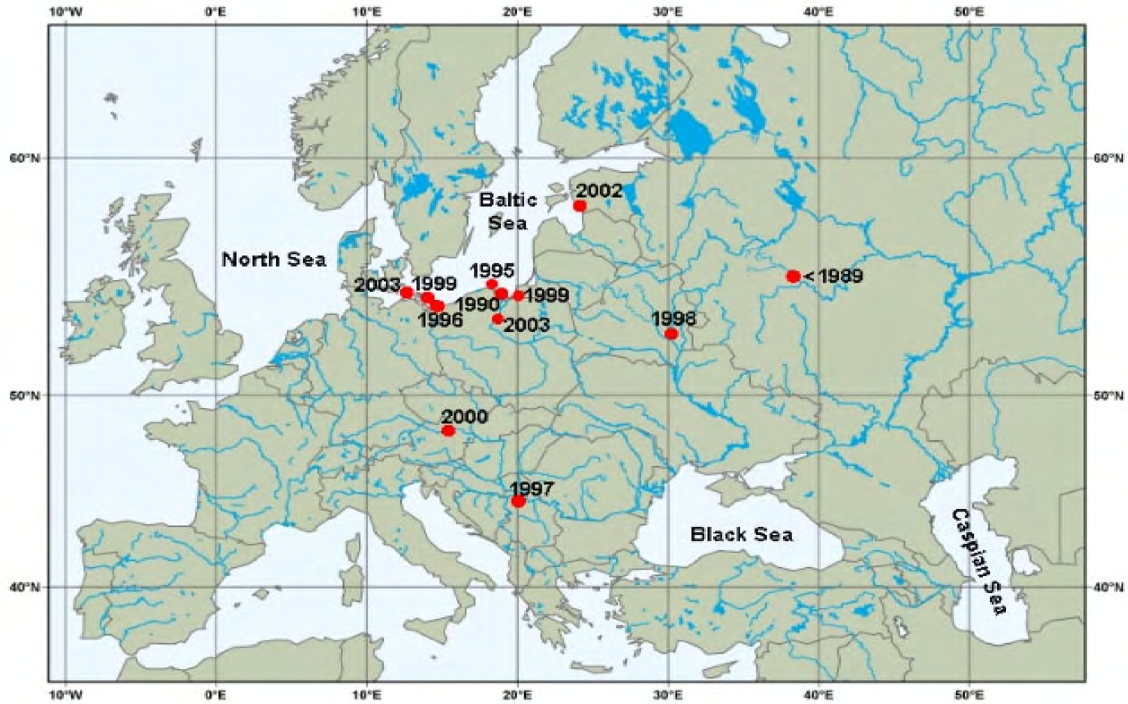

Fig. 3 Findings of *Neogobius melanostomus* in Europe.

We may assume that such a successful expansion of *N. melanostomus* – the species has reached the Great Lakes basin in North America (Jude, et al 1991) – is significantly related to anthropogenic factors: the development of navigation and shipping, and the modification of river beds and coastal zones by hydro-engineering constructions. We cannot exclude, though, that environmental changes favourable to the species occur in and near the regions of its natural habitats and as well as in the areas to which the species was brought. These changes may be explained, but only to some extent, by the natural evolution of biotopes and biocenosis. The aforementioned processes are mostly driven by anthropogenic factors that indirectly affect climate and result in the eutrophication of water basins, or the disappearance of the species that are the natural predators of *N. melanostomus.*

The biological and ecological features of the species will predispose it to a continuation of its expansion.

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Sweden
(prepared by F. Nordwall and I. Wallentinus)

1. LAWS AND REGULATIONS

The Swedish legislation for release of GMOs is based on National legislation (Miljöbalken 1998:808; the Regulation on enclosed use of GMOs SFS 2000:271; the Regulation on stocking GMOs in the environment SFS 2002:1086, complementary directions on GMOs FIFS 2004:2) which all mainly follow the new EU Directive 2001/18/EG.

A regulation prescribing that salmon (*Salmo salar*) and sea-trout (*Salmo trutta*) stocked into the sea should have there adipose fin removed was decided in 2003 (the Regulation on fishery SFS 2003:353, complementary directions FIFS 2003:34).

New regulations concerning crustaceans, prescribing that imported crustaceans should be kept in closed systems before being placed on the market.

The regulations concerning stocking of salmonids in rivers on the Swedish west coast free from the parasite *Gyrodactylus salaris* was sharpened, since stocking of salmonids was decided to be forbidden downstream second fish migration barrier (complementary directions, FIFS 2003:34).

2. DELIBERATE RELEASES

2.1 Finfish

In 2002 (no figures available for 2003) 2.1miljon individuals of Baltic salmon (*Salmo salar*) smolt and 0.6 miljon individuals of smolt of sea-trout (*Salmo trutta*) were released in rivers and coastal areas (both probably mainly of Swedish origin). In 2003, 10 000 individuals of pike-perch (*Sander lucioperca;* young of the year) were released in the province of Södermanland (propably of Swedish origin; and since not all county councils have replied the figure might be higher). About 0.4 millions of glass eels (*Anguilla anguilla*) from England were released in coastal areas and around 10 tonnes of small adult eels were transfered from the Swedish west coast into the Baltic Sea.

Two reports on introductions of fish in Swedish waters are now available in Swedish (Anon. 2003, Anon. 2004). The latter also includes, as an annex, a list of fish used in the aquarium trade.

3. ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.1 Finfish

A sterlet sturgeon, *Acipenser ruthenus*, which can live in both fresh and brackish water, was found in a tributary to the river Rönne (at Ängelholm, S Sweden) upstreams a migration barrier, when a power plant owner cleaned the grille to the turbines. It is not native to Sweden. The fish was released after being photographed. It is assumed to have been released from an aquarium (Anon. 2004).

There are still NO reports of *Neogobius melanostomus* from Swedish coastal waters, despite its common occurrence in the Bay of Gdansk, at some sites in northern Germany and a record from Estonia in 2002.

3.2 Invertebrates

According to surveys in 2002-2003, *Cercopagis pengoi* is present along the Swedish east coast from Gävle (north) to the northern part of Öland (south) and in the open northern Baltic proper (Landsort Deep, Gotland Deep). It has so far not been found in the lake Mälaren. However, the distribution is very patchy and densities are generally low (10-100 ind./m^3). Moreover, in Himmarfjärden Bay, a station where monitoring data for the last 6 years are available, *Cercopagis* abundances at the peak of development have decreased from 200-400 ind./m^3 in 1997 (Gorokhova et al. 2000) to 20-30 ind./m^3 in 2002 (Gorokhova et al. in press). Fish diet analyses have shown that *Cercopagis* is readily consumed by herring and sprat, within their size ranges commonly found during August-September, i.e. 5-15 cm for sprat and 5-25 cm for herring (Gorokhova et al. in press). Large fish exhibit clear positive selectivity for *Cercopagis*. As suggested by diet analyses and stable isotope studies (Gorokhova et al. submitted), the trophic position of herring has changed after the invasion of *Cercopagis*. With the central role of this species in the pelagic food web, this implies that the invasion by *Cercopagis* has resulted in a general food web change.

Sediment samples from very shallow bays (<1 m) taken in the summer of 2003 close to Kristineberg, the Swedish Skagerrak coast, yielded broken parts of juvenile polychaetes which looked very similar to the introduced species *Marenzelleria* cf. *viridis*. More complete specimens are needed before they can be identified with certainty (Alf Norkko, Finnish guest scientist at Kristineberg Marine research Station, pers. comm.). In the Öresund area some single specimens have in 2003 also been encountered in the northern part, previously seen further south (Peter Göransson, Miljökontoret, Helsingborg pers. comm.).

Marenzelleria, as reported in the WGITMO Report 2003, has been found from the very innermost part of the Bothnian Bay at Rånefjärden (about 30 km north of the town Luleå) to the town of Öregrund in the S Bothnian Sea. The increase in abundance does not seem to have continued in the north but outside the town of Söderhamn (Bothnian Sea) higher densities than anywhere else along the Swedish coast of Gulf of Bothnia have been recorded (Fig. 1). So far no negative effects on the native fauna have been seen, although the increase in time corresponded to a decrease of *Monoporeia* (Kjell Leonardsson & Annika Karlsson, Umeå Univ., pers. comm.) - cf. also below on experiments on competition between the two species.

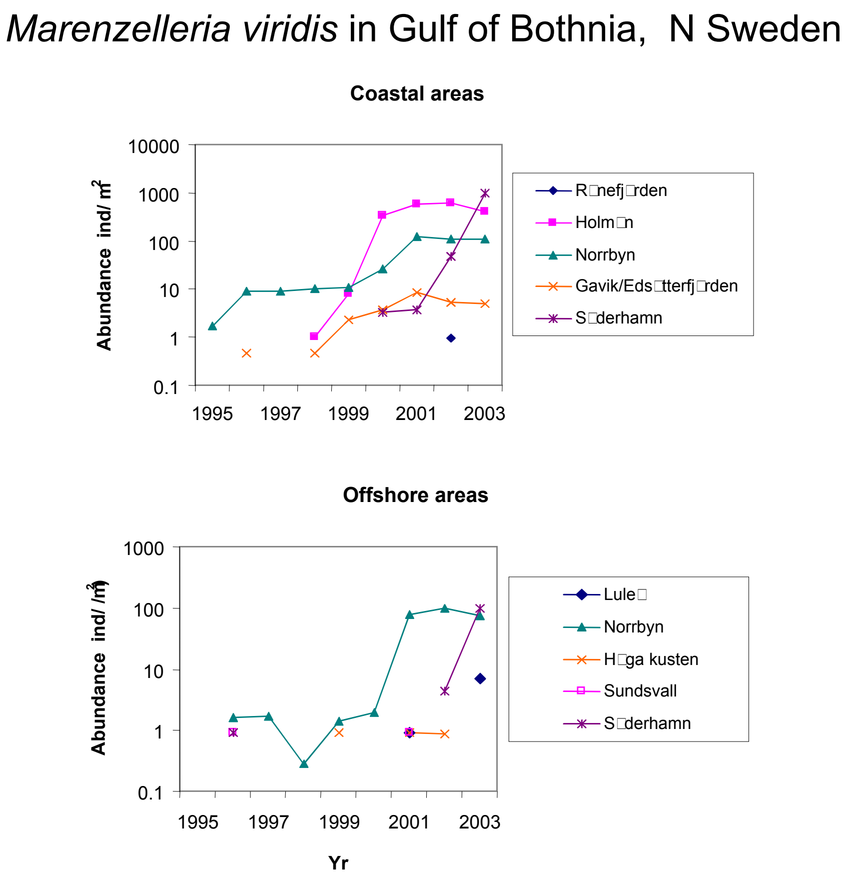

Fig. 1. *Marenzelleria* abundances 1995-2003 at the various sites in Gulf of Bothnia (unpubl. data by courtesy of Annika Karlsson and Kjell Leonardsson, Umeå univ.). For sampling sites , see next page.

Many experimental studies have been performed to elucidate if there is any competition between the introduced *Marenzelleria viridis* and the native amphipod *Monoporeia affinis*, both inhabiting the Baltic soft-bottom communities, where the amphipod is a key member. The amphipod lives in burrows during the day, but swims actively at night. Due to similarities in feeding mode and sympatric occurrence, the polychaete may compete with the amphipod for both food and space. In one study (Kotta and Ólafsson, 2003) interspecific competition for food between the polychaete and the amphipod was tested in a laboratory experiment at various *Monoporeia* densities, with and without added food resources, and with and without the polychaete. *Marenzelleria* did not have any effect on mortality in the amphipods, while it was shown that food addition, density of amphipods and presence of the polychaete had a significant effect on the growth of amphipods of different age classes. It was concluded that lower amphipod growth in the presence of *M viridis* was caused by competition for food and is likely to affect the population of *M. affinis* in deep soft-bottom habitats of the northern Baltic Sea. It is not known if that could be an explanation to the decrease of *Monoporeia* seen in the Gulf of Bothnia (see above).

Another study (Neideman et al. 2003) tested if the amphipod, the more mobile species, would avoid areas where the more sessile polychaete is present in high numbers and it was found that the amphipod burrowed in significantly lower numbers in patches with high polychaete abundance and that plastic tubes mimicking the polychaetes were not avoided by the amphipods thus the physical presence as such could not explain the amphipod's choice of burrowing site. Furthermore, the amphipod did not increase or prolong swimming activities in higher worm densities, indicating that increased swimming activity over dense polychaete patches and subsequent migration away from them is not a likely explaination of why this amphipod burrows less frequently in patches of high polychaete abundance.

According to a policy document (Anon. 2002) Chinese mitten crab should have established in the archipelago at Blekinge, the Baltic coast of SE Sweden. Since the salinity there is not more than around 7-8 psu, its does not seem likely that they are reproducing populations. In March 2004 a single specimen was reported from the archipelago N of Stockholm and single records are not unusual. There are NO reports of mass occurrences.

There were NO reports of American lobster in 2003 and the previously reported specimens are still waiting to be positively identified by DNA (samples are left for that). A new project, financed by the Nordic Council of Ministers, will monitor Norwegian, Swedish and Danish waters to see if and where American lobster may have established (Mats Ulmestrand, Inst. of Marine Research, Lysekil, pers. comm.).

Figure 1. Sampling sites, N Gulf of Bothnia: ● Coastal areas, Δ Offshore areas.

3.3 Algae and Higher Plants

Macroalgae

The red alga *Gracilaria vermiculophylla*, a brownish-red and more than 60 cm long agarophyte (Fig. 2), was first recorded during August-September 2003, at five out of twentyfive shallow archipelago localities with similar habitats around Göteborg (Wallentinus 2003, Wallentinus and Jenneborg 2003, Wallentinus et al. in press). They were recognized by the deep (75-150 µm) male conceptacles, i.e. much deeper than in the native *G.gracilis* and later confirmed by DNA-analyses (Jan Rueness, Oslo univ. pers. comm.). The patchy distribution points to a recent introduction, the vector, however, unknown. Some localities are close to the harbour area, but no shellfish aquaculture sites occur close by. In 2003 large-scale dredging of the harbour started with two Dutch "Trailing Suction Hopper Dredgers", but any ship could be the vector. The closest then known European site was Brittany, France, but *G. vermiculophylla* has later also been identified in samples from the land-locked Oostvoornse Meer, The Netherlands in the 1990s (Herre Stegenga, Leiden univ., pers.comm.).

In the autumn of 2003 the Japanese red alga *Heterosiphonia japonica* (i.e. "*Dasysiphonia* sp." in previous WGITMO reports) was found in the Koster archipelago most probably being dispersed from the south coast of Norway, where it now is common (Jan Rueness and Marit Ruge Bjærke, Oslo univ., pers. comm.). It was then also realized that specimens had been collected already in 2002 although not recognized until 2003 (Barbro Axelius, Stockholm univ., pers. comm.). An ongoing taxonomic revision may show that this species should be removed from the genus *Heterosiphonia* (Jan Rueness, Oslo univ., pers comm.). Probable vectors could be boats or fishing activities, since the main currents in the upper water mass is going from Sweden to S Norway, but drifting with northerly winds, which then would be a range extension of an introduction to Norway, cannot be ruled out.

Another red alga, *Aglaothamnion halliae*, common in harvbour areas on the south coast of Norway since at least 1980, was identified for the first time in 2003 in Strömstad, Grebbestad and Rönnäng (the northern and middle parts of the province of Bohuslän in harbour areas (Marit Ruge Bjærke, Oslo univ., pers. comm.). It is not unlikely that it has been in Sweden much longer but not recognized, being small and quite similar to some native species of that genus.

In late summer 2003 large amounts of drifting *Sargassum muticum* were seen in the N Öresund (Kullen), which has not been observed before, but no attached plants were found (Charlotte Carlsson, Länstyrelsen i Malmö). The southernmost reported record of attached plants is still from the middle part of the province of Halland.

Laboratory experiments have been carried out to test if the low epiphytic abundance on the invasive brown seaweed *Fucus evanescens*, compared to the congeneric *F. vesiculosus*, is due to a more effective chemical defence against epiphyte colonisation. A field survey of the distribution of the common fouling barnacle *Balanus improvisus* showed that the abundance was consistently lower on *F. evanescens* than on *F. vesiculosus*. However, contrary to those results, the experimental studies indicated that *F. vesiculosus* has a more effective anti-settlement defence than *F. evanescens* but both species deterred settlement by barnacle larvae, the settlement being lower on *F. vesiculosus* both in choice and no-choice experiments. Phlorotannins from *F. vesiculosus* also had a stronger negative effect on larval settlement and were active at a lower concentration than those from *F. evanescens*. The results showed that phlorotannins in fucoids have the potential to inhibit settlement of invertebrate larvae, but that settlement inhibition cannot explain the lower abundance of the barnacle *Balanus improvisus* on *F. evanescens* compared to on *F. vesiculosus*. Assessment of barnacle survival in the laboratory and in the field showed that this pattern could instead be attributed to a higher mortality of newly settled barnacles and observation suggested that the increased mortality was due to detachment of young barnacles from the seaweed surface (Wikström and Pavia 2004).

There have been NO major changes reported for the distribution or abundance of any of the other introduced macroalgae (*Bonnemaissonia hamifera, Dasya baillouviana, Colpomenia peregrina, Codium fragile,* on the Swedish west coast and *Chara connivens* in the province of Uppland on the Swedish east coast).

There are ongoing studies to elucidate if there are any active (e.g. halogenated) substances in the introduced red alga *Bonnemaissonia hamifera,* as well as in other native red algal species, which can affect settlement and growth of other organisms incl. bacteria. The goal is to see if these have any commercial use incl. antifouling paints (Gunnar Cervin, Göteborg Univ., pers. comm.).

Phytoplankton

Species which might be new to the Swedish west coast are the dinoflagellates *Dissodinium pseudocalani* and *Oxytoxum criophilum* (Mats Kuylenstierna, Göteborg univ., pers. comm.).

In one fjord on the Swedish west coast, Havsstensfjord,, there were high concentrations of raphidophytes of the genus *Chattonella* during April but no real bloom was built up (Edler 2003).

The PST-producing dinoflagellate *Alexandrium pseudogonyaulax* was common in samples from the Kattegat (Anholt and Fladen) during summer 2003 (Mats Kuylenstierna, Göteborg univ., pers. comm.)

Fig. 2. *Gracilaria vermiculophylla*, at Vallda, February 20, 2004.

Fig. 3. *Gracilaria vermiculophylla* on a sediment flat at a low water situation in February 2004 (the white patch is snow) and plants collected in Rivö, September 2003.

3.4 Parasites, pathogens and other disease agents

An unidentified rhabdovirus was found in a quarantine stock of glass eels at Helsingborg, S Sweden. The fish was not allowed to be stocked in inland waters.

Two rivers on the west coast of Sweden, previously uninfected, has been infected by the parasite *Gyrodactylus salaris*.

4.0 LIVE IMPORTS during 2003 (for EU countries amounts may be underestimated)

5.0 Fish

For consumption/processing

	Eel from:
	Metric tonnes
Norway	55
Denmark	50
Germany	13
Belgium	1
U.K.	1

Ornamental fish (not specified)

	Freshwater species from:	Marine species from
	Metric tonnes	Metric tonnes
Singapore	14	
The Czech Republic	13	
Thailand	6	
Israel	5	
Brasil	4	
Indonesia	3	2
Denmark	3	1
Colombia	2	
Vietnam	2	
The Netherlands	2	10
Hong Kong	1	
India	1	
Nigeria	1	
Sri Lanka	1	1
Peru	1	
Germany	1	

6.0 Live invertebrates for consumption/processing

	Scallops from:	Oysters (*Ostrea* + *Crassostrea)* from:	*Mytilus* from:
	Metric tonnes	Metric tonnes	Metric tonnes
Norway	213		217
The Netherlands	2	34	10
Denmark	2	17	2
Ireland		9	
USA	6	1	
U.K.	4		
Germany	3	1	

Belgium	1
Canada	1
Armenia	1

	Lobsters from:	"Edible crabs" from: :
	Metric tonnes	Metric tonnes
Ireland	2	418
Canada	139	
Norway	4	102
U.K.		44
USA	30	
Denmark	3	2
The Netherlands		2
Belgium	1	

LIVE EXPORTS during 2003 (for EU countries amounts may be underestimated)

Fish for consumption/processing

	Eel to:	Rainbow trout and trout to:
	Metric tonnes	Metric tonnes
Denmark	154	
The Netherlands	94	
Germany	7	
Finland	1	22

Ornamental fish (not specified)

	Freshwater species to:	Marine species to
	Metric tonnes	Metric tonnes
Norway	65	1
Finland	1	49
Denmark	1	

Live invertebrates for consumption/processing

	Mytilus to:	Scallops to:
	Metric tonnes	Metric tonnes
Germany	164	15
Denmark	66	
Norway	59	
France	53	1
Belgium	14	78
Finland	24	
The Netherlands	3	32
Italy		41
Spain		38
U.K.	1	1
Ireland	1	

7. OTHERS ON INTRODUCTIONS AND TRANSFERS OF MARINE ORGANISMS

Research project

The first publications with results from the research programme "AquAliens - Aquatic alien species - where and why will they pose a threat to the ecosystem and economy?" (financed by the Swedish EPA; http://www.aqualiens.tmbl.gu.se, co-ordinator Prof. Inger Wallentinus, Göteborg univ., see also the WGITMO report 2003) are now ready (for brackish and marine species: Gorokhova et al. in press, Nyberg & Wallentinus in press, Wallentinus *et al.* in press, Gorokhova et al. submitted). An evaluation of the activities so far, i.e., roughly after two years, but some parts started later, will be carried out in June 2004.

