ICES WGBOSV REPORT 2005

ICES ADVISORY COMMITTEE ON THE MARINE ENVIRONMENT

ACME:04

Ref. E

REPORT OF ICES/IOC/IMO WORKING GROUP ON BALLAST AND OTHER SHIP VECTORS (WGBOSV)

14–28 MARCH 2005

ARENDAL, NORWAY

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Conseil International pour l'Exploration de la Mer

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Recommended format for purposes of citation:
ICES. 2005. Report of ICES/IOC/IMO Working Group on Ballast and Other Ship Vectors (WGBOSV), 14-28 March 2005, Arendal, Norway. ACME:04. 97 pp.

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1 Opening and structure of the meeting

The 2005 meeting of the ICES/IOC/IMO Working Group on Ballast and Other Ship Vectors (WGBOSV) was hosted by the Institute of Marine Research, Floedevigen Research Station, Norway with Anders Jelmert, Norway as host and with Stephan Gollasch as chair. The level of interest in this field of research remains high as demonstrated by the large number of participants and contributions by correspondence. In total 25 participants from Australia, Belgium, Croatia, Finland, Germany, the Netherlands, New Zealand, Norway, Spain, Sweden, the United Kingdom, the United States of America and a representative from PICES attended the meeting (Annex 1).

Apologies were received from Dandu Pughiuc, International Maritime Organization (IMO) and Jose Matheickal (GloBallast Programme). Preparations for meetings of the IMO Marine Environment Protection Committee (MEPC) and funding constraints meant they were unable to attend. Further apologies were received from Anna Occhipinti (Italy) who was unable to travel owing to illness and Matej David (Slovenia) who provided an outline of the Slovenian risk assessment approach by correspondence. Also, Henrik Enevoldsen the IOC Project Coordinator of the IOC Science and Communication Centre on Harmful Algae was unable to attend.

The meeting was opened at 9 am on Monday March 14 2005 with Stephan Gollasch and Anders Jelmert welcoming participants, particularly new members who had not previously attended WGBOSV meetings. On Tuesday, March 15 2005 Erlend Moksnes, the research director of coastal zone management (including ballast water issues) at the Institute for Marine Research, Floedevigen Station, welcomed the participants with remarks on historical and international cooperation in marine research where the Floedevigen Station played a key role. The chair highlighted the participation of PICES and the potential for cooperative links between ICES, IMO, IOC, CIESM, BMB and PICES on matters of interest to WGBOSV.

The meeting took the form of five plenary sessions with round table discussions and drafting sessions following each session as well as evening drafting sessions. The Working Group considered the outcomes of the round table discussions and other recommendations of the meeting at a final session at the end of the week.

This was the first WGBOSV meeting with a duration of five days. The group felt the extra days enabled more time for discussions and subgroup work. For future meetings, it is anticipated that subgroup work will be required during the meeting to address the terms of reference. Therefore, WGBOSV recommends meeting in 2006 for at least three days.

2 Correction of 2004 WGBOSV meeting report

In Annex 7 Ballast Water Regulations of 2004 the WGBOSV Meeting Report it is stated that in Sweden “It is recommended by national Swedish law to follow IMO A.868(20)”. This is not true and should be deleted in future compilations of national Ballast Water regulations. The Chair expressed his apologies for this mistake and encouraged the attendees to take note of this change.

3 Terms of reference, adoption of agenda, selection of rapporteur

3.1 Terms of Reference

The meeting took note of the Terms of Reference (ToR) (Annex 2) and the Agenda was structured so as to allow each ToR to be addressed in turn. This required preparation of papers and reports by members for presentation at the meeting. The Chair thanked the members for preparing these reports and papers.

3.2 Adoption of Agenda

The Agenda was adopted (Annex 3) with amendments to reflect unforeseen changes. Abstracts of selected talks are presented in Annex 12.

3.3 Selection of Rapporteur

As in previous meetings, Tracy McCollin, United Kingdom, was appointed as rapporteur.

4 Terms of reference for the 2004 meeting of WGBOSV

The terms of reference were received as ICES Resolution 2ACME05 (Annex 2).

5 Scientific aspects of risk assessment of ballast water (ToR a)

There are differing views and philosophies relating to the benefits of applying risk assessment and risk management principles to ballast water management versus taking a 'blanket', all-encompassing approach. The key issues addressed by the participants at the round table discussion were:

- What is the role of risk assessment in the new IMO Ballast Water Management Convention?
- Under what circumstances and what bio-geographic scale does risk assessment become biologically meaningful?

A number of papers were presented in Session I of direct relevance to this ToR. Following the presentations a template was designed to ease the comparison and evaluation of relevant risk assessment approaches (Tab. 1). In general, two different assessment philosophies have been developed: risk assessment versus hazard assessment. A hazard assessment will allow management (or control) based on a ranking exercise, but not on a vessel by vessel basis. A risk assessment allows a single vessel or ballast tank to be evaluated and subject to management (or control). This table only covers management of vessels - other risk assessment methods are being used to identify ballast exchange areas, target species, etc.

Table 1 compares key risk assessment features of 12 research initiatives. The projects considered were carried out or are ongoing in Australia, North America, Europe and during the GloBallast Programme (Brazil, China, India, Iran, South Africa, and Ukraine). Key objectives of the studies considered here included:

- Risk identification for species invasions
- Estimates of the cost of toxic dinoflagellate introductions

- Identifying low risk routes, vessels and tanks
- Enhancing awareness and recommending ballast water management strategies
- Creating baseline knowledge on the risks associated with NIS and shipping
- Recommending ballast water management plans

The management unit of the risk assessments were either target species, routes, vessels or ports. The assessment unit covered regions, target species, port or routes on either a qualitative or (semi-) quantitative approach.

The overall principles for assessing the risk were either environmental match (studying up to 37 variables), species based tolerance or models covering four steps in the bio-invasion process: donor port infection, vessel infection, journey survival and survival in the recipient port. The temporal resolution ranges from monthly to annual data.

Tabel 1 Comparison of selected risk assessment initiatives relevant to vessel management (References at end of table). DSS = Decision Support System.

RISK ASSESSMENT INITIATIVE	MANAGEMENT UNIT	ASSESSMENT UNIT	ASSESSMENT BASED ON	APPROACH	ENVIRONMENTAL VARIABLES	ENDPOINT	TEMPORAL RESOLUTION	PURPOSE	DATE
Germany (Gollasch 1996)	Target species (varies)	Region	Environmental matching between localities	Qualitative	2	Hazard assessment	Annual	Risk identification for species invasions in German coastal waters	1992 - 1996
AQIS 1994	Target species (2)	Target species (2)	Species based tolerance, volume of ballast discharged and bloom dynamics	Quantitative	1	Estimate economic impact of toxic dinoflagellates on aquaculture, tourism, etc	Annual	Estimate cost of toxic dinoflagellate introductions in Australian waters	1994
Australian DSS (Hayes and Hewitt 1998, 2000)	Routes	Target species (8+)	Models four steps in the bio-invasion process: donor port infection, vessel infection, journey survival and survival in the recipient port	Quantitative	1	Target species life cycle completion in recipient port	Month	Identify low risk routes, vessels and tanks	1997 - ongoing
NORDIC countries (Gollasch & Leppäkoski 1999)	Target species (varies)	Port	Environmental match between donor and source localities	Qualitative	5	Hazard assessment	Annual	Risk identification for species invasions in NORDIC countries	1998-1999
EMBLA	Target species	Target species (various)	Models four steps in the bio-invasion process: donor port infection, vessel infection, journey survival and survival in the recipient port	Quantitative	2	Target species life cycle completion in recipient port	Month	Identify low risk routes, vessels and tanks	1998 - ongoing

RISK ASSESSMENT INITIATIVE	MANAGE-MENT UNIT	ASSESS-MENT UNIT	ASSESSMENT BASED ON	APPROACH	ENVIRON-MENTAL VARIABLES	ENDPOINT	TEMPORAL RESOLUTION	PURPOSE	DATE
GloBallast	Routes	Port	Environmental matching between localities, weighted by target species presence in the donor location and inoculation factors	Semi-quantitative	37	Identify and rank high and low risk ports	Annual	Enhance awareness and recommends ballast water management strategies	2000 - 2004
Slovenia	Vessels	Vessel + Target species	Four step assessment of the bio-invasion process: donor port infection, journey survival, survival in recipient port and potential to cause harm in recipient port	Quantitative ~ qualitative	2	Identify and rank high and low risk ports as well as high risk target species	Annual	Vessel-to-vessel assessment from low to high risk ballast water before discharge for ballast water management purpose (DSS)	2001 - ongoing
Canada 1 (MacIsaac et al. 2002)	Vessels	Target taxa	species based tolerance, and taxa concentrations in no ballast on board vessels (NOBOB)	Quantitative	2+	Journey survival of target species		Estimate risk associated with NOBOB vessels entering the Great Lakes	2002
Finland (Bitis)	Port	Port	Environmental match between donor and source localities	Qualitative	2	Hazard assessment	Seasonal	Create baseline knowledge on the risks associated with NIS and shipping	2003 - 2005
EMBLA (Croatia)	Routes	Routes	Locality based region and species tolerances	qualitative	1	Hazard assessment	Seasonal	Recommend ballast water management plan for Croatia	2004 - 2005
Netherlands	TBA	TBA	TBA	TBA	TBA	TBA	TBA	Review and develop a ballast water risk assessment framework	2004 - ongoing
Canada 2	TBA	TBA	TBA	TBA	TBA	TBA	TBA	Review and develop a ballast water risk assessment framework	2005 - ongoing

References:

Australian Quarantine and Inspection Service (AQIS) 1994. Bio-Economic Risk Assessment of the Potential Introduction of Exotic Organisms Through Ship's Ballast Water. Report No. 6 of the Ballast Water Research Series, Australian Government Publishing Service, Canberra, 47 pp. - this was the first Australian move into ballast water risk assessment.

Gollasch, S 1996. Untersuchungen des Arteintrages durch den internationalen Schiffsverkehr unter besonderer Berücksichtigung nichtheimischer Arten. Diss., Univ. Hamburg; Verlag Dr. Kovac, Hamburg, 314 pp.

Gollasch, S & Leppäkoski E 1999. Initial risk assessment of alien species in Nordic coastal waters. 1-124. In: Gollasch, S. & E. Leppäkoski (eds.) Initial risk assessment of alien species in Nordic coastal waters. Nord 1999: 8. Nordic Council of Ministers, Copenhagen. 244 pp.

Hayes, K.R., and C.L. Hewitt, 1998. A Risk Assessment Framework for Ballast Water Introductions. CRIMP Technical Report 14, Division of Marine Research, CSIRO, Hobart. 75 pp.

Hayes, K.H., and C.L. Hewitt, 2000. Quantitative biological risk assessment of the ballast water vector: an Australian approach. pp 370 - 386, Pederson, J. (ed.), Marine Bioinvasions, Proceedings of the First National Conference, January 24 - 27. Massachusetts Institute of Technology, Sea Grant College Program, Boston, Massachusetts.

MacIsaac HJ, Robbins TC & Lewis MA 2002. Modelling ship's ballast water as invasion threats to the Great Lakes. Canadian Journal of Fisheries and Aquatic Sciences, 59: 1245-1256.

5.1 Conclusions

As recommended in last year's meeting report the progress made in relation to risk assessment was reviewed. A summary report expressing the groups findings was drafted for submission to the next meeting of IMO Marine Environment Protection Committee (MEPC) in Summer 2005. The following general conclusions can be made in relation to this ToR. A synthesis of the following section was prepared as a submission to IMO MEPC (Annex 5):

WGBOSV notes that the IMO Risk Assessment Guidelines are to support the International Convention on the Management of Ships' Ballast Water and Sediments. Specifically, Regulation A-4 that allows Parties to exempt vessels from compliance with ballast water management prior to discharge if an acceptably low risk can be discerned. WGBOSV discussed the application of risk assessment principles in relation to Regulation A-4 application. It was agreed that the risk assessment to support an exemption must be able to determine the likelihood of an unmanaged ballast water discharge causing at least one new species introduction into the receiving port. An additional requirement includes identifying whether the species is known or suspected to impair or cause harm to the environment, human health, property or resources to aid in determining whether the species is "harmful".

Under the IMO Ballast Water Management Convention an exemption can be granted for up to 5 years for a ship that operates within a specified transit between two or more ports. It was agreed that the only biologically defensible means to determine an evaluation of risk over this period would be to undertake a species specific exemption within a single bioprovince (defined below). We noted that states have to inform neighbour states when an exemption is granted. Concerns were expressed regarding whether or not neighbouring states will have the power to veto the exemption under the proposed convention.

Several types of risk assessment have been conducted on ballast water with varying scales of assessment and objectives. Following significant discussion, it was agreed that the goal to achieve Regulation A-4 would be "to determine the likelihood of unmanaged ballast water

discharge causing at least one new species introduction (defined either as discharge, establishment, or spread) into the receiving port". It was agreed that two types of risk assessment are likely to achieve the stated goal.

Environmental matching risk assessments compare environmental conditions in the donor and receiving port to determine if they are sufficiently different that any species found in the source port are unlikely to survive in the receiving port.

.1 In order for environmental matching to "determine the likelihood of at least one new species introduction (defined either as discharge, establishment, or spread) into the receiving port", the environmental conditions of the source region must represent the physiological tolerances of the species found in that region.

Species-specific risk assessments consider information about individual species and the environmental conditions in the receiving port.