Lately the main emphasis has been on developing tools for risk assessment / quantitative analysis for organisms with three different strategies: freshwater plants and algae, emphasizing the dispersal by vegetative propagulae; crustaceans; as well as fish in fresh and brackish water, for which their life history strategies may play a large role for the establishment. Those risks will then also be coupled to the impact on economy and management. An introductory course in risk analyses have been run for those active in the programme and one Ph.D student from the Finnish project BITIS was invited. There have also been many articles in magazins and newspapers informing on the programme and on selected introduced species.

Meetings

On August 21, 2003, the research programme "AquAliens" had invited representatives from national and regional authorities, other receivers, museum employees and scientists from Sweden and Finland to present and discuss topics related to introduced aquatic species.

New problems that were highlighted were imports (above all from Germany and Poland) of live fish for fishing (mainly roach, a species native in Sweden, too), being hold alive by private persons coming in caravans to camp and fish. The risk is not so much that the fish will escape (mostly being killed before fishing), but the risk of spreading diseases not yet occurring in Sweden was strongly emphasized (see also Anon. 2004). The same also applies to the illegal imports of koi carp.

Much discussed was also the implication of the EU membership, which means that there is no longer any controll of imports from other EU countries (with several new countries becoming members in May 2004) and although species may have a negative effect on the biodiversity, it might still be problem to stop the import if they come from within EU. Furthermore, there are no legally binding acts preventing imports of algae, aquatic plants or lower invertebrates, unless there is a risk of spreading diseases and parasites. And even it there are laws, the many illegal introductions show that this is not enough, but that there must be mucher better information of the risk to the general public, through media, museums and others – to make people "think before you act".

Another concern was how many alien organisms would reach the seabeds, when hulls on anchored ships are cleaned in the water by divers, which is offered to ships by a company working in the Öresund. This also is a pollution problem, since toxic antifouling compounds may be spread. Also discussed were the suggested new inland canals in Europe, since they may imply higher risks of organisms arriving from the Black Sea area to European waters with a potential for further dispersal.

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United Kingdom
(prepared by I. Laing, G. H. Copp and T. Edwards)

1.0 LAWS AND REGULATIONS

An extended list of species pertaining to the Import of Live Fish (England and Wales) Act (1980) took effect in February 2003.

2. DELIBERATE INTRODUCTIONS AND TRANSFERS

2.1. Invertebrates

Deliberate releases of pacific oysters for cultivation continue at a similar level to that in previous years. The managed manila clam fishery in Poole Harbour continues to flourish; 300 tonnes were harvested in 2002. There are no reports of recruitment of this species elsewhere. There are just two other farm sites for this species in the UK and these produce about 30 tonnes annually. Hatcheries for producing and rearing seed of ormers (*Haliotis tuberculata*) have been established in south-west England.

2.2. Fish

Within the context of the UK National Trout and Grayling Fisheries Strategy, it is considered that the large-scale stocking of rivers and streams with farm-reared fertile brown trout (*Salmo trutta*) may pose an unacceptable risk to wild brown trout populations via genetic change resulting from interbreeding of stocked and wild fish. All-female triploid brown trout have been available commercially for some 5 years and, being essentially sterile, they offer a means of substantially reducing or avoiding genetic risks to wild stocks whilst maintaining the fishery benefits of stocking in "native trout" waters. However, insufficient information is available on whether there would be any detrimental impacts, which could be competition for food and habitat resources, predation on wild trout eggs and fry or agonistic behaviour on spawning grounds (Solomon 2000, 2003). The quality of stocked trout, as a sporting adversary and on the table, is also important to anglers. Stocking of triploid trout is thus the subject of on-going research funded by the UK Environment Agency.

3. ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.1 Fish

Marine

A 3.3 metre long (63.5 kg) oarfish (*Regalecus glesne*) was caught by rod and line off Skinningrove, northeast England in February 2003. This fish, a legendary sea monster, is usually found deep in sub-tropical waters of Atlantic, Pacific and Indian Oceans and is classed as scarce. The last one seen in Britain was found in 1981 on a beach at Whitby, North Yorkshire. The specimen is in the British Museum.

Freshwater:

Imported sturgeon species, *Acipenser* spp., and hybrids thereof have begun finding their way into the wild, presumably introduced by aquarists, garden pond enthusiasts and anglers. One such case is the capture in 2003 of a specimen of *Acipenser* spp. in a village pond (Hertfordshire) that lies within a few km of three different garden centres that sell such fishes. Identification is problematic, given the common aquacultural practice of hybridization within this genus. This was highlighted by a specimen captured in 2003, which initially was thought to be *Acipenser ruthenus* but subsequently was identified to be a probable hybrid of *A. sturio* and *A. oxyrhynchus* (personal communication from: M. Prokes & V. Barus, Institute of Vertebrate Biology, Brno, Czech Republic).

The pikeperch *Sander lucioperca* appears to be increasing its range, with regular sightings in lower parts of the River Trent (near Nottingham) and the River Hull (I.G. Cowx, personal communication). Now well-established in parts of the River Thames basin, including parts of the Upper Thames Estuary (S. Colclough, personal communication), the species appears to have spread to previously un-invaded river systems: fish of 15-20 cm FL thought to be pikeperch were reported by anglers in 2003 for the Welsh Dee. This sighting will be the subject of further investigation.

Concerns about the incidence of non-native fish introductions into public ponds raised by Wheeler (1998) have been substantiated through a collaborative study in 2003 carried out by CEFAS, Bedwell Fisheries Services and the Corporation of London (Copp, Wesley & Vilizzi, unpublished). This investigation revealed that the number of varieties of introduced non-native fishes can be reliably estimated by the distance of a pond to the nearest road, with ponds adjacent to roads the most likely to receive illegal introductions.

Similarly, following a publication in British Wildlife (Pinder & Gozlan 2003), a report was received of the of the Asian cyprinid 'topmouth gudgeon' (*Pseudorasbora parva*) occurrence in at least one water body in Yorkshire (R.E. Gozlan, personal communication). And the Ponto-Caspian cyprinid 'sunbleak' (*Leucaspius delineatus*) has also been observed in the River Frome, Dorset (R.E. Gozlan, personal communication).

3.2. Invertebrates

Marine

An alien crustacean species is colonising the sea lochs of the west Scottish coast. The skeleton shrimp (*Caprella mutica*) is a caprellid amphipod originating from North-East Asia. It was discovered and positively identified on the Scottish west coast in 2002 (Willis et al., in press). Scientists at the Scottish Association for Marine Science (SAMS) are investigating just how much of an impact the skeleton shrimp is having on native species.

Dense populations are generally found associated with artificial structures such as mooring ropes, aquaculture activities, harbours/marinas and boat hulls. The time of introduction is unknown. Various reports suggest that the species has been present on the Scottish West coast since the early 1990s. Possible introduction and dispersion vectors are aquaculture, ballast water and hull fouling. It is likely that the presence of this species in the UK is due to multiple introductions, probably via different vectors, rather than a single introduction event.

Little is known about the biology or ecology of this species, or its potential impact on marine systems where it has been introduced. It is also reported from Wales (Anglesey), the south coast of England (Poole Harbour, Empress Dock Southampton) and the west of Ireland (Betraghboy Bay, Connemara).

Freshwater

Signal crayfish (*Pacifastacus leniusculus*) continue to spread, but there is an initiative by the Environment Agency across England & Wales, but in particular in the North of England where the native crayfish still has strongholds, to attempt eradication of the alien species.

3.3. Algae and Higher Plants

Sargassum muticum is continuing to spread around the Welsh coast and is now well established in North Wales.

LIVE IMPORTS AND TRANSFERS

4.1 Fish

Imports of rainbow trout eggs into the UK were 75.8 million in 2002 (54.6 million into England and Wales, 21.2 million into Scotland). This represents a 13% increase on the total number of eggs imported in 2001 (66.7 million). These came mainly from the USA and South Africa, as well as from disease-free sources within ICES boundaries including Denmark, Northern Ireland, and the Isle of Man. There were 70 consignments of live eels imported from Holland (mainly) and France, for human consumption.

Imports of Atlantic salmon eggs into Scotland were 22.6 million in 2002. This represents a 9% increase over the previous year. These eggs came mainly from Iceland and other EU member states, with smaller quantities from Australia. A small quantity was also imported from the USA for the first time, as sources here are now available. Scotland also received 2.9 million salmon parr and smolts from other EU member states.

4.2 Invertebrates

The hatchery on Guernsey sent 7 shipments of pacific oyster seed and two shipments of ormers to shellfish farm sites in England. A further 9 tonnes of pacific oyster juveniles were re-laid at Scottish farm sites. Two shipments of half-grown pacific oysters were imported into England from Ireland.

Imports of live bivalve molluscs for human consumption continue. Although this activity is licensed it is perceived that there is a risk of accidental introductions of imported species as there is little control once the animals are sold on. To address this, new EU legislation has been developed (2003/804/EC) that will come into force in May 2004. This legislation will provide stricter controls on these imports and so should reduce this risk.

There were 30 companies licensed to import live American/Canadian lobsters for human consumption. There were no known reports of any lobsters of this species being found wild in UK waters in 2003.

5 LIVE EXPORTS TO ICES MEMBER COUNTRIES

5.1 Fish

In 2001 a total of 8.2 million Atlantic salmon ova were exported from Scotland. Exports to other EU member states decreased by 22% to 6.6 million. Exports to Chile fell by 40% to 1.6 million, the lowest level observed. Overall, exports were down by 27% based on the 2001 figure.

5.2 Invertebrates

Pacific oyster seed were produced in UK hatcheries and 70 consignments were exported to Eire, three to Northern Ireland and one to Guernsey. Eleven consignments of seed *Mytilus edulis* were sent to the Channel Islands.

7. MEETINGS

7.1. Research initiatives:

7.1.1. A Defra (Department of Environment, Food & Rural Affairs) contract is in progress to develop a comprehensive risk assessment framework for all non-native plants and animals of potential risk to the UK. This project is consortium based, involving CABI-Bioscience, the Centre for Environment, Fisheries & Aquaculture Science (CEFAS), the Centre for Ecology & Hydrology, Central Sciences Laboratory-CSL (coordinator), Imperial College, and the University of Greenwich/National Research Institute.7.1.2. Research at the Centre for Ecology & Hydrology in Dorset (Gozlan et al. 2003a, 2003b) on small-bodied non-native fishes has been expanded through collaboration with CEFAS and the Hull International Fisheries Institute. A Defra-funded PhD was initiated in early 2003 to examine the potential ecological and fish disease impacts of topmouth gudgeon and sunbleak.

7.1.3. A study on the introduction of pikeperch, *Sander lucioperca*, to the Thames catchment (Copp et al. 2003) has led to a post-doctoral fellowship (funded under the EC Marie Curie Programme), initiated in January 2004. This two-year study aims to assess the risks and to understand the processes of invasion by non-native fish species within and between river catchments.

7.1.4. Upcoming conferences dealing with non-native species include:

- The 11th European Ichthyological Society (EIS) in Tallinn, Estonia 6-10 September 2004, which will include a session on 'Alien Fish Species' will be included amongst as a thematic symposium.
- The 13th International Conference on Aquatic Invasive Species, which will be held in Ennis, Country Clare, Ireland. A wide variety of talks are expected, including numerous seminars on the impacts of zebra mussel invasions.

7.2. Policy initiatives:

There are several non-natives initiatives associated with the Joint Nature Conservation Council (JNCC; tracy.edwards@jncc.gov.uk), currently being progressed in the UK.

7.2.1. As part of a review of non-native species policy in the UK an inaugural meeting of a 'GB Forum on Non-native Species' was held on 11th February 2004, specifically to respond to Key Recommendation 8 of the 2003 Working Group Report. There is also government consultation seeking advice on how to undertake risk assessment, identify research needs and how the issue of non-natives should be co-ordinated within the UK, as well as who should be responsible for such co-ordination.

7.2.2. JNCC are responding to an obligation to report on the presence of non-native species on Ramsar sites (see http://ramsar.org/key_res_viii_18_e.pdf). This focuses on wetland (freshwater & marine, but not just aquatic) species in the UK. A separate review of Ramsar sites in the UK Overseas Territories and Crown Dependencies is being undertaken and non-native issues there will be addressed separately.

7.2.3. The UK Biodiversity Research Advisory Group (BRAG) have formed a sub-group to examine research issues in relation to the most significant, negative impacts of non-native, translocated and purposely-bred and released species. They have recently published a review of knowledge in which both research needs and gaps are identified on http://www.ukbap.org.uk/Groups/BRAGSubGroups/NNS.htm).

7.2.4. As part of the implementation of the EC Water Framework Directive (WFD), the UK WFD Technical Advisory Group (TAG) requested advice regarding the risk of water bodies not reaching 'good status' due to non-native species. A subgroup was formed, which has now reported to the group on a framework for risk assessment (http://www.wfduk.org). This is based on a two-phase process, with Phase I being a simplistic 'presence or absence' risk from non-natives. A key list of major invasive species were determined for the purposes of the water bodies in the UK, with supplemental species lists of 'High', 'Low' and 'Unknown' impact categories being determined for further resolution of risk during Phase II. As part of the Phase I exercise, species distributions are being looked at. The ten high-impact species being considered as priorities are:

- *Crassula helmsii*
- *Hydrocotyle ranunculoides*
- *Azolla filiculoides*
- *Myriophyllum aquaticum*
- *Dreissena polymorpha*
- *Pacifastacus leniusculus*
- *Spartina anglica*
- *Sargassum muticum*
- *Crepidula fornicata*
- *Eriocheir sinensis*

Of these, the final four species occupy estuarine/marine habitats.

As part of this work, it has been noted that Chinese mitten crap *Eriocheir sinensis* has been recently reported in the River Humber and in the River Ouse in the UK (Natural History Museum, pers com), indicating a spread anti-clockwise around the UK coast. Further detailed work on these species distributions could clarify further new records, to assist with updating the JNCC Non-Natives Species Directory (see below). Phase II will commence shortly and is believed to be delivered over the next year.

7.2.5. The UK Marine Non-Natives Directory published by JNCC (Eno et al. 1997) has not been updated due to restraints in funding and resource. However, the intention is to provide some sort of update to this directory and to provide a web-based mechanism for introductions to be reported to JNCC.

7.2.6. A Defra Biosecurity Horizon Scanning Project is in progress. This is led by Dr Jeff Waage (Imperial College), former chair of the Global Invasive Species Programme.

7.2.7. A review of various licensing functions, including non-native species, is being undertaken for Defra.

7.2.8. The Queens University at Belfast is due to report on the All-Ireland Review of Invasive Alien Species. Both Northern Ireland and the Republic are eager to integrate with future developments in Britain on this issue.

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United States of America
(prepared by G. Ruiz, J. Pederson, & P. Fofonoff)

1 LAWS AND REGULATIONS

U.S. Congress is considering new laws focused on marine invasions, including steps to reduce invasions from shipping and other vectors, as well as extensive surveys of non-native species. As noted in last year's report, the National Aquatic Invasive Species Act of 2003 was introduced in both the U.S. House of Representatives and the U.S. Senate in March 2003. This bill is still pending action. Hearings have again begun in U.S. Congress, both to consider legislative action on this bill (see last year's report for further detail) and modifications in response to the recent IMO agreement for ballast water treatment.

The U.S. Coast Guard has proposed new rules for reporting of ballast management and discharge by commercial ships operating in U.S. waters. Currently, only ships arriving to U.S. port from outside the Exclusive Economic Zone (EEZ) are required to report information on the source(s), treatment, and volume of all discharged ballast water in the U.S. The new rule (Federal Register, Volume 68, No. 3, 6 January 2003, pp. 523-53) requires ships to report, regardless of whether they operated outside the EEZ, extending the requirement to include coastwise (domestic) traffic across port systems, or Captain of the Port Zones. In addition, under the rule, ships not reporting would be liable for a civil penalty up to $25,000 per day for each violation. Some vessels would be excluded from this reporting requirement, including crude oil tankers engaged in coastwise traffic, military vessels, and U.S. Coast Guard vessels. These regulations are expected to go into effect by mid-2004.

The U.S. Coast Guard will be developing ballast water discharge standards. As part of the U.S. regulations, an Environmental Impact Statement (EIS) will be prepared to evaluate the standards and environmental effects.

The U.S. Coast Guard is also expected to begin a program to facilitate evaluation of technologies for ballast water treatment, whereby ships would evaluate technologies in cooperation with the Coast Guard. This program is expected to begin in 2004. Application is made to the U.S. Coast Guard for installing a system, which will be reviewed and accepted or not. A monitoring program will be conducted during normal operations with data provided to the Coast Guard. Ships that have been accepted into the program will be grandfathered with respect to future standards.

Several states have regulations and programs aimed at ballast water management, in addition to those that exist at the national level. States with such programs include California, Maryland, Michigan, Oregon, Virginia, and Washington. State programs vary in scope and current stage of implementation. California has the most extensive state program at the current time. California passed an initial Ballast Water Bill on January 1, 2000, and this was expanded in 2004 to include requirements for coastwise ballast water management (i.e., treatment), beginning in mid 2005.

2 DELIBERATE INTRODUCTIONS AND TRANSFERS

Invertebrates

Crassostrea ariakensis in eastern North America

The introduction of *Crassostrea ariakensis* into tidal waters of the Chesapeake Bay is now being considered by both the states of Maryland and Virginia. In 2003, the Virginia Seafood Council implemented a plan to grow up to 1 million oysters among 10 specific commercial shellfish operations in the lower Chesapeake Bay. This plan called for the use of triploid oysters. The plan was reviewed twice by a review panel of the Chesapeake Bay Program and a committee of the National Research Council.

As noted in last year's report, the planned introduction is highly controversial, due to the desire to revive a once-productive native oyster fishery in the Chesapeake and the potential risks associated with use of a non-native species (as noted in the National Research Council report; see reference in Section 4). The National Research Council report highlights the considerable uncertainties about the potential impacts of the non-native oyster, and calls for limited trials with a significant amount of research to address critical knowledge gaps (to evaluate risks). The decision and legal authority to proceed resides with the state of Virginia. Field trials, using triploid oysters, began in summer 2003; any oysters used in such trials are to be monitored over time and removed prior to reaching maturity. Both the use of triploid oysters and monitoring are intended to reduce the chances of establishment, although the National Research Council report points out the some oysters will revert to diploid with the risk of establishment.

Similar field trials are underway in the Pamlico Sound of North Carolina, also using triploid oysters, but full details of the scope of this activity are unclear at present.

Maryland, through its Department of Natural Resources, is now also considering the introduction of *C. ariakensis* into the upper Chesapeake Bay. In contrast to the previous case, Maryland proposes to use diploid (instead of triploid) oysters, potentially to establish a self-sustaining population in Chesapeake Bay. A Notice of Intent for the U.S. Army Corps of Engineers to conduct a formal review (Environmental Impact Statement), evaluating potential risks and benefits of such an introduction, was published in the Federal Register (Volume 69, No. 2, pp 330-332, 5 January 2004). This is expected to occur in the next 12-24 months.

Coincident with this development, the Scientific and Technical Advisory Committee (STAC) of the Chesapeake Bay Program convened a workshop to revisit critical information to be considered in the Environmental Impact Statement. This produced a brief report, which was intended to outline research priorities that (a) build upon analysis in the National Research Council report and (b) acknowledge explicitly the shift from using triploid to diploid oysters. This report is cited in the references (see Section 4).

Other Molluscan Species

As indicated previously, several non-native mollusks are grown along the Pacific coast, including the oyster *Crassostrea gigas*, mussel *Mytilus galloprovincialis*, and clam *Tapes philippinarum*. Along the Altantic coast the oyster, *Ostrea edulis* continues to be cultured at several sites. Detailed information about the scale of aquaculture for these species, and possible movement of aquaculture products – both regionally, nationally, and internationally, remains elusive.

Accidental Introductions and Transfers

Invertebrates

A. Atlantic Coast

Didemnum sp. A species of *Didemnum* is reported to have spread aggressively along both the Pacific and Atlantic coasts, occurring abundantly in both shallow and deep water in the northeastern U.S. The current range is much greater than reported last year. Some uncertainty remains about the species identification (variously referred to as *D. vexillum* and *D. lahillei*) and geographic origin. There is some agreement currently to use *D. lahillei* in New England. Although this species was first reported in 2000, a *Didemnum* species has been observed in Boothbay Harbor, Maine in the 1990s and it is possible that it was at other locations but not reported before the 2000 survey.