.1 Species-specific risk assessments are most useful for a small suite of species and rapidly lose the ability to discern 'low-risk' scenarios with increasing numbers of species.

.2 Given that many species may cause harm when introduced to new locations and the uncertainties associated with the large numbers of native species that are present in a source region, we recommend that species-specific risk assessments should only be conducted where the source and receiving ports share a majority of native species. This will enable the focus of a species-specific risk assessment to be restricted to those species that are non-native in the source and receiving ports, and any unshared species that may be harmful.

A system is needed that documents biological separation between coastal regions. These regions are defined as *biological provinces* (bioprovinces1). We recognize that several classification systems exist and no single system is sufficient for all species (i.e. most are applicable to benthic species but not pelagic or neritic). Determination and agreement of an acceptable system for the purpose of ballast water risk based exemptions requires significant scientific discussion and should be fit for purpose.

Risk Assessment Application

When using environmental matching, a limited suite of these parameters are likely to be the prime drivers of invasion success, adding further variables can have little effect and can create "noise" around the signal. Examining the signal:noise ratio one can seek to identity the most

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1 Bioprovince = an area within which the animal and plant species show a high degree of similarity. Examples of the biological provinces of the world are provided in Annex 5. Additional expertise is required in order to finalize the provinces and boundaries between them. We note that all boundaries between biological provinces overlap. Ekman and Briggs used predominantly physical processes to define bioprovinces, but this should be updated to include latest work. Also consider demographic process, allee effects, low carrying capacity. How are geographic regions be defined? If one takes propagules and move them to a new location if there are allee effects the movement will erode the boundary between regions. As a result the marine border idea needs to be specified. Seasonal issues and impacts should also be included (e.g. harmful Algal Blooms may be seasonally a problem but not throughout the year). Biogeographic boundaries are integrating these complex processes. Is there gene flow across boundaries? Does it contribute to establishment of genetic material from elsewhere.

important versus less important variables required for the risk assessment. However, adding too many variables may make the signal become less obvious resulting in a lack of risk resolution.

Some environmental overlap exists between all bioprovinces based on two relevant environmental parameters (temperature and salinity). This suggests that environmental matching between a source province and a receiving port will represent high risk in virtually all instances.

.1 One exception is noted: comparison of freshwater [<0.5 psu] and fully marine [>30 psu] environments. This exception will require a more detailed risk assessment outlined below.

Therefore, in reviewing the use of both types of risk assessment, we recommend that:

.1 Neither environmental matching nor species-specific risk assessed exemptions under Regulation A-4 are scientifically justified for voyages that start and end between contiguous or non-contiguous biological provinces with the exception below.

.2 Regulation A-4 exemptions should only be based on:

a) environmental matching risk assessments between freshwater [< 0.5 psu] and fully marine [> 30 psu] environments,

b) species-specific risk assessments for voyages that start and end within the same biological province.

Risk Assessment Method

Environmental matching risk assessment

.1 Environmental matching risk assessment (between freshwater and marine environments) should include seasonal comparisons of salinity, taking into account:

a) depth stratification,

b) distance to fresh/marine water bodies,

c) tidal and anthropogenic influence on salinity regime,

d) seasonal freshwater influx.

.2 Environmental matching risk assessments (between freshwater and marine environments) should include an assessment of native, cryptogenic or non-indigenous species, taking into account:

a) species that require freshwater and marine environments to complete their life-cycle, including species migrating between waters of different salinity regimes, i.e. anadromous (e.g. Sea Lamprey) and catadromous (e.g. Chinese Mitten crab) species,

b) species that are capable of surviving in both freshwater and marine environments.

.3 Species specific risk assessment is applicable for situations within biological regions, but port to port environmental matching is important when used between biological regions where there is a different species distribution.

.4 It was also discussed whether or not environmental matching will work with species that have resting stages.

.5 Low resolution information on receptor ports and broad data on tolerances for possible invaders complicate the task of risk assessment.

.6 Ship transit information is available from e.g. Lloyds of London, but this does not indicate where the ballast water originates because there are no records of ballasting and discharge.

Species-specific risk assessment

.1 Species-specific risk assessment (within a biological province) should identify:

a) the presence of all non-indigenous species (including cryptogenic species) in the ports or locations for which the exemption is sought,

b) the difference between non-indigenous species (including cryptogenic species) in the donor and receiving ports or locations,

c) those non-indigenous species (including cryptogenic species) that may impair or damage the environment, human health, property or resources.

d) those rare instances of native species in the source port not present in the receiving ports that impair or damage the environment, human health, property or resources.

.2 Species-specific risk assessment should be conducted on:

a) non-indigenous species (including cryptogenic species) that are present in the donor port or locations but absent from the receiving port or location; or

b) a list of actual or potentially harmful non-indigenous species (including cryptogenic species) agreed between the affected parties.

c) a list of harmful native species agreed between the affected parties.

.3 Species-specific risk assessments may estimate various events in the process of biological invasions. The two events recommended below are least sensitive to uncertainty - either of these should be used:

a) discharge of living organisms in the receiving ports or locations,

b) completion of the species' life-cycle in the receiving ports or locations.

.4 Species-specific risk assessments may consider multiple species. Exemptions should only be granted for assessments that consider ALL risk-assessed species as low risk.

.5 For many species the Australian risk assessment approach delivers helpful data but as has been demonstrated by the target species Crassostrea gigas the risk assessment results do not always correspond with observations. The model indicates that C. gigas would be able to grow north of Brisbane, but observations indicate it does not grow in this area. On the other hand the model results show unfavourable conditions for growth in Tasmania, however, C. gigas grows well there. As a result extreme values of tolerance need to be considered.

Parties considering exemptions should consult any State that the Parties determine may be adversely affected by the species included, or explicitly excluded, in the risk assessment.

Other Considerations

Risk based exemptions should be reviewed every 12 months and no later than 24 months because of the current rate of invasions in many regions of the world (e.g. a newly introduced species was recorded every 7 months in the North Sea and adjacent water bodies since 1950s).

Provision for rapid [< 14 days] suspension, cessation or immediate review of the exemption should be made for circumstances such as:

.1 outbreaks or infestations of harmful aquatic organisms (including algal blooms) or pathogens in the donor port,

.2 detection of new non-indigenous species (including cryptogenic species) in the donor port,

.3 new evidence of harmful behaviour by any species in the donor port,

.4 significant and enduring change in environmental conditions in the donor and/or receiving ports or locations (e.g. diversion of fresh or saline water flow, new warm effluent discharge of e.g. power plants).

Bio-geographic considerations associated with natural dispersal, oceanographic connectivity between locations, the distribution of known introduced marine pests and operational limitations of ships operating on "regional routes" must be considered when developing risk assessment approaches further.

5.2 Recommendations

- WGBOSV recommends that ICES consider submitting their findings in relation to risk assessment to IMO as an ICES Submission to MEPC53 (July 2005) (Annex 5).
- Recognising that risk assessment requires information about species distribution in coastal and port waters of ICES member countries, a sampling or monitoring strategy is needed. We propose to review existing or developing sampling and monitoring strategies for non-indigenous species and recommend possible actions.

6 Review on the status of ballast water research (ToR d)

6.1 Overview

In order to ease the collection of information relevant to this ToR the group has developed a new "National Report" format (Annex 7). ICES is requested to consider and approve the new report format. WGBOSV hopes that the submission of National Reports for future meetings will have the additional advantage of enabling standardised submission of information by members only able to participate by correspondence. The National Reports would especially facilitate the compilation of information relevant to this ToR. The format of the National Reports was discussed intersessionally and Finland and Sweden volunteered to prepare relevant reports based upon the draft National Report format for the groups consideration at the meeting (Annex 8 and 9). A National Report was also submitted by Spain and New Zealand during the latter part of the meeting (Annex 10 and 11). It should however be noted that the National Report format was changed at the meeting.

The Chair thanked Finland, New Zealand, Sweden and Spain for the preparation of the National Reports. These two examples facilitated the discussion on the National Report format at the meeting. A National Report format was agreed at the meeting and should provide information on (Annex 7):

- **Transport Vectors**

- Results of ongoing research project(s), i.e. project title, host institute, contact details, co-ordinator, project duration, key objective(s), web site if available
- Planning of new research project(s), web site if available
- Biology, treatment, sampling, legislation/regulations relevant to invasion vectors:
  - Ballast Water
  - Hull Fouling
  - Sediments
  - Sea Chests
  - Others (see ICES CRR 271 – Vector Pathways and the Spread of Exotic Species in the Sea)
- **Invasive Species Management**
  - Eradication Programmes
  - Management and Control of invasive species
- Risk Assessment Approaches
- Occurrence of New Ship-mediated Introduced Species

TAXON	YEAR OF FIRST RECORD	LOCATION OF FIRST RECORD	POSSIBLE INTRODUCTION VECTOR*	INVASION STATUS**	REFERENCE
…					

* Duplication with WGITMO report if the vector is unknown
** When spreading see details in Impact Section

- **Impact of Introduced Species**
  - Economic (quantify if possible)
  - Ecological
- **Other Relevant Information**
  - Proactive monitoring
- **References**

6.2 Risk Assessment

A summary of risk assessment approaches relevant to ballast water is given above.

6.3 Ballast Water Treatment

Since last years meeting report no major new technological achievement has been made with regard to ballast water treatment. Four German projects, of which two are finalised, and the completed EU MARTOB project considered various treatment technologies with the aim to assess their use for ballast water treatment onboard ships. Two projects (one German and one Dutch) are currently developing test protocols for type approval of ballast water treatment systems and will also develop methods aimed at assessing the viability of organisms after water treatment. The Ballast Water Treatment R&D Directory (http://globallast.imo.org/research), produced by the GloBallast Programme, provides a comprehensive resource in support of this ToR.

Presentations were made at this meeting regarding methods of testing ballast water treatment systems. Emphasis was given to the importance of prototype testing and for this testing to be carried out under realistic conditions. Much discussion was had over the test water characteristics and the experience of different projects such as the ETV program and the German study of mechanical separation techniques was very useful. The problem of introducing surrogate species into the test facility and then representatively sampling them was discussed. Other presentations were given regarding a project to identify "surrogate species" for use in such tests and also an overview of the use of flow cytometry during ship based testing and monitoring.

In summary, it seems that promising treatment systems capable of meeting the IMO ballast water discharge standard will (see Regulation D-2 of the IMO Ballast Water Management Convention) comprise of at least three components:

- mechanical removal of larger organisms by e.g. filtration or hydrocyclone,
- application of technologies to render harmless smaller (phytoplankton) organisms by e.g. the use of UV-radiation, and
- the use of "active substances" to meet the bacteriological standard as set forth in the IMO Ballast Water Management Convention. Here, several chemical formulations are tested for the application in ballast water treatment.

However, concerns have been expressed at meetings of the IMO MEPC regarding the use of active substances. WGBOSV suggests applying risk assessment tools to identify "high risk" ballast water. The use of active substances may then be limited to treating high risk ballast water and by doing so will keep the use of such substances to the essential minimum.

6.4 Research initiatives on biological invasions

Research initiatives on biological invasions and their introduction vectors are increasing on a global scale. The groups attention was drawn to ongoing projects in Europe. Some of these projects have been dealt with in last years meeting report and are copied into this report for reasons of comparison:

6.4.1 Nordic-Baltic Network on Invasive species (NOBANIS)

NOBANIS continues to develop a network of common databases encompassing national and regional specialist databases in the Nordic/Baltic countries into a common portal, with the objective of harmonizing invasive aquatic species related data, information and knowledge in the region. NOBANIS will provide a tool for exchanging information on invasive alien species, their impacts on biological diversity and the cultural landscape as well as experiences with eradication or control of invasive alien species from Greenland to Northern Russia and from Northern Norway to Germany and Poland. NOBANIS will provide administrative tools for making the precautionary approach operational in preventing the unintentional dispersal of invasive alien species and mitigating adverse effects of invasive aquatic species on biological diversity and the cultural landscape. NOBANIS will include searchable lists and inventories of alien species, a catalogue of experts on alien species, species accounts, species distributions and recommended preventative, eradication and control measures. The lists of introduced species in NOBANIS will be used to identify species that are invasive at present and species that may in the future become invasive. NOBANIS will also provide the foundation for the future development of an early warning system for invasive alien species. It will be possible to extract information from NOBANIS for fact sheets for dissemination to authorities, specialists, the news media and the general public. NOBANIS will establish a network for cooperation between competent authorities of the region and contribute to implementing recommendations from CBD's COP6 to establish regional cooperation to aid in eradication, control and mitiga-

tion of ecological effects of invasive alien species. The project Internet homepage is http://www.sns.dk/nobanis/.

6.4.2 Assessing Large Scale Environmental Risks with Tested Methods (ALARM, EC FP6 Integrated Project)

The strategic objectives of the integrated project ALARM, funded for 2004-2009 under the European Community Sixth Framework Programme, are to:

- develop an integrated large scale risk assessment to terrestrial and freshwater biodiversity: including risks consequent on climate change, environmental chemicals, biological invasions including pathogens, rate and extent of loss of pollinators;
- establish socio-economic risk indicators related to the drivers of biodiversity pressures; and
- develop a network that is consistently thinking, interacting & investigating on a continental scale.