In addition *D. lahillei* has been reported as covering 6 sq. mils of a productive Atlantic scallop fishing area in Georges Bank. The presence of *D. lahillei* raises several issues. This area is traversed by shipping vessels and visited frequently by cod and scallop fishing boats. It remains unclear if the introduction was from ballast water in this region near the continental shelf or if fishing vessels and gear may have introduced from near shore areas. This is one of the first reported invasive species near the continental shelf in the North Atlantic.

Perna viridis. The range for this species now includes the Atlantic coast of Florida, occurring first in 2002.

Phyllorhiza punctata. This species also was also reported for the first time to the Atlantic coast of Florida, a range extension from Gulf of Mexico. It was found in the Indian River Lagoon in 2001.

Caprella mutica. The amphipod was reported in Massachussets and Rhode Island from surveys by MIT SeaGrant, conducted in 2000.

Ficopomatus ushakovi and *Hydroides diramphus*. These serpulid polychaetes were found at several sites in Texas, during surveys (2001) by Smithsonian Environmental Research Center (SERC).

B. Pacific Coast

Littorina littorea. The snail was reported from two locations in 2002/3. A population of approximately 250 mature individuals was found in rocky rip-rap of San Francisco Bay. These were mature snails of a single size class, occurring along a 25 m stretch of shore. All observed individuals were removed in an attempt to eradicate the population. A second population has been reported from Anaheim Bay, Calfornia, but no details are available.

Hydroides diramphus. This polychate was found in San Diego Bay, California, during independent surveys by Andrew Cohen (San Francisco Estuary Institute) and SERC.

Algae and Higher Plants

Undaria pinnatifida. *Undaria pinnatifida* continues to be reported and increasing in abundance in Monterey Bay, California.

Caulerpa taxifolia. No new reports have been issued to confirm whether *C. taxifolia* has been successfully eradicated along the California coast, where small populations have been the focus of aggressive eradication efforts.

Ascophyllum nodosum. This alga (> 100 plants) was found on hard substrate and marsh vegetation, ranging from mid-intertidal to subtidal, in San Francisco Bay. The plants, some as large as 40cm in diameter, appeared to be healthy and growing along approximately 50m of shoreline in 2002. All observed plants were removed in an attempt to eradicate this population.

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ANNEX 5: NATIONAL REPORT OF AUSTRALIA AND NEW ZEALAND (AFFILIATE STATUS)

Australia
(prepared by K. R. Hayes)

1.0 LAWS AND REGULATIONS:

The Australian National Introduced Marine Pest Coordinating Group (NIMCG), in conjunction with the Coordinating Committee for Introduced Marine Pesr Emergencies (CCIMPE), are in the process of drafting a new National System for the Prevention and Management of Marine Pest Incursions. The new system is designed around three objectives:

1. prevention of new incursions;
2. early detect, containment and eradiction of new introductions; and
3. management of existing or newly established marine pests (Figure 1).

Research and policy initiatives are currently being drafted and implemented to cover all potential vectors, including hull fouling and ballast water of commercial vessels, hull fouling on recreational vessls, fishing vessels and international yachts, bio-fouling of aquaculture and the aquarium trade.

The implementation of the new ballast water arrangements in Australia will be managed via the Single National Interface (SNI). The SNI will provide a single point of contact for domestic and international shipping to report their ballast water discharge intentions. It will be used to communicate risk assessment results to vessels and to manage the compliance regime. Three options are currently being considered for this regime with varying levels of reporting and inspection.

At this stage it is envisaged that all other vectors will be managed through a certification process (commercial and recreational hull fouling) and voluntary codes of conduct (aquaculture and aquarium trade). The details of the new regime for these vectors and the nature of the compliance regime have yet to be finalised.

Research and development under the new national system has also yet to be finalised. Initial proposals suggest a research budget of at least $2.5 million per annum manabed by a “national centre” for marine pest research.

The implementation of the new system is to be supported by an Inter-Governmental Agreement (IGA). The IGA will determine cost sharing arrangements between the relevant commonwealth and state-based agencies for emergency response, initiation and on-going maintenance of the new system. NIMCG is currently aiming to finalise the IGA by June 2004. It is anticipated that new federal and state regulations will be developed to support the implementation and compliance arrangements of the new system as soon as the IGA is agreed. These new regulations will take at least 12 months to draft and implement.

2.0 DELIBERATE RELEASES:

Oyster (*Crassostrea gigas)* spat continue to be exported from Tasmanian hatcheries to South Australian oyster leases (e.g. Coffin Bay). Initial expectations were that salinity levels in South Australian embayments (> 36 ppt) were too high to permit oyster settlement. In 1990 and 1992, however, naturalised spat falls were observed in Franklin Harbour and Murat Bay. Isolated feral populations are now scattered across South Australia, but are much less extensive than their Tasmanian counterparts (pers comm. Bob Ward, CSIRO). The Pacific oyster is a NIMCG target species, and a declared noxious pest in New South Wales. It is unclear whether the Australian national translocation policy or the ICES Code of Practise are applied to these introductions.

No other deliberate releases of marine species have been reported in 2003/04.

3.0 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

Asterias amurensis

A significant range expansion of *Asterias amurensis* occurred in 2004. In January 2004 approximately 30 Northern Pacific Seastars were discovered by community groups at Inverloch. Inverloch is a small tidal inlet situated approximately 100 kms southeast of Port Phillip Bay. The discovery of the seastar in this location represents the first occurrence of seastars on the open coastline of the Australian mainland (i.e. outside of Port Phillip Bay). All seastars were removed by hand but over the coming months (January to March) small number of seastars (3 – 10) continued to be discovered at low tide trapped in rock pools in the at the mouth of Inverloch Inlet.

All the seastars are approximately 50 - 200mm in diameter and are believed to be from the same year class. The nature and timing of the discoveries suggested that the source population may have been situated "up-stream" of Inverloch because new individuals were only discovered following the completion of the tidal cycle. Substantial monitoring using video transect and community divers "upstream", however, failed to detect the source population. On the 20th March a "backfilling" survey "upstream" of the discovery site detected 68 seastars in a mussel bed situated in Anderson's Inlet. This is believed to be the source populations and intensive survey and removal operation using professional and community divers is planned for the 28th March.

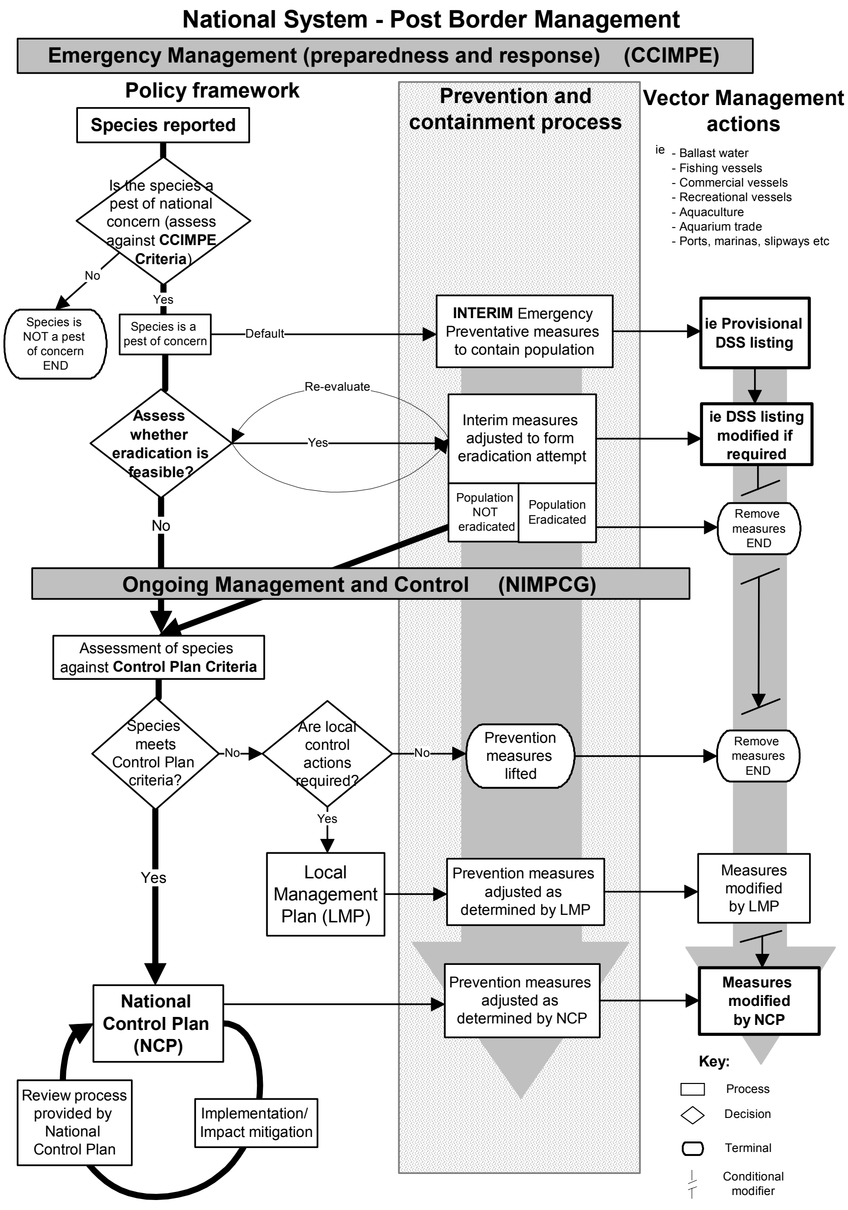

FIGURE 1 Overview of the (draft) new national system for the prevention and management of marine pest incursions

At its last meeting (March 16th) CCIMPE agreed that the discovery of the seastar constitutes a "significant" range expansion, thereby triggering access to emergency management funds under the agreed cost sharing arrangements. These funds will be used to continue monitoring the situation and removal of any newly discovered seastars.

Perna viridis

Another single live individual of *Perna viridis* was discovered last week in on a pylon of a floating dock structure. Snorkel dives on the remaining of the structure are planned to take place next week.

3.1 Fishes

15 species of marine (or salt tolerant) fish are currently recognised as introduced (14) or cryptogenic (1) in Australian waters (Hayes unpub data). None of these are currently considered to be pests of national concern (ie causing significant social, economic or environmental degradation). No new marine fish introductions have been recorded from Australia in 2003/04.

3.2 Invertebrates

223 invertebrate species are currently recognised as introduced (118) or cryptogenic (105) in Australian waters (Hayes unpub data). The vast majority of these are not considered to be pests of national concern (ie causing significant social, economic or environmental degradation). Below are listed the species identified by NIMCG as pests species of national concern.

Asterias amurensis

The northern Pacific seastar, *Asterias amurensis*, has recently been observed at Inverloch (see above). Otherwise no known change to its distribution

Carcinus maenas

No change in the distribution of *Carcinus* has been reported.

Corbula gibba

No change in the distribution of *Corbula gibba* has been reported

Crassostrea gigas (feral)

Crassostrea gigas has recently been confirmed to be prevalent through-out most estuaries in New South Wales, including the Port Kembla, Sydney, Botany Bay and Newcastle. All of these ports have been survyed to the standards set forth in the CRIMP protocols, but on each occasion the survey apparently failed to deted the presence of C. gigas (refer to the results of the Hastings demonstration project). The Pacific oyster was first introduced into New South Wales in 1967 and by 1973 was recorded in several estuaries (and ports) in New South Wales, as far North as Port Stephans.

Sabella spallazani

No change in the distribution *Sabella spallanzanii* has been reported

Musculista senhousia

No change in the distribution of *Musculista senhousia* has been reported

3.3 Algae

68 species of algae are currently recognised as introduced (23) or cryptogenic (45) in Australian waters (Hayes unpub data). The vast majority of these are not considered to be pests (ie causing significant social, economic or environmental degradation). Below are listed the species identified by NIMCG as pests species of national concern.

Alexandrium catenella

No change in the distribution has been observed.

Alexandrium minutum

No change in the distribution has been observed.

Alexandrium tamarense

No change in the distribution has been observed.

Gymnodinium catenatum

No change in the distribution has been observed. The results of the Hastings national demonstration project suggest that *Gymnodinium* spp known from ports of Victoria and New South Wales , but thought to be native non-toxic species, may in fact be the non-native toxic *Gymnodinium catenatum* (see below).

Undaria pinnatifida

No change in the distribution has been observed.

Figures 2 and 3 summarise the reported vectors and impacts associated with the 155 introduced species in Autralia. The most important vectors are hull fouling (S1), accidental introductions associated with deliberate translocations for fishery purposes (F2) and ballast water (S3). The majority of introducted species in Australia have no reported impacts (NR). The most frequently reported impacts are dominates/outcompetes and limits resources of native species (E3) and water abstraction/nuisance fouling (M2).

4.0 LIVE IMPORTS

All live imports into Australia are regulated by the Australian Quarantine and Inspection Service. Requests to import live biological material into Australia are subject to an import risk assessment conducted by Biosecurity Australia. To date all requests to import live marine organisms have been denied usually because the potential disease risks are considered to be too high. Imports of dead frozen salmon fillets (Canada) and prawns (Thailand) are permitted under strict quarantine conditions.

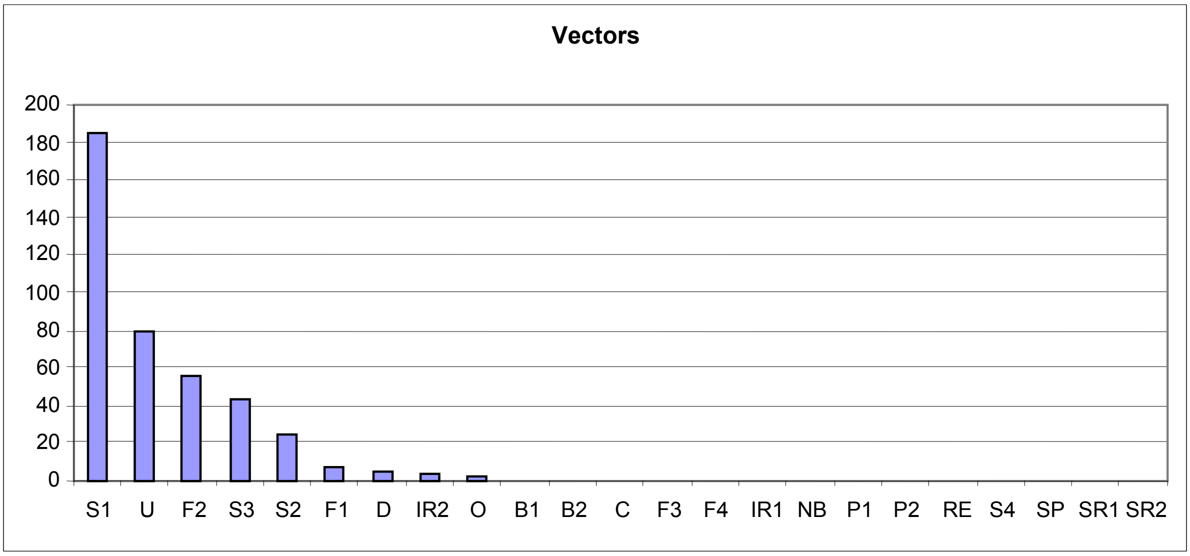

Figure 2 Reported frequency of vectors for introduced species in Autralia. B1 = Biocontrol: deliberate translocation as a biocontrol agent; B2 = Biocontrol: accidental translocation with deliberate biocontrol release; C = Canals: natural range expansion through man-made canals; D = Debris: transport of species on human generated debris; F1 = Fisheries: deliberate translocations of fish or shellfish to establish or support fishery; F2 = Fisheries: accidental with deliberate translocations of fish or shellfish; F3 = Fisheries: accidental with fishery products, packing or substrate; F4 = Fisheries: accidental as bait; IR1 = Individual release: deliberate release by individuals; IR2 = Individual release: accidental release by individuals (e.g. aquarium discards); NB = Navigation buoys and marina floats: accidental as attached or free-living fouling organisms; P1 = Plant introductions: deliberate translocation of plant species (e.g. for erosion control); P2 = Plant introductions: accidental with deliberate plant translocations; RE = Recreational equipment:

accidental with recreational equipment; S1 = Ships: accidental as attached or free-living fouling organisms; S2 = Ships: accidental with solid ballast (e.g.rocks, sand, etc); S3 = Ships: accidental with ballast water, sea water systems, live wells or other deck basins; S4 = Ships: accidental associated with cargo; SP = Seaplanes: accidental as attached or free-living fouling organisms; SR1 = Scientific research: deliberate release with research activities; SR2 = Scientific research: accidental release with research activities; U = Unknown.

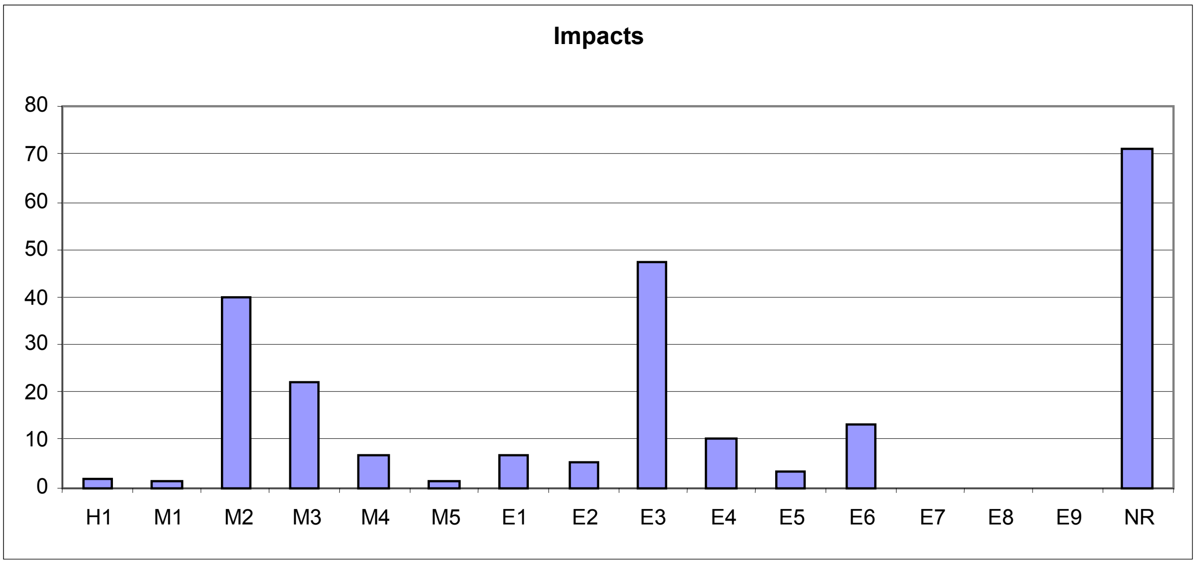

Figure 3 Reported frequency of impacts for introduced species in Autralia. H1 = Human health; M1 = Aquatic transport; M2 = Water abstraction/nuisance fouling; M3 = Loss of aquaculture/commercial/ recreational harvest; M4 = Loss of public/tourist amenity; M5 = Damage to marine structures/archaeology; E1 = Detrimental habitat modification; E2 = Alters trophic interactions and food-webs; E3 = Dominates/outcompetes and limits resources of native spp; E4= Predates native spp; E5 = Introduces/facilitates new pathogens, parasites or other NIS; E6 = Alters bio-geochemocal cycles; E7 = Induces novel behavioral or ecophysiological responses; E8 = Genetic impacts: hybridisation & introgression; E9 = Herbivory; NR = None recorded.

5.0 LIVE EXPORTS TO ICES MEMBER COUNTRIES

No information available.

6.0 PLANNED INTRODUCTIONS OF INTRODUCED SPECIES

Crassostrea gigas in continues to be imported to South Australia (see above).

7.0 RESEARCH PROJECTS AND REPORTS

7.1 Hastings National Demonstration Project

In July 2001, Australia introduced a risk-based Decision Support System (DSS) to manage ballast water on international shipping. Up until now, however, the accuracy of the risk assessments made by the DSS have never been evaluated or tested. It was not until the DSS was considered as a mechanism to assist the management of domestically sourced ballast water, coupled with the serendipitous advances in genetic technologies, that the opportunity arose to evaluate the accuracy of the predictions of the DSS. The results of that evaluation are reported here.