The strategic objectives of the invasion module of the project are to:

- assess concurrently both the risks (e.g. likelihood of establishment and naturalisation) and the impacts (ecological and economic consequences) of invasive species
- incorporate environmental, historical, cultural, and biogeographic data into assessments of the risks and impacts of invasions
- introduce a hierarchical perspective of ecosystem vulnerability by examining invasions at local and regional scales
- undertake a multidisciplinary approach, that involves stakeholders, ecologists, statisticians, modellers, and economists, to the problem of ecosystem vulnerability to invasions.

The team of Zoological Institute in St. Petersburg is responsible for coordination of relevant research in the ALARM sub-module on biological invasions in freshwater and estuarine ecosystems (details are available at http://www.zin.ru/rbic/).

6.4.3 Delivering Alien Invasive Species Inventories for Europe (DAISIE)

The project was launched with a kick-off meeting in February 2005. Effective control of invasive alien species has been hampered by a) the lack of monitoring for alien species at frequent enough intervals in regions of concern; b) a means to report, verify the identifications, and warn of new sightings; and c) risk assessments that predict the likelihood of a particular species becoming invasive. Europe has yet to establish a programme with the primary goal of detection, quantifying the possible risk, and warning managers before a respective alien species spreads beyond its point of initial introduction. Such a programme should provide:

- a warning system to alert regional managers,
- an inventory of alien species against which invasive alien species can be determined,
- a European information dissemination system,
- an early detection and monitoring system for alien species.

In response to these requirements, DAISIE will deliver a European “one-stop-shop” for information on biological invasions in Europe. It will bring together:

- The European Alien Species Expertise Registry: a directory of researchers and research

- European Alien Species Database: including all known naturalized alien species in Europe
- European Invasive Alien Species Information System: descriptions of all naturalized alien species known to be invasive in Europe
- Species Distribution Maps and Spatial Analysis: Distribution maps of all invasive alien species in Europe known or suspected of having environmental or economic impacts.

DAISIE will be a pivotal instrument in developing a Europe-wide strategy that encompasses both the geographical scale of the problem and unites the study of different taxa in marine, freshwater and terrestrial environments. DAISIE will address the need for a regional network of invasive alien species information. With direct access to national knowledge bases throughout Europe, those addressing the invasive alien species challenge could easily obtain data on which species are invasive or potentially invasive in particular habitats, and use this information in their planning efforts.

6.4.4 AquAliens

The Swedish EPA decided in 2002 to start the research programme "AquAliens - Aquatic alien species - where and why will they pose a threat to the ecosystem and economy?" (http://www.aqualiens.tmbl.gu.se). The programme is scheduled to run for five years and is built up of eight different projects distributed among four different universities at Göteborg, Lund, Stockholm and the Swedish University of Agricultural Sciences (at Uppsala and Umeå) as well as scientists at the National Board of Fisheries (at Öregrund and Drottningholm).

The main emphasis is to develop tools for risk assessment / quantitative analysis and to use these for the different organism groups and types of waters, including heterogeneity in space and time as well as stochastic events. The programme encompasses different organism groups for which patterns in characters and tolerance ranges for different abiotic variables will be studied, as will the ecological impact of the different species and which types of waters are most vulnerable. The vulnerability of different waters will also indirectly include the risks posed by discharges from ballast tanks and dispersal of hull fouling organisms, but the ballast water issue is otherwise not directly addressed. Species of direct economic importance are also addressed. There is also an interdisciplinary aspect including economics especially if economics can help in reducing the risks of new introductions. One item of vital concern is also to inform specific target groups (associations as well as local and regional authorities) and the general public of the problems introduced species may cause and to come up with recommendations to reduce the risks, partly in cooperation with museums and organisations.

In early summer 2004 there was a mid-term evaluation of the research programme. After a reapplication in late autumn 2004 money was guaranteed until May 2007, but some projects starting later will continue even after that. Studies on risks of establishment, dispersal and impact on different aquatic organism groups are being carried out, using both default-tree analyses and various population models.

6.4.5 PORT surveys in the Mediterranean Sea for ship-transported Alien organisms (PORTAL)

CIESM has launched the first Mediterranenan-wide port-survey program aiming at the collection of baseline data on alien species of targeted phyla (macrophytes, bryozoans, serpulids, hydroids, ascidians, molluscs and barnacles) inhabiting port and port-proximate manmade hard-substrates. Other organisms that might be disseminated by shipping from Mediterranean ports that pose a significant risk to human health (Vibrio cholerae, dinoflagellate cysts) are

also included. Scientists have been enlisted to sample 9 shipping ports, from Barcelona to Izmir, and two recreational marinas.

6.4.6 Algal introductions to European Shores (ALIENS, EC FP5 Project)

ALIENS is a multidisciplinary project on the ecological causes of the introduction, establishment and development of seaweed invasions on European shores. It addresses the genetic structure of various populations in Atlantic and Mediterranean Europe, and evaluates the economic impact of existing seaweed invasions on a European scale, comparing losses with costs associated with prevention and eradication. It also proposes a screening protocol for invasive macroalgae to be used in coastal zone management.

6.4.7 Disease Interactions and the Pathogen Exchange Between Farmed and Wild Aquatic Animal Populations (Fish, Mollusc and Crustaceans) – a European Network (DIPNET)

Following a specific call of research in support of EU policies, a contract based upon a proposal co-ordinated by IFREMER la Tremblade (France), was negotiated in Summer 2004. The project is a Concerted Action, aiming to integrate relevant data and information from diverse sources forming the factual basis for policy development, and to provide specialists and stakeholders a joint forum for exchange and debate.

The Workpackages include:

- Review of scientific information and data on disease interactions
- Risk assessment and modelling
- Epidemiology of diseases in wild fish and shellfish
- Network infrastructure and dissemination of information
- Scientific co-ordination and project management

The project duration is 24 months.

6.5 Cooperation with IOC and IMO's Marine Environment Protection Committee (MEPC) and other bodies on matters of joint interest

6.5.1 IOC

Henrik Enevoldsen the IOC Project Coordinator of the IOC Science and Communication Centre on Harmful Algae expressed his interest in the findings of WGBOSV and noted that in the field of biological invasions IOC focuses specifically on harmful algal blooms.

6.5.2 IMO MEPC

The IMO Ballast Water Management Convention was approved by Imo in February 2004 – a major step forward to solve the problem of ballast water mediated species introductions.

WGBOSV input was provided to IMO MEPC in form of written submissions and oral statements by the Chair as a representative of ICES. The information made available was noted and appreciated by MEPC, especially by the Ballast Water Working Group. A key contribution here was prepared at the 2003 meeting of WGBOSV and dealt with numbers of organisms in unmanaged, i.e. unexchanged and untreated, ballast water. As a result the allowable organism numbers in the ballast water discharge quality standard of the IMO Ballast Water

Management Convention were re-negotiated with a more biologically meaningful and scientifically defensible result.

WGBOSV encourages all ICES Member Countries to consider signing the IMO Ballast Water Management Convention.