All species have a unique genetic "signature". Identifying DNA sequences that uniquely identify species is nowadays a routine process but one that typically operates on individual organisms. Applying this existing technology to ballast water samples would require candidate individuals to be separated from the plankton sample thereby negating the advantages of genetic analysis over traditional morphological analysis. Here we report on a genetic technique – gene probes - that are capable of identifying the DNA of a species, at low concentrations, in unsorted ballast water samples

Gene probes were developed for three species of concern – *Asterias amurensis*, *Crassostrea gigas*, *and Gymnodinium catenatum*. The gene probes target a unique DNA sequence in the mitochondrial CoI gene (*A. amurensis* and *C. gigas*) or large subunit (LSU) ribosomal DNA (*G. catenatum).* A nested polymerase chain reaction (PCR) technique is used to first amplify all DNA with similar sequences, and then to amplify the target DNA from this enriched sample. All three probes were tested against as many closely related species as could be obtained and the reaction conditions optimized for the maximum sensitivity providing 100 percent specificity.

The *Asterias amurensis* probe correctly differentiated this species (56 specimens, 8 locations, 3 countries) from 12 native Australian seastar species (including 5 from the family Asteriidae). The test did not distinguish *A. amurensis* from *Asterias rubens* (Belgium) nor *Asterias forbesi* (Atlantic Canada). The test was sensitive enough to routinely detect 10 or more larvae in a 200 mg plankton sample. Ballast water samples collected in this study contained between 53 and 1656 mg/m^3 plankton, suggesting a minimum density of between 3 and 80 *A. amurensis* larvae/ m^3 in order to be detected by the probe. This minimum sensitivity is well below typical *A. amurensis* densities in the Derwent River during the July-October spawning season.

G. catenatum (4 samples, 3 countries) was successfully distinguished from 14 dinoflagellate taxa (17 strains, 3 countries), including 2 identified *Gymnodinium* species and 5 unidentified *Gymnodinium* species. Testing the specificity of this probe was complicated by the confused taxonomy of the dinoflagellates. Despite this, the possibility of a false positive from other species not tested was considered to be low because of the high interspecific variability of the primer binding site and the high specificity at low annealing temperatures. The *G. catenatum* test was slightly less sensitive than the *A. amurensis* test: between 7 and >103 cysts/m^3 would be required for detection over the range of ballast water samples tested (53 – 1656 mg/m^3).

The *C. gigas*-specific probe successfully distinguished *C. gigas* (26 samples, Tasmania) from 8 bivalve species (9 samples, 5 countries), including 4 *Crassostera* species. One *C. gigas* sample had a single base pair mismatch at the primed binding site, suggesting that there might be some intraspecific polymorphism at this site. Genetic characterization of the mt COI locus of *C. gigas* throughout its natural range in Asia as well as its *de novo* range, where it has been introduced, would be required to test the possibility of false negative results. The *C.gigas* probe detected 50 or more larvae at 6 hours post fertillisation and 5 or more larvae at 20 hours post fertilization when mixed with 150 mg plankton. This suggests that the probe would detect between 2 and 550 larvae/m^3 over the range of ballast water samples tested (53 – 1656 mg/m^3), depending on plankton biomass and larval size.

In this study the genetic probes were used to test ballast water sampled from 63 vessels (80 vessel/tank/date combinations). The ballast water samples were chosen to assess the probability of Type II errors (the probability that "low risk" ballast water actually contained detectable quantities of the target species at the end of the vessel's journey). A high proportion (84%) of vessels predicted by the DSS to be low risk for *Asterias amurensis* were correctly identified as low risk (*Asterias* was not detected at the end of the vessel's journey), suggesting that the DSS can provide effective risk mitigation for this species. Nine vessels (13%) predicted to be low risk had detectable *A. amurensis*. Seven of these vessels are considered most likely to have tested positive because of carry-over of ballast water from infected ports. This indicates the importance of accurate log-book information and the need to include the possibility that ballast water is carried over from the last three (or more) ports in the assessment of risk. Additionally, for three of the vessels, the positive results suggest that *A. amurensis* may be able to survive in ballast water longer than has been previously estimated (and longer than specified in the DSS). Positive results for two of the vessels suggest that the timing and/or duration of the spawning period in the Northern Hemisphere may also be incorrectly recorded in the DSS.

Crassostrea gigas was identified in 43% of vessels predicted to be low risk, indicating that the DSS is not adequately identifying high risk vessels for this species. The majority (97%) of Type II errors in this instance can be attributed to *C. gigas* being present in ports where it is recorded as being absent. All of the ports in question – Sydney, Port Botany, Newcastle and Port Kembla – have been surveyed to the standards set down in the CRIMP port survey protocols. These results indicate that the CRIMP survey protocols may need revision, or at least an understanding that they may not have sufficient statistical power for risk management purposes. The cause of the Type II error is unclear in the remaining 3% of vessels, but it is possible that *C. gigas* was completing its life cycle in the ballast tank and/or the samples were contaminated.

All vessels sampled in this study were assessed by the DSS to be low risk for *Gymnodinium catenatum* because the distribution of this species is very limited in Australia. Almost half (40%) of these vessels, however, tested positive for *G. catenatum* - an unacceptably high Type II error rate. Carryover of cysts in ballast sediments could explain all of these positive results because of the highly resistant nature of dinoflagellate cysts. It is also possible, however, that ports in which native non-toxic *Gymnodinium* spp. have been identified – Botany Bay, Sydney, Port Kembla, Adelaide, Melbourne and Portland – do in fact contain the toxic non-native *G. catenatum*. This is especially true for Melbourne because two vessels with positive identifications trade exclusively with between Melbourne and Burnie, and Burnie has recently been surveyed and found to be free of any *Gymnodinium* spp. Sixteen (52%) of the vessels that tested positive reported their ballast water source as ports thought to be free of any *Gymnodinium* spp. Eight of these vessels, however, had previously visited international ports where *G. catenatum* has been reported. The remainder had visited Australian ports with known or suspected populations emphasizing the importance of carryover. Two vessels testing positive reported their ballast water as sourced from Port Stanvic (yet to be surveyed), suggesting that this port may contain *G. catenatum* as well.

7.2 Port Surveys

The Australian National Port Surveys program began in 1995 as a jointly developed project between CSIRO CRIMP and the Australian Association of Port and Marine Authorities. The baseline port surveys are conducted to a standardised set of design and methodological protocols outlined in Hewitt and Martin (1996) and subsequently revised in 2001 (Hewitt and Martin 2001). Since 1995, CSIRO CRIMP and other state government, University and private consulting agencies have conducted surveys to the protocols outlined above and adopted by the ABWMAC. Thirty seven surveys have been completed to date (Table 1).

The original survey protocols called for all data and voucher collections associated with the survey to be returned to CRIMP for evaluation and storage. These requirements, however, were not always adhered to by the various survey organisations. As a consequence port survey data, samples and voucher collections reside in various locations throughout Australia and have yet to be formally collated. In the financial years 2003/04 and 2004/05 CSIRO Marine research sub-contracted Aquenal to assist in the a quality assurance/quality control audit of the port survey data and to track down the location of outstanding data, samples and voucher collections - wherever possible entering data into the port survey database. To date information from 13 of the 37 ports that have been surveyed has yet to be entered into the database (Table 1).

Data within the port survey database resides at various levels of taxonomic resolution. In some cases many samples are only identified to the level of family or group. Hence the number of species recorded under each survey varies dramatically. It is anticipated that it will be sometime (6 months or more) before the data is in a suitable format to allow synthesis and analysis.

Table 1 Current status of the Australian baseline port surveys and port survey data as of March 2004.

Port name	State	Month	Year	Survey agency(s)	Spp. in PSDB
Abbot Point	Queensland	July	1998	Reef Research CRC	0
Adelaide	South Australia	February	2001	MAFRI	0
Albany	Western Australia	February	1996	CRIMP	153
Brisbane	Queensland	March	2001	Coastal zone CRC	403
Bunbury	Western Australia	March	1996	CRIMP	116
Burnie	Tasmania	March	2003	Aquenal	0
Cairns	Queensland	November	2001	Reef Research CRC	0
Darwin	Northern Territory	April	1999	CRIMP/NT Musuem	812
Devonport	Tasmania	January	1996	CRIMP	228
Eden	New South Wales	November	1996	CRIMP	376
Esperance	Western Australia	March	2002	CPM Pty Ltd.	300
Flinders Island	Tasmania	July	1997	CRIMP	296
Fremantle	Western Australia	April	1999	CRIMP/Murdoch Uni	613
Geelong	Victoria	October	1997	MAFRI	289
Gladstone	Queensland	March	2000	CRIMP/CQU	241
Hastings	Victoria	March	1997	MAFRI	336
Hay Point	Queensland	May	1997	CRIMP	664
Hobart	Tasmania	April	2002	Aquenal	478
Karumba	Queensland	August	2000	Reef Research CRC	0
Launceston	Tasmania	April	2001	Aquenal	465
Lucinda	Queensland	July	1999	Reef Research CRC	0
Mackay	Queensland	May	1997	CRIMP	506
Melbourne	Victoria	May	2000	MAFRI	304
Mourilyan	Queensland	July	1998	Reef Research CRC	0
Newcastle	New South Wales	September	1997	CRIMP	455
Port Botany	New South Wales	October	1998	CRIMP/NSW Fisheries	335
Port Hedland	Western Australia	May	1998	CRIMP	552
Port Kembla	New South Wales	May	2000	CRIMP/NSW Fisheries	385
Port Lincoln	South Australia	May	1996	CRIMP	210
Port Phillip Bay	Victoria	March	1996	CRIMP	0
Port Walcott	Western Australia	November	2001	Ecologia	0
Portland	Victoria	May	1996	MAFRI	228
Spring Bay	Tasmania	April	2002	Aquenal	0
Sydney	New South Wales	June	2001	Australian Museum	361
Townsville	Queensland	November	2000	Reef Research CRC	0
Weipa	Queensland	October	1999	Reef Research CRC	0
Westernport	Victoria	August	1999	MAFRI	0

New Zealand
(prepared by C. Hewitt)

Laws and regulations

In New Zealand two pieces of legislation govern the introduction of all non-indigenous organisms. The Hazardous Substances and New Organisms Act 1996 governs the deliberate introduction of new organisms (including genetically modified organisms) using criteria including the effect on the environment. Very few approvals have been given since the Act came into force. The Biosecurity Act 1993 governs all accidental (or illegal) introductions and the deliberate introduction of organisms that are not new to the country.

The most recent amendment to the Biosecurity Act in 2003 has explicitly stated the obligation of all individuals in New Zealand to report organisms that they suspect as not belonging to an area or region. While the target audience for this amendment was the scientific community, the implications of this amendment are profound. Currently, education and awareness materials are being developed for biosecurity in all environments with a single point of reporting in the Ministry of Agriculture and Forestry (MAF).

The finalisation of the Biosecurity Strategy (2003) and subsequent decisions by cabinet have resulted in a significant realignment of biosecurity delivery within central government. The final structure is yet to be determined, however it appears that it will be organised around „intervention points" (e.g., Pre-border risk assessment, Pre-border interception, Post-border surveillance, etc...) rather than „sectors" (e.g., Animal, Plant pests, Forestry, Marine, Conservation, etc...). Marine biosecurity delivery may remain outside of this structure within the Ministry of Fisheries.

Deliberate releases

No new requests for information on recent deliberate introductions is not available. Domestic transfers and releases of native species (several species of fish, abalone and mussels) occur between sites in the North and South island frequently.

Accidental Introductions and Transfers

Cranfield et al. (1998) reported 148 species that were introduced to New Zealand accidentally. Nearly 70% of these are thought to have been introduced as hull fouling organisms (Cranfield et al. 1998). In addition, a number of introduced or cryptogenic species identified after 1998 were reported in last year's NZ National Report. Port baseline surveys currently underway will document any additional introductions. The identification of specimens collected during port surveys is ongoing. Here, we report any known change or new introductions since last year.

Fishes

A new species of blenny has been discovered in New Zealand. ***Omobranchus anolius***, native to Australia, is restricted to the eastern shores around Auckland. The species is cryptic in habitat, found under rocks in the high shore.

No additional information on the other species of gobies listed last year are available.

- ***Favonigobius exquisites***
- ***Acentrogobius pflaumi***, has since been confirmed using molecular markers
- ***Parioglossus marginalis***

Invertebrates

Cranfield et al (1998) reported 129 invertebrate species that have been introduced accidentally to New Zealand. Since this report was published the species listed below have been detected.

Charybdis japonica

The swimming crab *Charybdis japonica*, a native of Japan, Korea and Malaysia, was first discovered in New Zealand in 2000. *C. japonica* is currently distributed in estuarine areas east of Auckland in the North Island. The crab is already well established and eradication or containment is not considered feasible. Recent reports in new estuaries indicates that this species is expanding, though it appears that this may be by natural dispersal rather than human mediated.

Didemnum vexillum

In October 2001, an undescribed species of *Didemnum* was reported in large quantities from wharf piles in Whangamata Harbour in the Bay of Plenty. The same species was subsequently discovered covering a barge that was transferred from Whangamata to the Marlborough Sounds (New Zealand's primary marine farming region). This species has since been formally described as *Didemnum vexillum* (Knott 2002) and thought to be a New Zealand native, however continuing controversy exists between taxonomists.

The Port of Marlborough, Marlborough District Council and the New Zealand Mussel Industry are concerned with the potential impact this species may have on trade and mussel aaquaculture and have undertaken an eradication programme with Cawthron Institute. The Ministry of Fisheries has participated in the development of tools for eradication and control, however remains clear that the species is considered to be a native.

The recent discovery of the didemnid on Georges Bank has created continued controversy of the status in New Zealand. A critical review of the molecular and morphological evidence is necessary to prevent further negative publicity. While it is clear that the Georges Bank population is new, its relation with the New Zealand population is currently undertermined and cannot aid in determining the status of the New Zealand population without further work.

Paracorophium brisbanensis

The corophiid amphipod *Paracorophium brisbanensis* was identified from Tauranga Harbour in 2002 (Stevens et al. 2002). This species was previously recorded only from the eastern coast of Australia and was probably introduced to New Zealand by shipping (Stevens et al. 2002). No new information is available.

Cancer gibbulossus

The cancrid crab *Cancer gibbulossus* was identified from Wellington Harbour in 2002. This species was previously recorded only from the China Sea and was probably introduced to New Zealand by shipping. It is currently only known from within the harbour. No new information is available.

Biflustra grandicella

The bryozoan *Biflustra grandicella* was identified from Golden Bay (NW South Island) in 2003 and originally misidentified as *B. savignii.* This species was previously recorded only from the China Sea and was probably introduced to New Zealand by shipping as hull fouling. It is currently distributed widely within the bay and appears to have been aided in its spread by scallop dredges. In areas its density is significant, fouling the scallop dredges with >2 crates (1 m^3) of material. It is extremely fast growing and appears not to be fouled by epibiotic spiecies. A contract is underway to determine the extent of fouling, epibiotic condition and association with disturbance.

Algae

Cranfield *et al.* (1998) identified 19 species of adventive seaweeds in New Zealand. In addition, ***Codium fragile* ssp. *tomentosoides*** was reported from Waitemata Harbour in 1975. Port baseline surveys have detected one new species of introduced alga, ***Dictyota furcellata***. Although this species was previously collected in Manakau Harbour it was not identified until it was also collected from Tauranga Harbour during the port survey in March 2002.

No new information is available.

Undaria pinnatifida

Undaria was probably introduced in to New Zealand in ballast water in the late 1980's and has since spread around the coast. Given the high costs of attempting to eradicate *Undaria* and the limited success to-date, Central Government's approach to *Undaria* management is to slow its spread around the mainland and reduce the chances of it reaching remote locations such as the Sub-Antarctic and Chatham Islands. This is in addition to other initiatives implemented by a number of regional councils and the aquaculture industry to manage undaria in their areas. On March 2000, a fishing vessel with *Undaria* on its hull sank near a remote New Zealand island. Using the Biosecurity Act, the Ministry of

Fisheries ordered the vessel to be moved to reduce the risk of *Undaria* getting from the vessel to the island. Although attempts to salvage the vessel were unsuccessful, the powers of the Biosecurity Act enabled an adaptive management approach to be undertaken whereby a three year monitoring and eradication programme was put in place. This programme appears to have eradicated *Undaria* from the vessel.

The gross distribution of Undaria has not changed and the species has not been detected in the Chatham Islands, sub-antarctic islands or Fiordland.

Caulerpa taxifolia

No additional citings after removal from the Auckland Aquarium.

Gymnodinium catenatum

The toxic dinoflagellate *Gymnodinium catenatum* was discovered in New Zealand in May 2000. This species had not previously been recorded in New Zealand. Recent evidence suggests that it may have been present in New Zealand for a significant amount of time (Irwin *et al.* 2003).

Dasya spp.

An unknown species of *Dasya* was collected from Nelson during the port survey. It has not yet been determined whether this species is a new introduction or an undescribed native species. No new information is available.

Live Imports

Information not available.

Live Exports to ICES Member Countries

Information not available.

Planned Introductions of Introduced Species

None planned.

Meetings, Conferences, Symposia or Workshops on Introductions and Transfers

ASFB 2003

The Australian Society for Fish Biology (ASFB) met in Wellington during July 2003. Greg Ruiz and Cynthia Kolor were among the invited speakers during the two day invasive species symposium. Several of the talks will form papers in an invited issue of the New Zealand Journal of Marine and Freshwater Research.

NZMSS 2003

The New Zealand Marine Sciences Society (NZMSS) annual meeting in September 2003 was held jointly with the Australasian Society of Phycology and Botany (ASPAB). The meeting had two introduced species symposia. Other workshop speakers were from the shipping industry, the Ministry of Fisheries, Yachting New Zealand, port companies, regional councils, ocean and coastal law, mussel farmers, commercial divers, and science providers.

Biosecurity Summit

Following the release of the Biosecurity Strategy in August 2003, central government hosted the first Biosecurity Summit (October 2003) to allow stakeholders to express expectations and central government to provide direction in implementation of the strategy. It is intended that this will be an annual meeting designed to provide a forum for a biosecurity stocktake.

Fourth International Marine Bioinvasions Conference - 2005

The Ministry of Fisheries will host the next Marine Bioinvasions Conference in New Zealand in 2005. We are currently finalising linkages with the New Zealand Marine Sciences Society (NZMSS) and the Australian Marine Science Association (AMSA) to jointly hold the meeting in August 2005. Final venue and dates have yet to be determined.

In country activities

Surveys

Baseline surveys

The Ministry of Fisheries (MFish) commissioned baseline surveys of the marine organisms in those ports and marinas where exotic marine species are most likely to arrive. The objective was to identify and record what marine life presently exists at the ports, including exotic species that have already become established. Monitoring will then be able to detect new introductions of exotic marine species to enable a response if necessary. This information will also be used to measure the effectiveness of our border controls.

The ports of Wellington, Nelson, Picton, Timaru, Tauranga, Lyttelton and Taranaki were surveyed over the southern hemisphere summer of 2001-02. The remaining ports selected (Auckland port and marina, Opua port and marina, Northland port, Whangarei marina, Gisborne, Napier, Otago, and Bluff) are being surveyed this summer. Port surveys are based on the CRIMP protocols.

Targeted surveillance

MFish is also implementing a risk-based surveillance programme for marine pests to enable rapid response to incursions. The surveillance is targeted at the following species, which are likely to establish in New Zealand and have the potential to significantly affect our marine environment:

Asterias amurensis (Northern Pacific seastar)
Caulerpa taxifolia
Carcinus maenas (European shore crab)
Eriocheir sinensis (Chinese mitten crab)
Potamocorbula amurensis (Asian clam)
Sabella spallanzanii (Mediterranean fanworm)
Undaria pinnatifida

The initial focus is on eight harbours (Whangarei, Waitemata, Tauranga, Wellington, Nelson, Lyttelton, Otago, and Bluff) that have been identified as high-risk on the basis of:

- their past history of invasion
- current international shipping movements
- the variety of habitats available; and
- restricted exchange of water with oceanic environments.

Two techniques are being used to refine the sampling programme. Hydrodynamic models simulate where discharged ballast water and the larvae of pest species are most likely to be dispersed to within each harbour. This is combined with detailed information on the distribution of preferred habitats of the target species. The field programme of surveillance began in earnest in October 2002.

Public surveillance network

A public surveillance network (involving the public, recreational divers, marine researchers, marine industry workers (e.g. marine farmers), and other government departments) provides additional monitoring in a broad range of areas. A series of identification guides is being produced and distributed to these groups.

Survey Reports

Progress and final reports will be posted on the Ministry of Fisheries website www.fish.govt.nz.

Technical Reports

The Ministry of Fisheries will publish the results of port baseline surveys and other marine biosecurity research in the technical report series: Marine Biodiversity Biosecurity Reports.

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ANNEX 6: NATIONAL REPORT FOR GUEST COUNTRIES

Italy
(prepared by A. Occhipinti)

SUMMARY : The report updates the findings of NIS in Italian marine waters. New species of fish, invertebrates and algae were added to the list, which needs revision and some amendments, especially for algae. A few already established species continued to expand. Information is also provided on the Manila clam fisheries and on the environmental effects of *Tapes philippinarum* harvesting. A few research projects are under way.