With appreciation WGBOSV notes that Stephan Gollasch was asked to represent ICES at MEPC52 and 53 and the intersessional meeting prior MEPC53 enabling independent statements outlining the findings of WGBOSV.

Currently guidelines are being developed to further the uniform implementation of the IMO Ballast Water Management Convention. Of particular interest to WGBOSV are the following guidelines.

Risk Assessment Guideline

WGBOSV commented on the current draft of the risk assessment guideline (MEPC52/2/4) and expressed appreciation of the work carried out by Norway in preparing this draft. WGBOSV hopes that its findings relevant to risk assessment based exemptions will support the development of the IMO Risk Assessment Guideline.

The group also reviewed Appendix 1 of the guideline entitled "Application Form to Port State". Here we recommend considering to add another section on "Port Information". This section could provide details on the presence on introduced aquatic species and an assessment of the potential harm for donor and recipient ports or region not managing ballast water between the two localities. WGBOSV believes this is key information when carrying out a risk assessment relevant to this guideline. For consistency reasons, we also suggest to use the term "harmful algal bloom" throughout the document (see section 4 of Appendix 1 in MEPC52/2/4).

Guideline for Approval of Ballast Water Treatment Systems

As reported in last years meeting report, the current lack of internationally accepted evaluation protocols for efficiency tests of ballast water treatment systems is a major problem. However, one test protocol suggesting Artemia salina as a surrogate species for various zooplankton taxa is in use for practical tests of candidate treatment techniques. A more comprehensive suggestion for type approval of ballast water treatment techniques is currently in preparation within the USEPA ETV consortium as reported at the meeting. A relevant protocol and guidelines are also currently being developed by IMO in an intersessional activity lead by the Netherlands.

The USEPA ETV consortium notes that the test data of ballast water treatment systems will have legally binding implications Therefore the test set-up is built with automation and control instruments to provide legally defensible data with huge data archives. The system also has built in alarms and contingency options, checklists and confirmation authorities. A comprehensive validation and baseline process in progress. An ETV test can be completed in a six week block.

Other WGBOSV comments regarding the type approval guideline for ballast water management systems (MEPC53/2):

- Currently land-based and ship-board tests are planned for approval tests. The group assumes that ballast water treatment systems when installed on different ship type and on individual ships may function differently. As a consequence, the test results may only be compared on a limited scale.

- Tests for the biological efficiency of candidate treatment technology (biotests) are necessary. WGBOSV recommends carrying out biotests for prototype testing in land-based facilities and onboard ships.

- WGBOSV also discussed the need for onboard biotests either as part of the type approval process or as part of the installation procedure for every piece of equipment. It was not agreed which of these was most appropriate, with some views seeing the onboard biotests as part of the type approval process, and others desiring a 'full-scale' land based test for type approval, followed by an onboard biotest following installation of every piece of equipment to ensure the proper function of the treatment systems.

- When carrying out biotests organisms may need to be added to the challenge water as naturally occurring densities of native organisms may not reach the required densities in the test water. In case organisms need to be added (surrogate species) this has to be done in a way that minimises the impact on the test organisms. It should also be noted that the surrogate species should be selected very carefully, i.e. native and non-toxic organisms should be selected. In case non-native species are selected, proper quarantine measures should apply to minimize the risk of a species invasion as a result from the tests.

- When samples are taken, the sampling points should be of consistent design. Relevant technical details should be provided by the guideline.

Guideline for Compliance Control Sampling

The logistical problem of sampling to determine compliance is not trivial. According to the draft sampling guideline large volumes of water need to be dealt with and it is assumed that larger volumes of water cannot be dumped into the bilge water system after sampling. However, sampled water may be pumped over board by e.g. using the back-flush pipes of ballast water treatment systems.

Other comments regarding the ballast water sampling guideline (BLG9/11/2):

- The provision in the draft sampling guidelines stating that sampling should only be undertaken where clear grounds exist that indicate the likelihood that a vessel is in non-compliance with the Ballast Water Management Convention, contradicts the Convention and should be deleted.

- WGBOSV recommends keeping all three sampling approaches, i.e. sounding pipe, manhole and discharge line sampling and leaving the decision of where to sample to the port state control authority. It should be noted that certain treatment technologies treat the ballast water upon discharge, i.e. in this instance the only recommended sampling point is the discharge line. However, in case of non-compliance the water and organisms therein have already been discharged during sampling. Once non-compliance has been proven this information may be made available to the next port of call of the vessel as a warning for the port state control authorities and the ship may also be sampled again when revisiting the port.

- When sampling via sounding pipes we recommend using pumps.

- When sampling the ballast water discharge line WGBOSV recommends sampling continuously until the entire tank volume is emptied assuming that species may concentrate in certain water depths. Sampling only part of the water column may miss patches of species.

- Microbial samples should be analysed immediately after sampling. Relatively short generation times of microbes and possible mortality in storage prior to analysis may have an impact even after a few hours. The group also notes that less than 1% of the microbial

taxa occurring in marine water may be cultured with standard technologies. As a result, culture methods should be selected according to the target taxa under consideration. As local environmental conditions such as salinity, particle load and temperature will guide the specifics of the method to be used (e.g. agar type, incubation temperature), there will not be direct compatibility in the widespread application of this protocol. What is crucial is that methods are internally consistent within a test.

- The number of heterotrophic bacteria suggested as a requirement for the influent water (104cells per ml) may be too high and may invalidate many land based tests. This is owing to the fact that only 0.1 – 1% of the bacteria present in the water may be cultured. Although 104cells per ml could be cultured from most waters reducing the requisite concentration of bacteria in the influent water to 103cells per ml will reduce the chance that tests of technology are invalidated simply because the natural concentrations of (culturable) bacteria were low. This lower limit should nonetheless provide an adequate assessment of the treatment technology.
- Prior to sampling there should be proof that the sampling system has been cleaned.

6.5.3 Global Ballast Water Management Programme (GloBallast)

The GloBallast Programme was finalised in December 2004. As a result, the GloBallast Programme Coordination Unit at IMO was unable to be represented at this meeting of the WGBOSV due to funding constraints. To obtain an update on the programme and/or specific information on the planned second phase of GloBallast (GloBallast Partnerships) visit http://globallast.imo.org in the first instance and contact Jose Matheickal at jmatheic@imo.org for further details.

6.5.4 ICES WGITMO

As invasion vectors may overlap there is a need for close cooperation between working groups that target intentional introductions with others focussed on unintentional introductions. WGBOSV noted with interest that the WGITMO Handbook of Invasion Vectors, where WGBOSV input and comments were delivered at last years meeting, was recently printed as ICES Cooperative Research Report No. 271.