1.0 LAWS AND REGULATIONS:

An interministerial trilateral task force for the Adriatic Sea Ballast Water Management was established with representatives of Croatia, Slovenia and Italy. The task force provides technical and scientific support in view of the foreseen implementation of the International Convention for the Control and Management of Ship's Ballast Water and Sediments in the Adriatic Sea, where agreements between riparian States are needed in order to identify ballast water exchange areas. In fact, according to the Convention criteria, in the Adriatic the exchange point requirements of at least 200 nm or 50 nm from the nearest land and at least 200 m depth are not met, therefore they are to be designated in consultation between States.

2.0 DELIBERATE RELEASES

2.1 Invertebrates

Italy is the fifth producer of molluscs in the world, mainly due to the culture and harvesting of the introduced Manila clam (*Tapes philippinarum*). The introduction of the Manila clam into the Lagoon of Venice in 1983 has evolved into a rapid colonisation and subsequent expansion of its exploitation during the nineties. After the demographic explosion of the clam population, a number of environmental, biological, operational, social and political problems emerged, among which: collapse of prices, increase in illegal vessels, collection in forbidden areas, trading without health certification, availability and collection of seed.

The total harvest was 4,500 tons in 1993 and 40,000 tons in 1996; in the last years it has remained rather stable around the latter figure. An important mortality has been experienced in 2001, concomitant with a bloom of pico-cyanobacters (Sorokin and Boscolo, 2002). The people involved in the area of the lagoon of Venice, including legal and illegal operators, total about 2,200 fishermen, on 16,000 hectares of fishing grounds; about 3,000 hectares have been subjected to a regulated exploitation, a further 1,200 hectares have been requested by fish farmers. Because of sanitary problems, collecting in the central basin, where the urban centre of Venice is located, has been forbidden; the species is prevalently distributed in this area, where also a nursery area is located West of Venice, raising concern about safety of the product.

A better regulation and organisation of the whole activity is needed (Sorokin et al., 1999).

The sampling gears used vary from hand collection at low tide, rake fishing from boats, or mechanical vibrating rake and hydraulic dredges. The latter have caused extensive consequences in the ecosystem of the lagoon, by resuspension of huge amounts of sediments (Pranovi *et al.,* 2001), affecting primary production because it disrupts bottom algal communities. Settled sediments cover macroalgae and microphytobenthos and underwater light radiation is too low for photosynthesis. Bottom re-suspension contributed also to the spread of algal cells all over the lagoon: the composition of phytoplankton has changed because Bacillariophyceae, particularly Pennatae (usually on the bottom) enhanced in the water column. Furthermore, the search for new fishing grounds promoted the eradication of macrophytes in many areas of the lagoon.

Clam harvesting is carried out mainly by means of a gear locally called ''rusca'', developed by local fishermen. The rusca consists of an iron cage, an outboard engine propeller, which produces a water flow directed onto the bottom suspending sediments and fauna, and a net bag where the clams are collected. The immediate effects of rusca operations on sediment biogeochemistry, sedimentresuspension, and macro- and meiofauna community have been assessed (Pranovi et al., 2004). The plume of resuspended sediment increased (up to two orders of magnitude greater than undisturbed areas); suspended particulate matter, Ctot, Corg, Ntot, and sulphide concentrations in the water column increased too. Experimental rusca hauls significantly reduced macrofauna density, but not meiofauna. An ecosystem approach to study the complex effects of clam harvesting was implemented (Pranovi et al., 2003) using a trophic mass-balance model: the key-role played by *Tapes philippinarum* as an ecosystem control agent is highlighted and indications of sustainable fishing effort is offered.

The proliferation and spread of *Tapes philippinarum* in the Lagoon has brought about significant changes in the benthic communities where the NIS has supplanted the native species such as *Tapes decussatus*. The latter species, that was already declining when Manila clam was introduced, probably because it was overexploited, has now low densities and was also affected by the trematode parasite *Bacciger bacciger* at the end of the nineties. Also the indigenous bivalves *Cerastoderma glaucum* and *Paphia aurea* show low densities.

The introduction of the Manila clam in other lagoons of the Northern Adriatic, namely the lagoons of Marano (about 1,800 tons per year), Caleri, Scardovari (10,000 tons) and Goro (9,000 tons), was followed by the organization of fishermen into cooperatives that cared better for the rational management of the resource, with regulated seeding and harvesting operations. Benthic fluxes of materials influenced by bivalves have been studied in the Lagoon of Goro (Delta of the River Po) by Nizzoli et al. (2003).

Manila clams are collected also in small lagoons of the regions Lazio, Puglia and Sardinia.

New localities for *Tapes philippinarum* are the harbour of Ancona and the coastal muddy sand on the nearby coast of Senigallia (Cristiano Solustri, pers. comm.) and the brackish environment of Pialassa Baiona (Emilia Romagna Region) (Gamba et al., 2003).

3.0 ACCIDENTAL INTRODUCTIONS AND TRANSFERS

3.1 Fish

The cornet fish, *Fistularia commersonii,* distributed in the Indian and Pacific Ocean, and already collected in the Israeli coast and in Greece, has been caught by bottom trawling (40-60 m) in the Strait of Sicily, southward of Lampedusa island (Fiorentino et al., in press).

3.2 Invertebrates

The following species have been added to the list of NIS for Italian coasts.

Melibe viridis (= Melibe fimbriata), a nudibranch mollusc of Indo Pacific origin, was introduced in the Mediterranean (Greece, 1970) and was observed in the Messina Straits (Mojetta, 1998) and the Ionian Sea (Moosleitner, 1986). It has been recently found in Taranto and Porto Cesareo (NW Ionian Sea) by Mastrototaro (2003).

Haminea callidegenita, an opistobranch mollusc from the Pacific coast of the USA, probably introduced together with cultured bivalves, had been found in the Lagoon of Venice (Alvarez et al, 1993a) and the brackish Lake Fusaro (Alvarez et al, 1993b). Also *Polycera hedgepethi* (Cervera et al., 1988) must be added to the list.

Aplysia parvula is considered a lessepsian species and was reported from Malta and Sicily by Bebbington (1970). The finding by Terlizzi et al. (2003), from a vertical rocky cliff near Otranto (southern Adriatic Sea) is the first record of the species along the continental coast of Italy.

The ascidian*, Polyandrocarpa zorritensis* has been identified in Taranto and La Spezia (Mastrototaro and Brunetti, pers. comm.) as a first record for the location.

New information was made available for the following species that have been already reported in the previous years.

Anadara demiri is found as an epibiont on other molluscs in the Adriatic (Solustri et al., 2003a). *Anadara demirii* e *Musculista senhousia* have entered the Lagoon of Venice (Mizzan, 2002).

Taranto is a new location for *Musculista senhousia* (Mastrototaro 2003, 2004), adding to the already long list for that locality (Mastrototaro, 2004). *M. senhousia* is more widely distributed in the Adriatic (Solustri et al., 2003b), and its effects on the benthic communities have been studied in the Sacca di Goro (Mistri, 2003a). The predation by crabs, that show a preference for this Asian date mussel, might contribute to the control of mats in the habitat (Mistri 2003b).

Brachidontes pharaonis has been found in a protected marine area of a small island near Sicily (Russo and Scuderi, in press). The metabolism of this Lessepsian species has been studied by De Pirro et al. (in press). Information on *Rapana venosa* in the Adriatic has been provided within the ICES (2004) report on this species, and by Savini et al. (in press).

The copepod *Acartia tonsa* has replaced the congeneric species *A. margalefi* and *A. latisetosa* in the inner parts of the Northern Adriatic lagoons (Comaschi et al., 2000). This was observed in the Lagoon of Venice (Comaschi and Cavalloni, 1995), the Sacca di Scardovari, and the Laguna di Caleri (Bressan and Moro, 2002). In the Lagoon of Venice, detailed observations have been made both in tidal cycles (Bressan et al., in press) and along a seasonal cycle (Camatti et al., in press).

Rhithropanopeus harrisii is frequently caught on the *Musculista senhousia* beds in the Lagoon of Goro (Mistri pers. comm.). *Percnon gibbesi* has expanded in new localities in Sicily (Mori and Vacchi, 2002) and elsewhere. The data on the structure, bathymetric distribution, microhabitat preference and diet of a newly recorded population in a marine protected area in NW Sicily, demonstrate that it is well adapted to the new habitat (Cannicci et al., submitted manuscript).

3.3 Algae and Higher Plants

The following microalgal species have been added to the list of NIS for Italian coasts:

Asterodinium is a distinctive genus of unarmoured dynoflagellates, it was initially reported from the tropical Indian Ocean with the description of two species *A. gracile* and *A. spinosum*. Later *A. gracile* and the new species *A. libanum* were reported in the Lebanese coastal waters. Four individuals of *Asterodinium gracile* were reported from four stations in the Tyrrhenian Sea (NW Mediterranean) in 1999 oceanographic cruises (Gomez and Claustre, 2003).

The dynoflagellates *Ostreopsis* cf. *siamensis* and *Ostreopsis* cf. *ovata* have been isolated from samples of the Tyrrhenian Sea (Penna *et al,* in press).

The toxic algae, *Coolia monotis, Ostreopsis lenticularis* and *Prorocentrum mexicanum,* have been found in sea water and marine organisms in the Southern Adriatic coast, near Bari (Rizzi et al., 2003).

An extensive revision of the status of macroalgal NIS in Italy, including taxonomic and biogeographic considerations, is under way; the cancellation of some species from the previous list and the addition of new ones is foreseen.

New information was made available for the following species that have been already reported in the previous years:

The dynoflagellate, *Alexandrium minutum*, has been found in the coastal Bay of Siracusa (Sicily), where it developed a toxic strain, followed by the bloom of another HAB species, *Lingulodinium polyedrum* (Giacobbe, in press).

Studies are in progress to analyse the role of human-made structures as a vehicle of expansion of exotic species. This research includes studies on factors promoting the spread of the invasive alga *Codium fragile* ssp. *tomentosoides* on coastal defence structures along the north-east coast of Italy. Experiments are in progress on interactions between this macroalga and the mussel *Mytilus galloprovincialis*, which is the main space-holder on hard-bottom habitats in this region (Bulleri et al 2003, Bulleri et al. submitted manuscript).

Caulerpa taxifolia, established in a massive form in Liguria, and expanding in the Tyrrhenian coasts (Sicily, Calabria and Toscana) has been found also in Campania (Russo et al., in press) and in Sardinia (Cossu et al., in press).

In the Gulf of Naples two conspicuous invasive species have been recorded in the last decade: the green alga *Caulerpa racemosa* and the red alga *Asparagopsis taxiformis*. In the Gulf of Naples the former has been observed since 1997 (Buia et al., 2001) (first record in Italy at Lampedusa island in 1993) and at present it has spread over a substantial part of the coastline. It only shows rapid growth during summer time on all kinds of substrate, from the surface down to 60 m depth.

A. taxiformis, recorded from Egyptian coast in 1800, was first observed in the Gulf of Naples in 2000, where it suddenly appeared with an invasive pattern. It represents the gametophitic life stage in a heteromorphic diplo-haplontic life cycle; the tetrasporophytic stage is called *Falkenbergia hillebrandii.* Even if both phases are present throughout the year on rocky substrate down to 20 m depth, only the gametophyte forms a continuous belt, more relevant during the cold season. In 75% of surveyed sites both species were present, *C. racemosa* had higher coverage (Flagella, 2003). DNA sequences studied from specimens all over the world demonstrated that all Mediterranean specimens belonged to one of the Indo-Pacific lineages (Andreakis, 2003a, b). *Asparagopsis taxiformis* was also recorded in Sicily (Barone et al., 2002).

7.0 MEETINGS, Conferences, Symposia or Workshops on Introductions and Transfers

The study group of the Italian Society of Marine Biology on invasive species has met at Port el Kantaoui (Tunisia) on 6th June 2003 and has set the basis for the preparation of this Report.

The influence of environmental stress on NIS introductions has been the object of a review, drawing examples from Mediterranean case histories (Occhipinti Ambrogi, 2003).

The research program coordinated by ICRAM (Central Institute for Marine Environmental Research, Rome) is nearly completed; it gives support to the Ministry of Environment in the application of the Barcelona Convention - Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean.

A research project on the distribution and reproductive potential of *Rapana venosa* in the Northern Adriatic Sea, funded by the Ministry of Environment has been launched at the end of 2003.

The ALIENS Project (Guala et al., in press) funded by the European Community (2002-2005) involves partners from Spain (Univ. of Oviedo), U.K. (Queen's Univ. of Belfast), Portugal (Centro de Ciencias do Mar of Faro), France (Univ. of Marseilles), Italy (Stazione Zoologica of Naples).

The research is focused on:

- the understanding of the ecological causes underlying the success of invasive seaweeds along European shores;
- the estimate of actual levels of alien introductions and evaluating ecosystem's susceptibility to future invasions;
- the assessment of genetic variability of populations of invasive species and unravelling phylogeographic patterns among them.

In Italy, the activities carried out on *Caulerpa racemosa* and *Asparagopsis armata* in the Gulf of Naples involve:

- distribution of invasive species and assessment of the impact on local communities;
- ballast water investigations in commercial harbours;
- ecophysiology of the two species;
- genetic diversity on regional, pan European and worldwide scale by means of cytoplasmatic and nuclear molecular markers.

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Note: This report is the outcome of a special working group of the Italian Marine Biology Society (SIBM) on a voluntary basis. It does not reflect an official position or knowledge of the relevant Italian Government bodies.

It has been prepared according to the guidelines for ICES WGITMO National Reports; it updates the Italian status presented in Vancouver, March 2003.

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INFORMATION NOTE

Russian Federation
(prepared by V. Panov)

Monitoring and studies of ecosystem impacts of alien species in the Baltic Sea coastal waters in Russia

At present, the Zoological Institute of the Russian Academy of Sciences (ZIN RAS) is involved in a number of national projects focused on the research of invasive alien species in Baltic Sea coastal ecosystems. These projects are funded by the Russian government as part of national efforts to implement relevant international agreements regarding invasive alien species (particularly Decision VI/23 COP6 of the Convention on Biological Diversity).

In 2002, the Ministry of Industry, Science and Technology of the Russian Federation launched a federal program entitled *Research on Priority Directions in Development of Science and Technologies* for the 2002-2006 period. Within the framework of this Program, ZIN RAS is conducting a three-year (2002-2004) project to assess the impact of alien species on the ecosystem in the Baltic Sea Basin. This is under the auspices of the national project on the assessment of the impact of alien species on the structure, productivity and biodiversity of ecosystems in Russia (http://www.zin.ru/rbic/projects/impabalt/). In co-operation with two sub-contracting institutions in Kaliningrad, the P.P. Shirshov Institute of Oceanology RAS and AtlantNIRO, ZIN RAS is focusing on field and experimental studies of alien species for the ecosystem impact assessment, predictions of new invasions, the development of a national alien species information system (http://www.zin.ru/rbic/projects/iasnwrussia/), and the development of a scientific basis for state policy regarding biological invasions.

Since early 2003, ZIN RAS has been involved in a new national project on biosecurity and the monitoring of biological invasions in aquatic ecosystems of the European part of Russia, funded by the Ministry of Industry, Science and Technology of the Russian Federation. The main goal of the project includes monitoring biological invasions in the eastern Gulf of Finland and the timely incorporation of monitoring data in the open information system with GIS-applications. Currently, this project serves as the main source of funding of the online GIS “Invasive Species of the Baltic Sea” (http://www.zin.ru/rbic/projects/invader/), part of the HELCOM project on development of open information resources on the invasive alien species in the Baltic Sea.

Since early 2003, ZIN RAS has also been involved in a project of the Presidium of the Russian Academy of Sciences Program on Biodiversity Conservation (2003-2005), which deals with biological invasions in Baltic Sea coastal waters and includes studies of the diversity of marine coastal ecosystems under the influence of biotic factors. The main objectives of this project include assessing the impact of alien species on biodiversity and the structural-functional organisation of coastal ecosystems of the Baltic Sea, and the evaluation of the resistance of coastal ecosystems to the impact of invasive alien species.

ANNEX 7 ABSTRACT OF DAN MINCHIN´S PREPSENTATION AT THE PICES XII ANNUAL MEETING.

12th Annual Meeting of the Pacific International Council for the Exploration of the Sea (PICES)

Seoul, Korea, 10-18 October 2003

Session S4: MEQ/BIO: Aquaculture in the Ocean Ecosystem

ABSTRACT

Between a rock and a hard place: aquaculture and challenges posed by invasions

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Useful aquatic exotic species and their associated biota continue to spread worldwide. Those introduced for cultivation are normally confined and exposed to a wide spectrum of environmental conditions including anthropogenic activities that create a wide suite of conditions; some of these will be suitable for unwanted biota to target. The arrival of such biota is seldom realised until some impact or economic effect is caused and by this time its spread may have already taken place making elimination unlikely. Controls should be possible for those harmful and potentially harmful species spread with stock movements although unauthorised movements or releases continue to take place. For this reason public awareness and codes of practice (such as the ICES Code of Practice), if employed, should considerably reduce the risks by importation. Unfortunately there is a spread of species carried by other vector processes that can cause harm. Not all of these processes are fully understood although shipping, recreational activities and natural dispersal following new colonisation have been implicated and their overlap with aquaculture may seriously impact on production. However, due to historical circumstances the cessation of culture activities in port or marina regions are unlikely to be acceptable to those operating businesses there. Water quality may be reduced in some areas where other activities take place posing additional stresses that may result in susceptibility to pathogens or obfuscate brood management. The option of moving culture operations offshore may well reduce the impact of invasive species normally prone to appearing within sheltered bays and estuaries. Cultivation offshore will result in different problems arising from increased operational costs, algal bloom events and appearances of gelatinous zooplankton, often overlooked as a causative factor in the mortality of cultured fish. In the future, with changing environmental conditions, new challenges posed by exotic species may be expected in both inshore and ocean environments.

Powerpoint presentation raised issues related to:

- ICES & PICES
- WGITMO brief history
- TBT and no TBT, the new shipping problem, plumes, exotic cells
- Freshwater runoff, turbidity, climate
- Shipping, new ideas and lateral thinking
- Marinas, recreational vessels
- Aquaculture service vessels
- Human consumption of live products
- Shellfish
- Vector overlap
- Gelatinous zooplankton
- Algal blooms
- Climate change
- New species in culture
- High variability of aquaculture/port sites
- Rapid management policy
- ICES Code of Practice
- Meetings in 2004
- Expect the unexpected
- Water & Sociological impacts
- Species, modes of life: tubeworms, tunicates, byssate mollusca
- Farming under a wide range of conditions
- Climate change

ANNEX 8: FINAL DRAFT ADVISORY REPORT ON THE RED KING CRAB

ICES Special Advisory Report

The intentional introduction of the marine Red King Crab* Paralithodes camtschaticus *into the Southern Barents Sea.

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Abstract

The Red King Crab (*Paralithodes camtschaticus*) was intentionally transferred from areas in the Northern Pacific Ocean to the Russian Barents Sea during the 1960s (1961-1969), to create a new and valuable commercial resource. A reproductive population in the receptor region was evident ten years later and from this time the species has continued to spread both north and east in the Barents Sea and southwards along the coast of Northern Norway. Ecological impacts upon the native fauna are investigated through, among others, analysis of the diet of the crab, as molluscs, echinoderms, polychaetes and crustaceans are frequently found as prey items.

Problems following the invasion of the Red King Crab are displayed as bycatch of crabs in gillnet- and longline-fisheries. The crab is regarded as a commercial resource both in Russia and Norway. Management of the Red King Crab is undertaken as a joint stock between Norway and Russia through the Mixed Russian-Norwegian Fishery Commission.

1. Introduction

The Red King Crab *Paralithodes camtschaticus* (Tilesius, 1815) (Reptantia, Lithodidae) is native to the Okhotsk and Japan Sea, Bering Sea and Northern Pacific Ocean. On the Asian side of the Pacific, crabs are found from Korea, along the eastern coast of Siberia and the coasts of Kamchatka peninsula. In the Northeast Pacific and Bering Sea the Red King Crabs are distributed throughout the Aleutian Island chain, north to Norton Sound, Alaska, and southeast to Great Bay in Vancouver Island, Canada (Figure 1). Russian scientists intentionally introduced larvae, juveniles and adults of this species from western Kamchatka peninsula to the southern Russian Barents Sea over the period 1961-69. Ten years later, in the 1970's, a reproductive population of Red King Crabs had become established in the receptor region (Orlov and Ivanov, 1978). It spread from this location may have been due to both natural dispersal of larva by coastal currents and by adult migration. This review describes some of the current knowledge of the species in its home range and the introduced population.

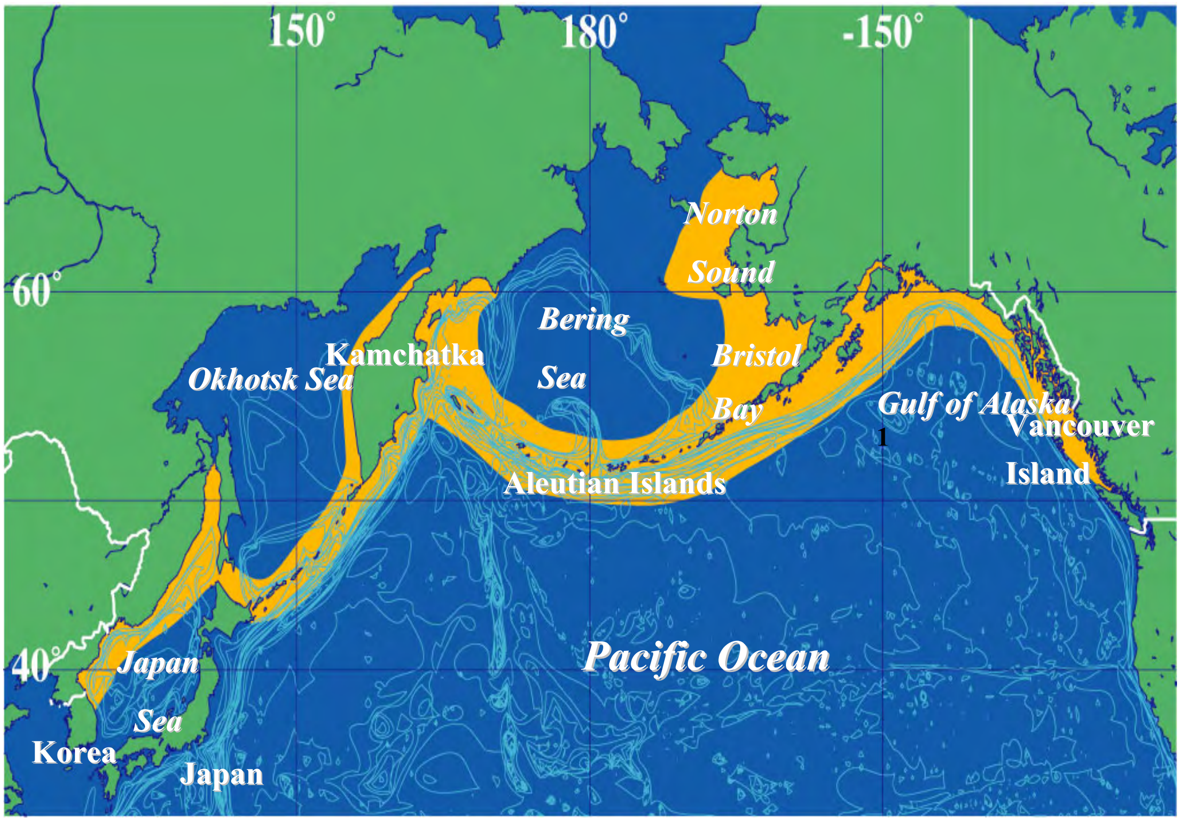


Figure 1. The native distribution of the Red King Crab (light grey shading) along the coasts of Korea, Japan, Russia, Alaska, and Canada.

2. Identification

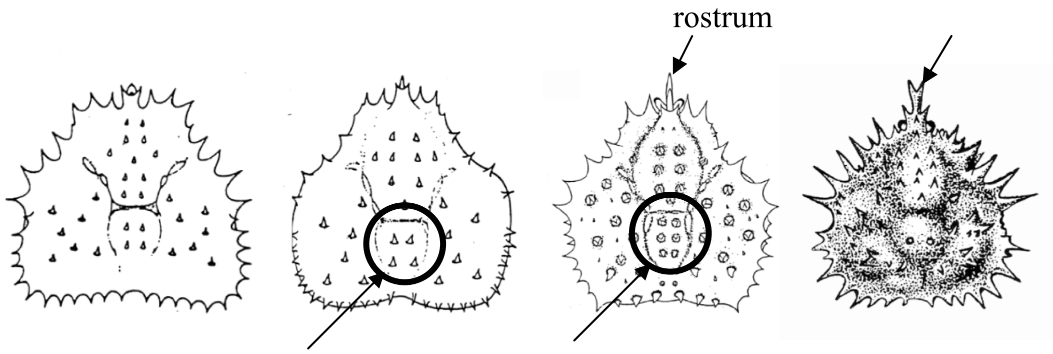
King Crabs are among the world's largest arthropods, having a crab-like morphology and a strongly calcified exoskeleton (Cunningham *et al*., 1992). Furthermore, they have a fused head and thorax, an asymmetrical abdominal flap, one pair of chelipeds, three pairs of walking legs and an array of antennae and mouth parts (mandibles, maxillae and maxillipeds). *Paralithodes camtschaticus* is one of several species of the genus present in the subarctic areas of North Pacific Ocean and Bering Sea (Table 1).

Table 1. Taxonomy of the crabs cited in the present paper.

Class	Crustacea	
Subclass	Malacostraca	
Order	Decapoda	
Family	Lithodidae	
Genus	Lithodes	Paralithodes
Species	*Lithodes maja*	*Paralithodes camtschaticus*

		Paralithodes platypus *Paralithodes brevipes*

Characteristics distinguishing the three species *P. camtschaticus* (Red King Crab), *P. platypus* (Blue King Crab) and *P. brevipes* (Hanasaki Crab) include the shape and number of spines on the posterior and postero-lateral margins, the cardiac and branchial regions of the carapace (Figure 2). *Lithodes maja* is morphologically similar to the King Crab group, but is distinguished from adult *Paralithodes* by the comparatively smaller body size and the bi-fid rostrum. It ranges from the Barents Sea southwards along the coast of Norway and Greenland and to the south coast of Ireland and England.



P. brevipes Hanasaki Crab | *P. platypus* Blue King Crab | *P. camtschaticus* Red King Crab | *L. maja* -

Figure 2. The carapace of four different Lithodidae crustaceans, where *Paralithodes platypus* (Blue King Crab) and *P. brevipes* (Hanasaki Crab) inhabits the subarctic North Pacific Ocean and Bering Sea, while *P. camtschaticus* (Red King Crab), in addition, is recorded in the Barents Sea (*L. maja* ranges: see above). Characteristics that distinguish the four species include the shape and number of spines on the posterior and postero-lateral margins, the cardiac and branchial regions of the carapace and the rostrum.

3. Biology in the native range

3.1 Some basic features

Based on the three largest, reproductively independent, and most productive populations in West Kamchatka, West Okhotsk Sea, and Bristol Bay, Rodin (1989) defined some basic factors. These factors include the complex of biological, geographical and oceanographic features of the habitat of these crabs. The larvae of the Red King Crab develop in the coastal zone. After hatching into a brief (couple of minutes) prozoea stage, the larvae pass through four pelagic stages, followed by a settling stage (megalopa), in about two months. The larvae may be transported considerable distances by currents. For survival of the young, the larvae must be transported to favourable habitats. Successful recruitment of the benthic juvenile crab will depend on a well-developed sessile community with dense concentrations and large areas of hydroids, bryozoans, and sponges are needed to support a massive settlement of larvae. The habitat must be temporally synchronised with the spring phyto- and zooplankton peaks and in the upper 15 m of the water column (Shirley and Shirley, 1989). The survival in one-year-old Red King Crab is directly related to availability of cover, while dependence on the epifaunal community apparently decreases, as crabs grow older (~2 years).

3.2 Seasonal migration

P. camtschaticus has two migrations, a mating-molting and a feeding migration (Figure 3). The patterns of behaviour are similar off the coasts of Japan, Russia, and Alaska (Marukawa, 1933; Vinogradov, 1941; Powell and Reynolds, 1965). The shoreward migration to shallow waters (10-30 m) takes place in late winter and early spring where they mate and breed (Marukawa, 1933; Wallace *et al.*, 1949; Powell and Nickerson, 1965) with the subsequent hatching of larvae at a short prozoea stage (and further transition into the first zoea stage (Stone *et al.*, 1992)). The termination of spawning activities is followed by migratory feeding movements, of both male and female crabs, towards progressively deeper water (300 m). Sexes are not found together until the following season (Cunningham, 1969).

Sexually immature crabs (smaller than 120 mm in carapace length, CL), generally remain in shallow water along the coast at 20-50 m depth (Wallace *et al*., 1949) and are seldom associated with adults in deep water.

3.3 Salinity and Temperature

Little is known of the salinity tolerances of the Red King Crab. In its most northern range (Nome, Norton Sound in Alaska) the crabs occur in the shallow coastal water when ice is present but are, however, absent during the ice-free period (Jewett and Onuf, 1988). The bottom salinity and temperature beneath the ice was 34ppt and –1.8 ºC (Hood *et al*., 1974); but during the ice-free period ranged from 22-24.5ppt and 8.8-11 ºC (Rusanowski *et al*., 1987). This suggests that salinity may be a factor for their absence during ice-free periods.

The Red King Crab is known to tolerate temperatures of –1.7 to +11 ºC (Rodin, 1989) and this varies according to the life history stages. The West Kamchatka Red King Crab sub-population overwinters on the continental slope where the warmer Pacific Ocean water mixes with the colder waters of the shallow shelf. The migration period from the over-wintering area to shallow water depends on increases of the bottom water temperatures, as well as the physiological conditioning prior to spawning and molting (Rodin, 1989). The geographical extent of the subzero temperatures influence the time of their shoreward migration. In spring, normally May-June, high densities of adults accumulate at 10-15 m where temperatures are approximately 2 ºC. Following reproduction in June and July adults forage at around 50 m depth at roughly 2 ºC. In cold years, where the females are unable to penetrate through the cold-water layer (-1 to –1.7 ºC) and into the coastal zone, the release of larvae takes place at depths of 80 to 120 m. In these cases the larvae are transported to unfavourable areas and larval mortality is high (Rodin and Lavrentev, 1974). Red King Crab populations at the West Kamchatka shelf have strong year classes appearing at approximately 5-7 years intervals (Rodin, 1989). Once temperatures decrease the crabs disperse to deeper water where they overwinter (Rodin, 1989).

Fecundity, size and age of maturity, average annual growth varies throughout its native range. In the northern areas of the Pacific, the Red King Crab undertakes a spring spawning migration from 200-300 m depth to shallow water (10-50 m). Here little moulting takes place over the winter, and the hatching of the larvae occurs when the majority of crabs reach the coastal zone in June. Whereas in southern areas with higher temperatures, the spring spawning is widely distributed from the shore to 100-120 m depth, winter molting of males is normal and hatching take place in May where females aggregate.

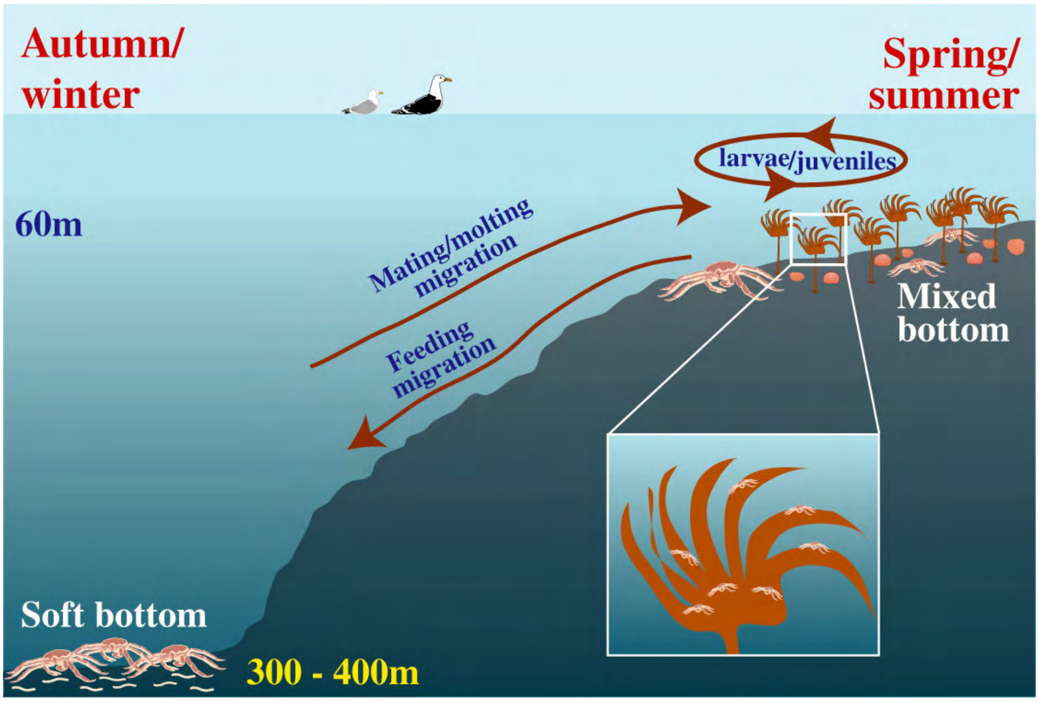


Figure 3. Seasonal migration of *Paralithodes camtschaticus*: the mating-molting migration in the spring/summer period to various substrates with benthic communities principally composed of calcified prey organisms, and a subsequent feeding migration in winter/autumn to soft substrate where annelids occur (enlarged picture: juvenile Red King Crabs associated with kelp).

3.4 Life stages and habitat

Settlement of larvae in shallow waters (<20 m) usually takes place on sponges, bryozoans and macroalgae (Marakawa, 1933). Red King Crabs smaller than 20 mm carapace length (CL) have no podding behaviour and remain solitary the first year as cryptically living beneath rocks and stones and in crevices. In the second year (20-25 mm CL) podding behaviour are seen (Dew, 1990). After the first two years they migrate to deeper water (20-50 m depth) where they congregate in large, tightly packed groups, often referred to as pods (Powel, 1974).

Adults occur on sand and mud substrata (Vinogradov, 1969; Fukuhara, 1985) and aggregate according to size, life history group or sex. Extensive aggregations, where both sexes occur, are made during the spring spawning season. After this period, the sexes form separate aggregations for the remainder of the year (Fukuhara, 1985). The regions where these spawning aggregations occur can also be found in shallow water where kelp occurs (Powel and Nickerson, 1965). The kelp may provide them with some protection for the females following moulting ecdysis and make them less vulnerable during mating (Jewett and Onuf, 1988). Red King Crabs may live 20 years (Kurata, 1961) and can reach a carapace length of ~220 mm and a weight of ~10 kg (Wallace *et al.*, 1949).

3.5 Feeding activity

The nature of the food consumed varies according to the life history. The pelagic larvae consume both phytoplankton and zooplankton (Bright, 1967) and once settled feed on hydroids, the dominant epifaunal component of the refuge substrate within the Kamchatka shelf region (Tsalkina, 1969). Dew (1990) reported that small Red King Crabs (>20 mm CL) feeds on sea stars (50-200 mm), kelp, *Ulva* sp., molted king crab exuvia, *Protothace staminea* (clam), *Mytilus edulis* (mussel), nudibranch egg masses, and barnacles. Occasionally crabs were observed dragging around large sea stars during the entire nightly foraging period. These stars were sometimes left near the base of the pod in the morning, and taken up again upon pod breakup.

Post-larvae show three different behaviour patterns 1) remaining cryptic during daylight and foraging as solitary individuals at night (0 and 1 year-old crabs); 2) less obvious feeding pattern at night and aggregating (1-2 year-old crabs); and 3) feeding either during daylight or night, but principally at night and remaining in groups or becoming solitary (Tarverdieva, 1978). Adults are opportunistic, omnivorous feeders according to what is most readily available in the benthos (Cunningham, 1969). They normally use the most abundant benthic organisms as food, and usually one food group/or species is dominant and varies according to region (Kun and Mikulich, 1954; Kulikova, 1955; Jewett *et al.*, 1989). The weight of food consumed includes approximately 86% of taxa that have calcareous shells. These are echinoderms (*Ophiura sarsi*, and *Strongylocentrotus* sp.) and molluscs (*Nuculana radiata*, *Clinocardium californiense*, Buccinidae and Trochidae) (Cunningham, 1969). An increase in the consumption of calcareous benthic animals is found in connection with moulting (Herrick, 1909; Fenyuk, 1945; Logvinovich, 1945). Kulichkova (1955) suggested that crabs need to replace calcium carbonate lost during molting and that the young clams and barnacles in shallow waters are an abundant resource to fulfil this need. Crabs contain significant more food in their gut during spring-early summer (Takeuchi, 1959; Jewett *et al.*, 1989) when compared with the late summer-fall-winter months (Jewett and Feder, 1982).

It appears that adult Red King Crabs have two distinct methods of feeding: 1) grasping and tearing apart larger invertebrates, and 2) sieving organisms using the third maxillipeds following the scooping-up of sediment by the lesser chela. Logvinovich (1945) referred to the frequent occurrence of sediments in the stomachs and intestine of crabs. Foraminifera, minute molluscs, and amphipods found in stomachs probably result from the sieving method of feeding, as these either burrow in or occur on sediments. Remote cameras have shown that the scooping of sand frequently occurred even when there was evident food available (Cunningham, 1969).

Observations on the degree of gut fullness would indicate that crabs browse on food as it is encountered (Cunningham, 1969). At times of moulting, during growth and at times of reproduction, the food intake declines but such pauses do not normally last more than two to three weeks (Kulichkova, 1955) and thereafter they feed avidly (Takeuchi, 1967).

Adult crabs are active and consequently, where there are low densities of available food, they may swiftly migrate, by walking rapidly on the long legs, to a different and less exploited region where food is more abundant (Somerton, 1981). This ability to range over long distances by walking, up to 3-13 km per day (Marukawa, 1933; Vinogradov, 1941) and 172 km in six months (Hayes and Montgomery, 1963) or 426 km during a year (Simpson and Shippen, 1968), enable the adult crabs to exploit considerable areas of sea bottom (Cunningham, 1969).

4. Non-native distribution

4.1 Date and mode of arrival

During the period 1961-1969, 1.5 million zoea I larvae, 10,000 1-3 year old juveniles (50% females and 50% males) and 2,609 5-15 year old adult (1,655=females, 954=males) *P. camtschaticus* from West Kamchatka, was intentionally released in the Kolafjord in the east Barents Sea (Russia) to create a new and valuable fishing resource in the region (Orlov and Karpevich, 1965; Orlov and Ivanov, 1978). Since then, the crab has spread both east along the Kola Peninsula, and westwards into the Norwegian zone (Figure 4).

In the Russian part of the Barents Sea the highest densities were observed on both sides of the Rybachi Island during late 1980s and early 1990s. Then during the late 1990s crabs became abundant on the eastern part of the Peninsula. The range up to 2002 included Cape Kanin and the entrance of the White Sea to the east. Further northwards the crab was found on the Kanin Bank and at the Goose Bank. Russian scientists believe that the Red King Crab in the Barents Sea have reached the limits of its eastern distribution (probably due to salinity and temperature).

It was not until 1992 the crab became abundant in Norwegian waters, first occurring in the southern areas of Varangerfjord. The general rate of spread of the distribution along the coast of Northern Norway is shown in Figure 5. By 1994 the Red King Crab had spread to the northern side of the fjord, and it was caught in Tanafjord for the first time in 1995. At that time it had almost certainly established breeding populations in the coastal waters between Vardø and Tana. Further range extensions were noted in Laksefjord and Porsangerfjord in 2000, and by 2001 fishermen caught several adult crabs west of Sørøya and west of the North Cape. In 2002 crabs were captured close to Hammerfest and three crabs were caught by a longliner at about 120 nautical miles off the North Cape.

Figure 4. The distribution of the Red King Crab (light grey shading) in the native northern Pacific, Otkhotsk and Bering Sea and the non-native distribution in the Russian and Norwegian southern Barents Sea.

BOX 1. **Future management options in Norwegian waters**

Due to the fact that the Red King Crab is well established in the Barents Sea through a period of about 40 years, it will be unrealistic to believe it could be eradicated. We therefore see three management options for the crab in future:

I. Continuation of to day's management regime where the crab is managed as a valuable fish stock, and the annual TAC (total allowable catch) is set aiming at a long term sustainable harvesting.

II. Keeping the crab stock at a minimum possible level through deliberate actions. A non-regulated fishery has been proposed to reduce the crab stock in Norwegian waters. We are however, reluctant to such a method due to the fact that it is only large males that are of any commercial value. It therefore seems necessary to introduce economical incentives such as a reward system to keep the crab stock at a lowest possible level.

III. The Mixed Russian-Norwegian Fishery Commission have asked Norwegian and Russian scientists to submit a suggested western border for the distribution of the crab in the Barents Sea, based on scientific knowledge. Unless it may be difficult to realize the management implications of such a border, this may well constitute a third option.

4.2 Natural history in receptor region

4.2.1 Larvae

Laboratory studies have shown indications of better larvae survival at temperatures of 6 ºC when compared with 1-3 ºC (Larsen, 1996). This counts in favour for *P. camtschaticus* to become a successful invader of Norwegian waters.

4.2.2 Adults

In Norway immature and mature crabs migrate generally westward. Large egg-carrying females are the often the first individuals to be caught in new areas (own observations: J. H. Sundet). The release of brood by these females may greatly enhance their rate of spread. Results from tag-recapture experiments carried out in the Varangerfjord reveal that adult crabs here move only short distances (2-15 nm, nautical mile; 1 nm =1,852 m) over a three-year period. It would appear that as the abundances of crabs increases they range further, nevertheless tagged individuals have been found to move over significant distances over short periods of time.