6.5.5 PICES

Mark Wells (USA) attended the WGBOSV meeting representing PICES. He reported that the interaction with WGBOSV was largely informative. The attendance of ICES representatives at previous PICES Annual Meetings was much appreciated. He summarized the findings at the last PICES Annual Meeting in Honolulu in Fall 2004 (see Annex 14), where Stephan Gollasch attended to represent WGITMO, WGBOSV and ICES together with the ICES Secretary General, David Griffith. Session S5 entitled "Natural and anthropogenic introductions of marine species" was cosponsored by ICES and jointly convened by William P. Cochlan (USA/PICES), Yasuwo Fukuyo (Japan/PICES) and Stephan Gollasch (Germany/ICES).

The final oral presentation at the meeting was given by Stephan Gollasch outlining an introduction to the history, practices and work products resulting from the ICES efforts on the introductions of marine organisms. He concluded with a number of suggestions including the establishment of a PICES Working Group on Species Invasions (not limited to HABs), and the reciprocal attendance of PICES and ICES members at their annual meetings and working sessions. He urged PICES member countries to follow the 'ICES Code of Practice for the Introduction and Transfer of Organisms' when planning species introductions, and emphasised the need for both regional and global networks to most efficiently deal with biological invasions, given that an invasive species could originate from a non-PICES nation.

A close cooperation between ICES and PICES is of particular interest as many introduced species in ICES Member Countries originate from coasts of the Pacific Ocean. The groups attention was also drawn to the PICES Annual Meeting in Vladivostock, Russian Federation in September/October 2005 and the joint ICES/PICES meeting on "Marine Bioinvasions" in 2007, likely to be held in Boston, USA, and ICES input was strongly encouraged. ICES will fund the participation of Stephan Gollasch at the PICES Annual Meeting in Vladivostock where he will co-convene a session relevant to biological invasions.

6.5.6 International Commission for the Exploration of the Mediterranean Sea (CIESM)

Representatives of CIESM were unable to attend WGBOSV in 2005. CIESM activities relevant to biological invasions include the preparation of a series of reports published as a CIESM Atlas on non-native species introduced into the Mediterranean Sea, the convening of expert panels on ship-mediated transfer of species, and the launching of the basin wide program PORTAL (see below) on port surveys for alien species.

6.5.7 Baltic Marine Biologists (BMB)

Stephan Gollasch (Germany) represented the BMB working group "Non-indigenous Estuarine and Marine Organisms" (NEMO). NEMO was established in 1994 and is currently convened by Stephan Gollasch. NEMO will actively continue its work with the aim to further raise awareness relevant to biological invasions and to facilitate international cooperation in research initiatives along the Baltic shores.

6.5.8 ERNAIS

The importance of international cooperation on invasive species issue on both the regional (Pan-European) and sub-regional levels is well recognized by the European scientific community. Also, the European Strategy on Invasive Alien Species, adopted under the Bern Convention in December 2003, aims to promote the development and implementation of coordinated measures and cooperative efforts throughout Europe to prevent or minimize adverse impacts of invasive alien species, including regional and sub-regional cooperation in exchange of information. European cooperation relevant to aquatic species invasions resulted in the 2001 establishment of the European Research Network on Aquatic Invasive Species (ERNAIS), which currently includes more that 100 experts (scientists, managers and administrators) from 27 countries (searchable online ERNAIS experts database is available at http://www.zin.ru/rbic/projects/ernais/). Facilitation of international cooperation in research, scientific information exchange and management of aquatic invasive species in Europe and worldwide is a main objective of ERNAIS. In the long-term perspective an ERNAIS integration into the Global Invasive Species Information Network (GISIN) is aimed for.

Another objective of ERNAIS was of particular interest to WGBOSV – the planned early warning system for newly introduced aquatic invaders. ERNAIS plans an electronical journal with the working title "Biological Invasions in European Coastal and Inland Waters" which should be an applied journal focusing on invasions in European (geographic Europe) inland and coastal waters. This journal would provide the opportunity of timely publication of first records of biological invaders for consideration in risk assessment and other early warning systems. This journal will provide the opportunity to publish relevant technical reports and other accounts not publishable in refereed regular scientific journals.

6.6 Conclusions

The following general conclusions were made in relation to this ToR:

Overall

WGBOSV believes that its findings are of great value for groups or organizations such as the International Maritime Organizations' Ballast Water Working Group, IOC, BMB, CIESM, PICES and others. The participants felt that significant new levels of cooperation had been achieved both among ICES Member States and on a global level. There is a continued interest in co-operation with groups such as e.g. BMB, CIESM, IMO, IOC and PICES.

WGBOSV encourages all ICES Member Countries to consider signing the IMO Ballast Water Management Convention.

Ballast Water Treatment

Testing of ballast water treatment systems continues. However, it should also be noted that further details on ballast water treatment technologies currently being tested cannot be given due to patents pending.

It appears that any new ballast water treatment system is likely to involve a combination of technologies, for example, primary filtration or physical separation followed by a secondary biocidal treatment using e.g. UV or biodegradable "active substances".

WGBOSV noted the outcome of the R&D Symposium on ballast water treatment measures which was held in Singapore in May 2004 (2nd International Conference & Exhibition on Ballast Water Management) and expressed the view that similar conferences should be held in the future to stimulate cooperation and to avoid duplication of efforts.

A review of available technologies for ballast water treatment will be carried out at MEPC53 in Summer 2005.

Ballast Water Exchange

Ballast water exchange at sea is considered to be highly variable with regard to its biological effectiveness and should not be undertaken in most regional seas due to the water depth limitations (see IMO Ballast Water Management Convention). In shallower waters, an exchange of ballast water may have limited effectiveness; with a documented worst case scenario that after the exchange organisms are found in larger densities compared to organisms in the original water in the tank. Further, safety concerns were expressed regarding undertaking ballast water exchange at sea. Overall, ballast water exchange is seen as an interim solution until ballast water treatment technologies are available.

Public awareness

There has to be a continuous effort in order to maintain awareness. The group noted the growing ERNAIS network of experts in biological invasions, coordinated by Vadim Panov (Russia) and Stephan Gollasch (Germany). WGBOSV noted the development of ERNAIS and expressed interest in the planned electronical journal as an early warning instrument for first records of aquatic invaders which is currently lacking.

Port profiles

There is a clear need for port surveys as many of the first records of invasive species are from port areas. In addition species-specific risk assessment initiatives based upon the comparison of port biota will benefit from the knowledge of biological invaders in ports. The data obtained from these surveys could also be part of an early warning system on the occurrence of harmful aquatic species. WGBOSV suggests that existing port sampling protocols could be used as a starting point in order to encourage standardisation of methods.

Hull Cleaning

Hull cleaning carried out in ports and coastal waters was discussed as a potential introducing vector. WGBOSV noted that hull fouling is the dominating vector of species introductions in certain regions. Some countries have regulations with guidance as to how to carry out hull cleaning, others lack comparable instruments.