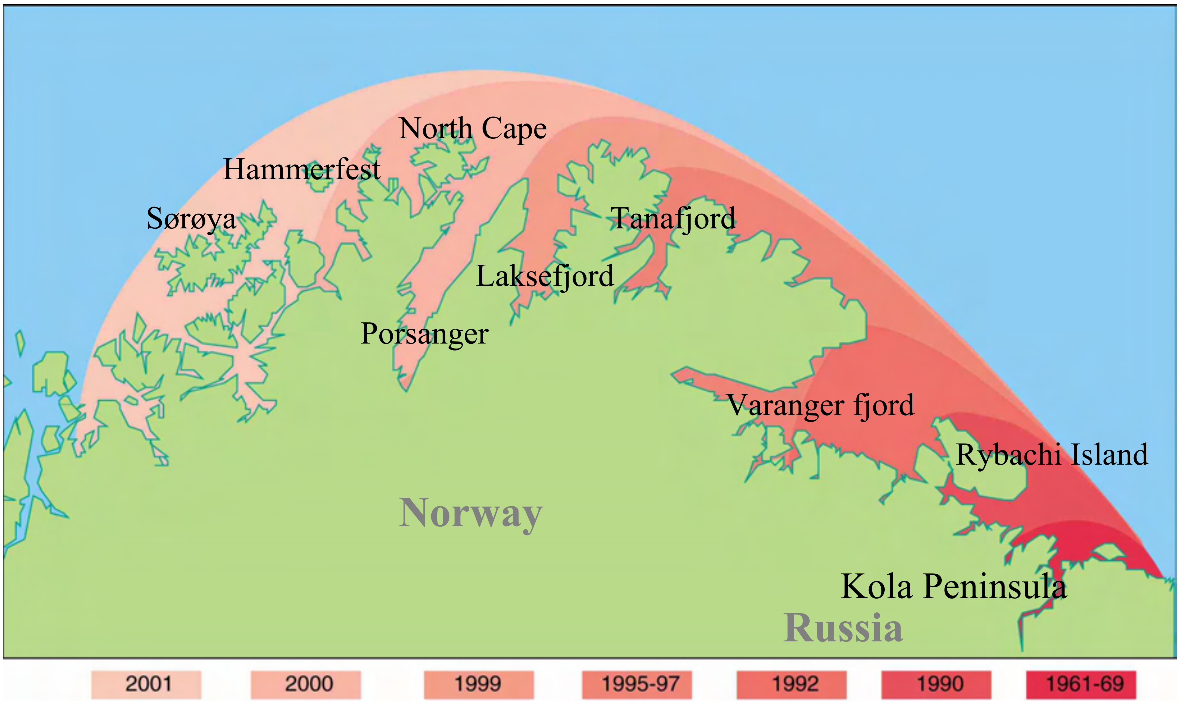


Figure 5. Generalised distribution and spread of the Red King Crab from its release region in the Barents Sea.

4.2.3 Temperature

In the Okhotsk Sea, the bottom temperature at 100-300 m is ~0 ºC. In the Barents Sea and northern part of the Norwegian Sea at 100 m depth the temperature varies from 0 to ~+6 ºC in winter. The temperature increases with a southward progression along the coast of Norway. However, temperatures remain low around Svalbard and in the Northern Barents Sea. Laboratory studies have shown a temperature preference in immature Red King Crabs to temperatures below 4-6 ºC (Hansen 2002). Hansen (2002) speculated that the crab will spread to elsewhere in northern Norway and may extend further south as the uppermost temperatures are likely to be limiting but remain unknown. He also indicated a northward spread to Svalbard.

4.2.4 Food

The Red King Crab in the Barents Sea region feed on bivalves and echinoderms in the spring and summer and polychaetes in the winter, in a similar way as native populations and the availability of food for the crab would appear to be the most important factor in limiting its distribution in its new environment (Gerasimova, 1997).

Total index of stomach fullness (organic stomach content (g)/crab weight (g)) (Table 2) of the Red King Crab in the Barents Sea (Manushin, unpublished data) is similar to the Red King Crab population from the North Pacific Ocean (Tarverdieva, 1976; 1978) and indicates that the food availability in the Barents Sea is presently sufficient to support the existing population. However, there appear to be some changes in the diet from echinoderms to fish over the period 1997-2000 which is probably as a result of crabs feeding on fish discarded from fishing vessels (Figure 6).

Consumption of benthos species in the Murmansk region at depths >100 m (calculated as daily stomach content and energy balance of the crab) ranged from 15,000 to 20,000 tonnes per year (Manushin, unpublished data). These data are based on daily consumption for all crab size groups scaled up to a year and includes an estimate of 20% of the food handled not being consumed.

Manushin (unpublished data) indicated a calculated daily ingestion of 6 g organic food for a 3,000 g crab while 1.7 g for a 500 g crab at a temperatures of 3 °C while 16 g and 3.5 g respectively at 6 °C.

Zhou *et al*. (1998) demonstrated laboratory studies which indicated a daily ingestion rate of more than 70 g and ~20 g wet weight organic food (squid) per day for 3,000 g and 500 g crab respectively (Temp. 5.4-9.4 ºC).

Laboratory studies at temperatures of 5-6 ºC by Jørgensen (unpublished data) on mature (1,700-3,000 g) and immature (~500 g) crabs, foraging on calcified epibenthic prey species ranging in size from 3-6 cm, show they can kill ~300 g and ~150 g prey (*Chlamys islandica*, *Strongylocentrotus droebachiensis*, *Modiolus modiolus*, *Astarte* sp., *Buccinum undatum*, *Asterias* sp. or *Henricia* sp.), respectively, per day.

Positive identification of food items within stomach analysis may be difficult. Decapods rarely swallow entire animals, but normally tear-away pieces using their chelipeds. The pieces are crushed by the gastric mill and so are pulped on entry to the stomach making food identity difficult. While feeding, fragments of prey may be scattered and lost before reaching the mouth. In laboratory studies the valves of large bivalves remained on the tank floor following feeding. Should large molluscs be included in the diet following moulting in shallow water the numbers they destroy in the course of feeding may be underestimated if the volumes in the gut are back-extrapolated.

Table 2. Index of stomach fullness of king crab in different areas.

Area	Total index of stomach fullness, $^{o}/_{ooo}$	Predominant food items	References
The Kola Bay	7	Echinoderms	Kuzmin, Gudimova, 2002
The Barents Sea	4-7	Echinoderms	Gerasimova, 1997
The Barents Sea	4-7	Fish	Manushin, unpublished
Western Kamchatka	3.8-18.6	Molluscs	Kulichkova, 1955
Southern Sakhalin	1.3-4.9	Echinoderms	Kulichkova, 1955
The Bristol Bay	4.7	Echinoderms	Tarverdieva, 1978
The Bering Sea	7.0-7.7	Echinoderms	Tarverdieva, 1976
Southern Sakhalin	3.8-4.3	Molluscs	Klitin, 1996

4.2.5 Feeding behaviour

Feeding observations from laboratory studies demonstrate high walking activity of the crab and when prey touched the fringes of hairs on the inner edges of the chelipeds and maxilipeds it was drawn in under the body towards the mouth. As also stated by Zhou and Shirley (1997) vision appeared to pay little role in foraging. When feeding on bivalves the right larger claw easily crushes the smaller preys outright. Once the shell has been crushed, flesh is torn out by the left smaller chela directed to the mouth-parts and ingested. Larger flattened bivalves as scallops were edge-chipped, the valves grasped by the chela and pulled open in order to expose the flesh. Identification of bivalve species from stomach analysis, using flesh from bivalves, would be a challenge, furthermore Red King Crab foraging may be underestimated when stomach content are correlated to benthic biomass *in situ*. The laboratory results may demonstrate the susceptibility of native scallop (*Chlamys islandica* Müller, 1776) bed communities to Red King Crab predation (Jørgensen, unpublished data). The data-set suggest a mature crab preference of prey sizes larger than 30 mm, and for round prey-bodies a maximum of 60 mm height/diameter. Larger round-shaped bodies that, after a period, could not be crushed were abandoned for another prey. Flattened prey-bodies as scallops and *Asterias* sp. had no upper limitations and probably no size refuge from predation when both mature and immature crabs are present.

Both mature and immature crabs left valves on the bottom as fragments or as edge-chipped after tearing the bivalve flesh into pieces and consuming it. The laboratory results demonstrate that abundant Red King Crabs could have significant effect on Norwegian scallop beds (500-1,000 g scallops/m^2, Jørgensen, unpublished data). The actively moving Red King Crab may be capable of, not only crushing bivalves, but also picking up soft animals and scooping meio- and micro-organisms, which will have a non-reversible effects on the bio-diversity of native benthic communities.

4.3 Field assessments of environmental impacts

Scallop beds along the Norwegian coast are used as models for benthic shallow water communities with high availability of calcified prey species recorded from Red King Crab stomach analyses. The scallop beds may represent a potential food reservoir in spring/summer (May-July) for mature migrating Red King Crabs increasing food ingestion to replace recently expended energy. A principal challenge posed in field assessments of environmental impacts is to isolate the effect of interest (predation from Red King Crab) from noise introduced by natural spatial and temporal variability. One way is Before-After, Control-Impact (BACI analysis) presented by Underwood (1992). This design use comparison sites with one putative impacted and several (minimum two) randomly selected control locations, which not necessarily have to be identical. The sites are monitored at replicated, random intervals of time from before to after the putative impact starts. The logic of the design is that an impact in one site should cause the mean abundance of animals there to change more than expected on average in undisturbed sites. Impacts are those disturbances that cause mean abundance in a site to change more than is found on average. If the magnitude of change in the population is within the resilience of natural populations, the impact gives no cause for concern. Two fjord localities, where one may be impacted within the few next years were localised and has been monitored since 2001. We may need to include at least one more field station to get enough control sites for the monitoring program.

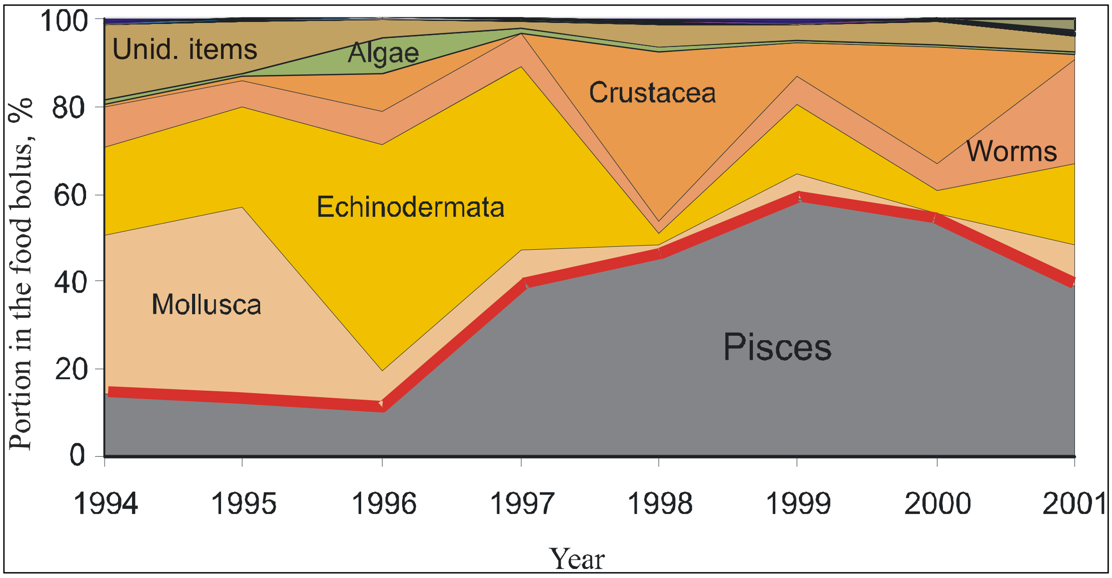


Figure 6. The proportion (%) of fish, molluscs, echinoderms, worms, crustaceans, algae and unidentified items in adult crabs stomachs over the period 1994-2001 from depths greater than 100m (Manushin, unpublished data).

5. Fishery and management

5.1 Fishery

The joint Russian-Norwegian Fishery Commission initiated the fishery for the Red King Crab in the Barents Sea as a research fishery in both national waters in 1994 and at the same time surveys of the crab stock started. Only male crabs larger than a fixed carapace length were legal for catch. Today, the agreed minimum legal size is 132 mm, but a minimum legal size of 137 mm is practised in Norwegian waters. An overview of the total allowable catches (TAC) and legal stock estimates is shown in Figure 7. The research fishery for the crab continued until 2002 and the TAC was, during that period, divided equally between Russia and Norway. In 2002 new agreed fishery regulations were introduced and in Norway the king crab fishery became an ordinary commercial fishery with a Norwegian quota of 100.000 crabs. A total of 124 Norwegian vessels participated in this fishery in 2002. In Russia the king crab fishery is still a research fishery and is carried out from large vessels (~130 m length).

5.2 Bycatch and socio-economic effects

For centuries coastal fisheries in north eastern Norway have been carried out with gillnets and longlines. Today, the typical small-scale fisherman uses gillnets, operated from small vessels in fjords and the near shore fisheries for all available species. The concurrent increase in the Red King Crab stock in recent years has resulted in huge bycatch problems, particularly in the gillnet fishery. The crabs impact the longline fishery by removing bait from hooks, thereby reducing catches of targeted fish. The bycatch of crabs increased steadily from 1997 to 1999, but in 2000-2002 the bycatch rate decreased, and the estimated number in 2002 was only 30% of that in 1999. This is probably due to a reduction in the cod gillnet fishery. Low abundance of cod have forced the fishers to move further west along the coast of North Eastern Norway in search of cod and thereby reduced the probabilities for bycatches of the crab.

Some available size distribution data for crabs caught in the gillnet fishery shows that few juvenile Red King Crabs are caught. Most crabs seem to be larger than 120 mm CL. More than 60% of the crabs caught in gillnet fishery for cod in Varangerfjord are females, while large males dominate the bycatches in the lumpsucker gillnet fishery in early summer.

In order to compensate for the loss of fishery and equipment (gillnets, longliners etc.) caused by the invasion of the Red King Crab, the criterions for participation in the annual crab fishery are set in favor of the local small-scale fishermen.

This is generally acknowledged by fishermen from other parts of Norway, since the presence of the crab directly influence the conditions of the local fishermen.

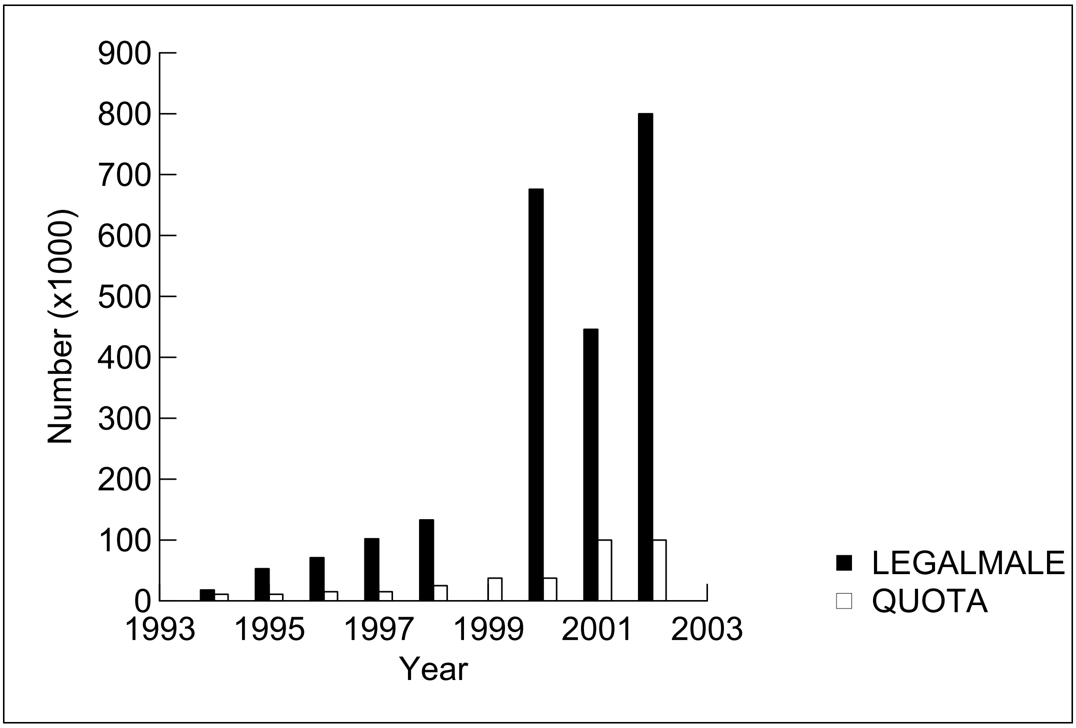


Figure 7. Estimated stock of legal male (i.e. amount of crabs that can legally be caught) Red King Crabs (filled bars) and the Norwegian annual quota (open bars) in the Norwegian part of the Barents Sea.

5.3 Management

The Red King Crab in the Barents Sea is managed as a joint stock between Norway and Russia, and the main body deciding upon management actions is the joint Russian-Norwegian Fishery Commission. Therefore, all research on this species is performed in cooperation between the two nations scientists. The Commission sets a common TAC limit, which is divided between the two nations dependent on the standing stock in each economic zone.

Up to now, the main goal of the crab management has been to perform a long-term sustainable harvest of the stock, and this has in many ways influenced the research undertaken.

Box 2: **Ongoing and future research in Norwegian waters**

The Norwegian Ministry of Fisheries have decided to launch a comprehensive research and surveillance program on the ecological impacts of the king crab in Norwegian waters in 2003. The research will be carried out of the Institute of Marine Research in cooperation with other research institutions in Norway. The program is planned to last for at least ten years and the available cost for 2003 is set to NOK 4.7 mill. All planned research will be closely cooperated with Russian research activities in the same field. The research program is structured as follows:

I. Basic biology

- Environmental demands of the crab as temperature preferences, habitat preferences etc.
- Potential for spreading based on the environmental conditions in northeastern Atlantic including coastal Norway.
- Studies of population biology of the crab including development of population models.
- Bioenergetic studies of the crab

II. Distribution and spreading

- Development of larvae drift models
- Migration studies of adult crab and developing of models

- Risk analyses for spreading of the crab via ballast water
- Continuous surveillance of the distribution front
- Studies of migration pattern throughout the year

III. Direct and indirect effects on habitats

- Establish time series on zoo benthos composition on soft and hard bottom both in areas with and without crab. Isolated studies of effects of the crab on bottom fauna.
- Interaction with other (native) species

i. Qualitative and quantitative effects of food competition

ii. Study effects of the crab on fish stocks with demersal eggs

IV. Genetic studies

- Comparison with crabs from the origin site (Okhotsk Sea)
- Studies of genetic drift in Barents Sea king crab

V. Observational methodology and data analysis

- Development of new methods (sample design)
- Methods for estimating stock size (acoustic, UTV etc.)

VI. Diseases

- Reveal the role of the crab as a vector for spreading new diseases or diseases harmful for the native fauna.

VII. Parasites

- Study the parasite fauna associated with the king crab in the Barents Sea
- Reveal the role of the crab as vector for spreading native or introduced parasites that may be harmful for the native fauna.

VIII. Translation of Russian literature relevant for the crab as an introduced species

IX. Workshop 2003

- A workshop was arranged in Tromsø in June 2003 with invited experts on introduced species. The main aim of the workshop was to draw upon the experience with other introductions in the future management of the crab in Norwegian waters.

5.4 The future

Concise scientific answers to questions about the future impacts of the Red King Crab in the Southern Barents Sea cannot be given. So far, indications point in the direction of continuous migration both further north in the Barents Sea, as well as a southwards spreading along the coast of Norway. Due to the pelagic phase of the crab larvae, the possibility of ballast water being a vector of spreading is likely. The fact that ship traffic (oil- and gas transportation) both in the Barents Sea and in the Northern Norway is likely to increase in the near future, emphasize the possibility of ballast water spreading of the species to other areas in the Atlantic Ocean (e.g. American east coast).

6. Acknowledgements

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ANNEX 9: DISCUSSION PAPER OF THE EUROPEAN COMMISSION ON COMPREHENSIVE RULES AT EU LEVEL REGARDING INTRODUCTIONS, TRANSFERS AND CONTAINMENT OF AQUATIC ORGANISMS IN AQUACULTURE

EUROPEAN COMMISSION
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DISCUSSION PAPER

The need for binding rules regarding introductions, transfers and containment of aquatic organisms in aquaculture

WORKING DOCUMENT
DOES NOT NECESSARILY REPRESENT THE VIEWS OF THE COMMISSION SERVICES

1. Introduction

There are currently no comprehensive rules at EU level regarding introductions, transfers and containment of aquatic organisms in aquaculture. However, the Commission announced last year in its Strategy for the sustainable development of European aquaculture, COM(2002) 511 final (19/9/2002), the intention to propose management rules on the introduction of non-indigenous aquatic species in aquaculture. It was stated that these rules would be consistent with the provisions of the International Council for the Exploration of the Sea (ICES) Code of Practice on the Introductions and Transfer of Marine Organisms. The intention to develop guidelines on containment, so as to minimise salmon escapees in particular was announced in the same Communication.

This note sets out the reasons for introducing harmonised Community rules in these areas and aims to fuel debate at the 2 December 2003 Consultation meeting on the suitability, scope and content of the proposed legislation. It provides background on the main issues involved and examines some of the problems caused.

The aim of DG Fisheries is to have a draft Regulation adopted by the Commission in the first half of 2004 and for this to go forward for consideration by Council and Parliament during the second semester.

2. Reasons for action

Action has been promised in the Strategy for the Sustainable Development of European Aquaculture but there are several other reasons to act, including:

- The Biodiversity action plan for fisheries (COM(2001)162final (27/3/2001) Volume IV), where Action IX, concerns *inter alia* a thorough evaluation of the potential impact of new non-indigenous species to aquaculture and promoting the application of the ICES/EIFAC Codes together with development of guidelines on containment of farmed fish. In the Council Conclusions on this action plan the need to minimise the genetic risk for wild fish stocks caused by escapement of farmed fish was acknowledged (par 13).
- Rio Article 15 and other subsequent international agreements recognise formally the need for a precautionary approach in relation to species introductions

- FAO in its Code of Conduct for responsible fisheries (1995) calls at 9.3.1 for: 'efforts …to minimize the harmful effects of introducing non-native species or genetically altered stocks for aquaculture ….promote steps to minimize adverse genetic, disease and other effects of escaped farmed fish on wild stocks" and at 9.3.2 calls for "codes of practice and procedures for introductions and transfers of aquatic organisms".
- The Bergen Declaration, (action 33) agreed at the Fifth international conference on the protection of the North Sea, (signed by B, Dk, F, D, NL, Nor, Sw, CH and the EC) in the context of environment protection requirements, acknowledged the guidelines developed by NASCO in cooperation with the salmon farming industry in the North Atlantic on containment of farmed salmon and invited development and implementation of the FAO Code of Conduct.

3. Background and reference material

Non binding codes of practice and guidelines currently exist for introductions, transfers and containment of aquatic organisms in aquaculture, as follows:

2003 ICES Code of Practice on the Introductions and Transfers of Marine Organisms (http://www.ices.dk/reports/general/2003/Codemarineintroductions2003.pdf)

1998 EIFAC (FAO) Codes of Practice and manual of procedures for consideration of introductions and transfers of marine and freshwater organisms (not currently available on-line, the document, excluding appendices, is attached as a TIF file)

2001 NASCO Guidelines on Containment of Farm Salmon (CLN(01)53, as subsequently incorporated into NASCO's Resolution to minimise impacts from aquaculture, introductions and transfers, and transgenics on the wild salmon stocks (also known as the "Williamsburg Resolution"), CNL(03)57, agreed at the last Council meeting in June 2003, (http://www.nasco.int/pdf/nasco_cnl_03_57.pdf).

In EU legislation, the supplementary provisions (Article 22) of Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora cover the issues of re-introducing native species and deliberate introduction of non-native species. The Habitats Directive requires Member States to *"ensure that the deliberate introduction into the wild of any species which is not native to their territory is regulated so as not to prejudice natural habitats within their natural range or the wild native fauna and flora and, if they consider it necessary prohibit such introduction."* The results of the assessment undertaken is to be forwarded the 'Habitats' committee' which meets twice a year.

The extent to which the Environmental Impact Assessment rules are applicable to the introductions, transfers and containment will need to be examined as part of the scoping exercise.

The Second Report of the European Community to the Convention on Biological Diversity - Thematic report on alien invasive species, October 2002, is a valuable information resource,

(http://biodiversity-chm.eea.eu.int/convention/cbd_ec/F1036489359/F1036491559). It lists aquaculture (fish molluscs and crustaceans introduced for production, disease organisms accompanying introduced species) as on of 15 pathways for unintentional and intentional introductions. Among the problems listed are the spread of *Bonamia* in oysters and concerns about two Japanese seaweeds. One, *Sargassum muticum* was introduced to Europe through oyster transplantation and can clog coastal waterways. The second, *Undaria,* was intentionally introduced to France and was recently found in the UK; it has the potential to displace native species and is spreading vigorously.

Section 3 of the report reviews 'EU legal and administrative measures relevant to invasive alien species' dealing with imports into the Community and unwanted introductions (transfers) within the Community. It states that 'the **Community does not currently have a horizontal programme or instrument on alien species'** but describes legislation on animal and fish diseases (Infectious salmon anaemia is highlighted), 'Ecological threat' species (CITES) and introductions damaging to habitats and wild species (Habitats Directive), among others. European case law on restricting movement of alien species is reviewed and Community-funded research projects and partnerships relevant to the topic are listed.

The report states that modern aquaculture development in the coastal zone is considered to be at high risk of disease transfer from ballast water when the culture facilities and areas of fishing area located near shipping routes. "The recent world-wide growth of aquaculture along such infrastructure elements amplifies this risk" and "possibly renders tight disease regulations for this industry useless in many areas."[1]

A recent review (Chapter by Minchin & Rosenthal, in Leppäkoski et al 'Invasive aquatic species of Europe, Distribution, impacts and management' 2002, Kluwer Academic Publishers)on species introduced for stocking and aquaculture describes problems which have occurred. This documents 69 cases of introductions of exotic species cultivated or used for re-stocking in Europe. The list includes ten cases involving algae, one flowering plant, three gastropod molluscs, 28 bivalve shellfish cases and 27 cases involving fish.

The review describes *inter alia*:

Problems resulting from oyster movements including two protozoan parasites of the native European oyster which has resulted in the decimation of this species in Europe

Problems involving the introduction of exotic crayfish species to freshwaters for restocking purposes, including the early spread of the crayfish plague most likely with introductions from North America

The recent spread of king crab *Paralithoides camtschatica* along northern Norway following its introduction to Northern Russia in the 1960s from the Pacific Ocean

Problems with salmonids including the spread of the gill parasite *Gyrodactylus salaris* and the introduction of eggs of Pacific Coho salmon to France in 1971

The authors recommend that future introductions should take account of the problems which have evolved following inappropriate introductions in the past and advocate the use quarantine as proposed by ICES.

Regarding containment, the current scientific view is that escaped fish do have a negative effect on wild fish but that this is difficult to quantify due to the lack of a baseline. A ten year long scientific study published recently (Royal Society Proceedings, McGinnity & Ferguson, 2003) warns that wild Atlantic salmon could be wiped out through interbreeding with farmed fish and deliberately stocked fish. It is estimated that some two million Atlantic salmon escape each year from fish farms into the North Atlantic. Over 600 000 farmed salmon are said to have escaped in Norway last year and new Norwegian regulations aimed at reducing this are to come into effect on 1 January 2004 for new farms and 1 January 2006 for existing farms. These set requirements for developments, dimensions, operation, installation, and the daily running of cage farms. Mandatory tagging of farmed fish is also under consideration in Norway. The views of the Consultation meeting area will be requested on the merits of having binding Community legislation in this area.

4. Objectives and form of the Commission proposal

The ICES Code of Practice is a mechanism to manage the international movement of exotic species, including any intentional release into the wild even if establishment was not intended. It does not cover the unintentional introduction of exotic species related to shipping and other vectors. The Code is voluntary and the decision making process a quite slow involving scientist from ICES member countries on either side of the Atlantic. The Mediterranean Member States, on the other hand, are not members of ICES. One possibility for Community rules would see the ICES code adopted with a modified format for decision making at EU level. Decisions should ideally be made within a defined time-frame.

For freshwater, the possibility of adopting the less developed EIFAC Codes of Practice will be examined. The latter incorporates an early version of the ICES Code adopted in 1979 and is generally less exigent than the current ICES document, although a review is currently being undertaken by EIFAC. NASCO has recently incorporated it guidelines for containment of farmed salmon into the new Resolution mentioned above. The containment guidelines cover aspects ranging from site selection, equipment and structures to management system operations and verification.

5. Impacts

The proposal will be drawn up with the help of EU scientific experts (governmental and non-governmental) who have worked on these areas with ICES, EIFAC and NASCO in the past, together with industry and NGO representatives. At

[1] European Concerted Action Study entitled Testing monitoring systems for risk assessment of harmful introductions by ships to European waters

the 2 December meeting the participants will be asked their opinion on what Community action is needed in this area. A study is planned on the impact any new measures on business and on employment.

6. Timetable

2/12/03 meeting in Brussels with government and private experts from EU 25, EFTA, relevant organisations, industry and NGOs

Reflection on measures to be proposed following consultation meeting

Drafting of a proposal, further consultation and adoption by the Commission during the first semester 2004.

Consideration by Council and European Parliament during second semester 2004.

ANNEX 10: OBJECTIVES OF THE WORLD STURGEON CONSERVATION SOCIETY

Mission statement

The Society intends to act as an international forum of scientific discussion for all persons interested in pertinent issues on sturgeons while at the same time seeking opportunities for close co-operation at an international level.

The vision for this society is to see stocks thriving once again in important sturgeon waters such as the Caspian Sea, the North and Baltic seas, rivers in China as well as in the Great Lakes region of the United States and Canada in addition to other North American watersheds. The Society therefore hopes through its activities to enhance the understanding of species protection world-wide and across national borders in regions with different cultural and political backgrounds (using the highly endangered sturgeons as case examples) in order to foster the sustainable use of natural resources that are traded globally.

The objectives of the Society are:

a) to foster the conservation of sturgeon species and restoration of sturgeon stocks world-wide

b) to support the information exchange among all persons interested in sturgeons. This particularly applies to the following subject areas:
   - general biology
   - species and habitat protection
   - stock enhancement
   - biological resource management
   - fisheries and fisheries-related issues
   - aquaculture
   - cultural and regulatory issues

c) to promote information exchange with national, regional, international, inter-governmental organisations, educational institutions (e.g. university and scientific institutes) and non-governmental organisations (NGOs).

d) to foster and support interdisciplinary and multidisciplinary research on all aspects of sturgeons (e.g. biology, management and utilisation of sturgeons).

e) to enhance the co-operation between and among anglers, fishermen, scientists, governmental agencies, local communities and non-governmental organisations (NGOs) and international organisations.

f) to inform the public on all aspects of the status and biology of sturgeons, requirements for their effective species protection, and needs for appropriate management. The tools to achieve this objective include the use of adequate and modern publications and means of communication as well as the organisation of international conferences.

The Society focuses exclusively and directly on non-profit goals. It acts selflessly and serves primarily non-profit-oriented purposes.

ANNEX 11: PICES WORKING GROUP ON *MARICULTURE IN THE 21ST CENTURY*

Working Group on *Mariculture in the 21st Century – The intersection between ecology, socio-economics and production*

Proposal: Working Group under MEQ & FIS

Title: *Mariculture in the 21st Century – The intersection between ecology, socio-economics and production*

Short Title: WG on *Marine aquaculture*

Duration: November 2003 to October 2006

Terms of Reference:

1. To review and report on the current status and projected trends in aquaculture in marine and estuarine regions of PICES that substantively contribute to world aquaculture.

2. To develop an overview of current and emerging issues, with respect to environmental and ecosystem function, sustainability of production (*e.g.*, carrying capacity of ecosystems), and socio-economics.

3. To convene a workshop on "Scientific issues for sustainable aquaculture in the PICES region". A product from the workshop would be recommendations for a PICES Action Plan on scientific issues of mariculture.

Recommended Co-Chairmen for the Working Group are Drs. Ik-Kyo Chung (Korea), Carolyn Friedman (U.S.A.), and a scientist suggested by Chinese delegates.

ANNEX 12: PICES SECTION ON HARMFUL ALGAL BLOOMS AND THEIR IMPACTS

Section on *Harmful algal blooms and their impacts*

Proposal: Section under MEQ

Title: Harmful algal blooms and their impacts

Short title: HAB-S

Terms of Reference:

1. To develop and implement annual bloom reporting procedures that can be consistent with ICES procedures and therefore incorporated into HAE-DAT and used to update the North Pacific Ecosystem Status Report. This will be important in assessing impacts of HAB events and as a research tool to understand patterns that will eventually lead to an increased prediction capability.
2. To exchange national reports of HAB incidents and development in order to inform PICES of new toxins, new developments, and new approaches. Both toxin producing and nontoxic (but harmful) algal species should be included.
3. To focus on specific needs for scientific advice among PICES member countries by identifying topics of interest, and providing syntheses of the available scientific information on those selected topics. Example topics for discussion and synthesis might include:

a. Mitigation practices to reduce the impact of HABs;

b. Numerical model development of harmful algal bloom initiation and transport for predictions and forecasts;

c. Relationship between oceanographic processes and HAB formation (*e.g.*, how the physics of nutrients, trace metals tie into bloom formation);

d. Organism identification using molecular biological techniques;

e. Discussion of possible changes to certain monitoring techniques (for example, cell numbers *vs*. toxin levels);

f. Species introductions including issues of anthropogenic sources (*e.g.*, ballast water) or natural systems (*e.g.*, species range extension).

4. Together with TCODE, to develop a meta-database that describes HAB monitoring and research efforts in each PICES member country.
5. Support the harmonization of methods for identifying HAB species. This could include intercalibration workshops co-sponsored by PICES and ICES.
6. Development of early warning systems for the detection of HABs. This could include discussion of ocean observing systems and techniques.
7. To educate the community (managers, students) about biology and ecology of HAB organisms. For example, an in-depth study and documentation of selected HAB species ("top ten") could include information about physiology, taxonomy, etc. of each of the species.

Recommended Co-Chairmen: Drs. Hak-Gyoon Kim (Korea) and Vera Trainer (U.S.A.).

Note: A "Section" represents a sub-committee under a Scientific Committee that has a longer lifespan than a Working Group. Its purpose is to provide input to the parent Scientific Committee on specific issues for which expertise may be lacking in the parent committee. Sections should be reviewed periodically to ensure they continue to meet their objectives.

ANNEX 13: RECOMMENDATIONS TO THE COUNCIL

1 Invasive species continue to be a major problem on biodiversity as reflected by a statement of the Secretary General of International Maritime Organization (IMO) who stated recently "…biological invasions are considered to be one of the top four anthropogenic threads to the worlds oceans…". Further national and international legislation, e.g. the Convention on Biological Diversity, recognises this as a treat. Shipping is only one vector by which invasive species may arrive as illustrated by the Vector Handbook.

2 WGITMO has succeeded by developing a Code of Practice. Internationally many countries are following the Code either voluntarily or through versions embedded in their legislations.

3 WGBOSV focuses on shipping while other vectors and effects of invasive species are purview of WGITMO.

4 WGITMO continues to underpin the role of ICES to existing and new clients (e.g. NGOs, CBD) through evaluation of existing and new introductions (intentional and un-intentional), their impacts (through biological, social and economic evaluation) and assessment of management and control options on the marine environment, with the aim to reduce the adverse impact on fisheries, mariculture, biodiversity and ecosystem function.

5 WGITMO provides the following services, specifically:

- an early warning system of new invaders and their spread within and between regions (forecasting), identification of natural versus anthropogenic processes in aiding spread, and information on status and trends.
- identification of impacts of individual species, and synergies of impacts between species
- identification of eradication, incursion response, control tools and or methods that have proven to be useful
- information for public awareness activities targeted at authorities, industries, and the public.

To meet these needs the National Reports will be summarized and analysed on an annual basis to detect patterns and identify products, such as Alien Species Alert Reports, early warnings of emerging vectors and codes of practices on incursion response.

It is planned to summarise and analyse the information in a "rolling format". The first requirement will be to meet the information as requested by REGNS.

6 At the 2004 WGITMO meeting, the focus was:

- Summary Report on Species Introductions 1992-2002,
- Alien Species Alert Report on the Red King Crab,
- Final Draft of the Vector Handbook,
- contribution to REGNS, and
- rapid response and control options of new invaders.

7 WGITMO noted with great appreciation the publication of the ICES Code of Practice on Introductions and Transfers of Marine Organisms 2003 and the ICES Cooperative Research Report No. 264: "Alien Species Alert: *Rapana* Report". WGITMO recommends that ICES add to the existing WGITMO webpage references to download locations of the ICES Code of Practice and the *Rapana* Report. It is further suggested to add a reference to the "Vector Handbook" and the "Alien Species Alert Report on the Red King Crab, *Paralithodes camtschaticus*"once published.

8 ICES is asked to continue its cooperation with PICES and to support attendance of a WGITMO member at the PICES XIII Annual Science Conference in Honolulu, Hawaii in October 2004 for mutual benefit and for continuing the collaboration.

9 WGITMO recommends at its annual meetings to continue include an opportunity for the participation from non-ICES countries (e.g. Mediterranean countries and other international organizations, such as CIESM and PICES) on the basis of their expertise on species that are invasive elsewhere and that may be of concern to ICES member countries. As in previous years, the very detailed information provided by the Italian participant was greatly appreciated by the WGITMO.

10 WGITMO asks ICES to consider the establishment of a similar working group within PICES for improved future cooperation especially noting that several important introduced species originate from PICES member countries.

11 WGITMO recommends a continuation of the Alien Species Alert Report series taking the following taxa into consideration (in order of priority):

- *Undaria pinnatifida* (Japanese kelp)
- *Hemigrapsus penicillatus* and *H. sanguineus* (Asian shore crabs)
- *Crepidula fornicata* (Slipper Limpet), and
- *Homarus americanus* (American Lobster).

A rationale is provided in the body of the meeting report.

12 WGITMO suggests to evaluate the need for risk assessments for

- accidental and intentional introductions,
- control options,
- rapid response plans,
- current Code of Practice (review in light of new initiatives on risk assessment, impact assessment protocols and developmental practices). As a result of this initiative the comprehensive appendices of the Code, published on the Internet, may need to be updated.

13 WGITMO recommends that the working group meet at least two days in Norway in the week starting with March 14th 2005 in conjunction with the meeting of the ICES/IOC/IMO Working Group on Ballast and other Ship Vectors (WGBOSV) to:

a) synthesise and evaluate National Reports to address the items listed above under 5,

b) advance the discussion with the aim to prepare a draft report for rapid response and control options (such as decision trees and regulations) by 2006,

c) to prepare a report summarizing introductions and transfers of marine organisms into the North Sea and wherever possible their consequences as input to the 2006 meeting of REGNS (Regional Ecosystem Study Group for the North Sea) and the 2006 Theme Session on Integrated Assessments,

d) plan Aliens Species Alert report including evaluation of impacts and increasing public awareness,

e) development of risk assessment guidelines (see under 12).

Supporting information:

Priority:	The work of the Group is essential to prevent future unintentional movements of invasive and/or deleterious aquatic species including disease agents and parasites with the legitimate trade in species required for aquaculture and fishing purposes. Commercial movements of organisms increase over time highlighting that a very high priority must be given to the development and implementation of precautionary actions to avoid unwanted impacts. Appropriate protocols are outlined in the Code of Practice. Vectors others than shipping and effects of invasive species are purview of WGITMO. The work of this Group supports the core role of ICES in relation to planned introductions and transfers of organisms.
Scientific Justification:	a) The work outlined above in 5 is needed for the working group to maintain an overview of relevant activities in Member Countries and other areas from which species could be spread to Member Countries and to contribute to REGNS. b) The work on rapid response and control options will provide guidance on what to do in case a new species is recorded. c) see a). d) The preparation of Aliens Species Alert Reports including an evaluation of impacts will contribute to the REGNS ToRs e) This report is needed to keep the Code of Practice on the Introductions and transfer of marine organisms up-to-date. As a result of this initiative the comprehensive appendices of the Code, published on the Internet, may need to be updated.
Relation to Strategic	

Plan:	
Resource Requirements:	Normal meeting facilities provided by host country and participation of national members.
Participants:	WGITMO members and invited experts from, e.g., Australia, New Zealand, Mediterranean countries that are not members of ICES, representatives of relevant PICES WGs. WGITMO recommends to invite experts on (a) risk assessment of marine invasions for input on the relevant Appendices of the Code of Practice and (b) experts with relevant expertise to contribute to the Aliens Species Alert reports (species to be selected by ICES).(c) experts from countries which have developed/are developing rapid response plans.
Secretariat Facilities:	None required
Financial:	None required
Linkages to Advisory Committees:	ACME
Linkages to other Committees or Groups:	WGHABD, WGEIM, WGBOSV, WGAGFM, WGMASC Mariculture Committee.
Linkages to other Organisations:	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 WGITMO and EIFAC, in addition to a continued dialogue between WGITMO and BMB, PICES, IMO, IOC, EU, HELCOM, EIFAC, BMB, CIESM.
Cost share	ICES 100 %