6.7 Recommendations

In order to ease the collection of information relevant to this ToR the group has developed a new "National Report" format (Annex 7). National Reports are only useful if there is a commitment to produce this “globally and annually” and make it generally available. The key issue here is consistency and every effort should be made to submit information either at the meeting or by correspondence. ICES is requested to consider and approve the new report format.

WGBOSV suggests preparing a species spreadsheet documenting new findings of introduced species to be updated annually.

WGBOSV highlights the need to continue discussing case histories of selected introduced species.

It was recommended that the WGBOSV should continue to support the Ballast Water Working Group of the International Maritime Organizations Marine Environment Protection Committee (IMO MEPC BWWG). It was recommended that WGBOSV should contribute to the development of the Guidelines currently being worked on in the Ballast Water Working Group at MEPC.

As concerns have been expressed at meetings of the IMO MEPC regarding the use of active substances for ballast water treatment WGBOSV suggests applying risk assessment tools to identify "high risk" ballast water. The use of active substances may then be limited to treating high risk ballast water and by doing so will keep the use of such substances to the essential minimum.

Given the TBT ban by 2008 and the potential implications for hull fouling, including that on smaller vessels, the group felt that this could become an issue of increasing importance in ICES member countries. The group recommends to carry out an evaluation and review of existing and emerging hull fouling regulations and treatment options.

It is recommended that this TOR should remain on the agenda of WGBOSV to

- continue its global review of shipping vectors through the participation of representatives from ICES, IMO, IOC, CIESM, BMB and PICES Member States and of invited experts.
- critically review and report on the status of ballast water research with an emphasis on new developments in ballast water treatment technology and its evaluation.

7 Responses for the CONSSO Issue Group on Sustainable Shipping (IGSS) (ToR b)

A ballast water management strategy for the North Sea has been developed by the Issue Group on Sustainable Shipping (IGSS) of the Committee of North Sea Senior Officials’ (CONSSO) (Annex 6). The strategy recognizes that ballast water treatment on vessels will eventually be the preferred management method. As treatment technologies are not yet available ballast water exchange is recommended as an interim measure. The recommended strategy is based upon ballast water exchange for vessels sailing through oceanic waters. For vessels unable to exchange ballast water or not sailing through oceanic waters, the port state or port states may

designate areas for ballasting operations or identify areas where ships need to apply additional measures, as outlined in the Annex to the IMO Convention.

The Ballast Water Management Strategy for the North Sea/North West Europe was introduced to the group through a paper and a presentation submitted by Brian Elliott of the Maritime and Coastguard Agency in the United Kingdom. These outlined:

- the background to the development of this strategy;
- its links to the IMO Ballast Water Convention;
- the aims and objectives of the internationally funded scoping study being undertaken by Det Norske Veritas (DNV); and
- the work programme being suggested by DNV.

Egil Dragsund from DNV then outlined the team being employed to undertake this work.

The appropriateness of each management option to the waters of North West Europe will then be addressed by the study by calculating the risk reduction of each measure. The project will then recommend a suite of management measures with an analysis of the consequences of each option in terms of risk reduction and the management / monitoring burden on each state, so that policy makers can identify the most appropriate management option for the strategy.

7.1 Review and comment on a preliminary version of the Scoping Study

The above mentioned scoping study to obtain technical advice on how this strategy should be implemented has been instigated by the Maritime and Coastguard Agency (MCA) in the United Kingdom, on behalf of a consortium of countries who are co-funding the project, namely: Belgium, Germany, the Netherlands, Norway, Sweden and the United Kingdom.

This Scoping Study will:

- identify the present risks to the region, and within the region, of non-indigenous species invasion and movement through ballast water and sediments;
- identify the concerns of each State in the region;
- recommend a geographic region for the strategy; and,
- identify the various management measures that can be adopted to reduce the risks of non-indigenous species invasion through ballast water in the region.

Tenders were received for this project in November 2004 and were evaluated by the consortium in December 2004. This evaluation has identified a successful tenderer, however due to administrative delays and problems the contract was not awarded to DNV until 17th February 2005. It is expected that DNV will be able to submit a draft final report by the end of May or the beginning of June 2005. At that stage CONSSO, OSPAR (BDC) and their Member States will have an indication of how to develop the strategy further, and be able to assess the implications of the future workload of such a strategy and its cost.

For OSPAR BDC to be able to recommend a way forward for the development of a Ballast Water Management Strategy for North West Europe, the scoping study will have to be reviewed and its findings agreed. The United Kingdom has proposed the following procedure for BDC to agree the findings of the scoping study report and develop a paper for the OSPAR Commission Meeting in Dublin in late June on the future development of this strategy:

- The United Kingdom will circulate the report when it has been submitted and agreed by the funding partners.
- The United Kingdom proposes to invite OSPAR delegates (or national experts) to the end of contract workshop, where a presentation of the findings of the project can be given by the successful contractors. Any remaining issues or concerns can be discussed at this workshop and a consensus on the way forward can be achieved. This meeting is a pre-requisite of the contract and would probably be held in the United Kingdom. A correspondence group could also be set up for individuals who cannot attend such a meeting, or to discuss issues that arise prior to such a meeting.
- The United Kingdom will write up the findings of such a workshop and, after circulation to BDC Members for comment, submit it to the OSPAR Commission Meeting.

This process aims to provide the OSPAR Commission Meeting with a report which has been agreed by all Contracting Parties, or if that is not possible, one which identifies clearly the areas of disagreement. The OSPAR Commission Meeting can resolve any remaining issues and recommend the way forward so that a finalised strategy can be developed in time for the Ministerial Statement in April 2006.

The planned response for the CONSSO Issue Group on Sustainable Shipping (IGSS) report was originally planned for consideration by WGBOSV 2005 but owing to delayed project start should be considered at WGBOSV 2006.

The following synopsis of the presentation surrounding development of the Ballast Water Management Strategy for the North Sea/North West Europe reflects the discussions at the meeting and the following conclusions were agreed:

7.2 Appropriate geographical approach for ballast water management strategies

WGBOSV discussed the geographical approach and came to the following conclusions:

- The boundaries set by the Convention (ballast water exchange 200 nautical miles (nm) from the baseline and in waters of 200 meters depth – or 50nm/200m if this cannot be achieved) are primarily political boundaries with little or no universal biological or geographical significance. Therefore, the scoping study should consider boundaries based on the influence of coastal ecosystems in the North Sea and North West Europe. It was recognized however that these geopolitical boundaries should still be used as a base for strategy and management decisions, as they follow the jurisdiction limits of many coastal states. Information on the influence of coastal ecosystems should then be integrated with these boundaries to help formulate appropriate management measures.
- The group felt that there were very few areas that could be designated as ballast water exchange areas within 200nm in NW Europe, however there are some areas of the Deep Norwegian Trench that could be considered, however this issue would be incorporated in Norway's comments and concerns being submitted to the Scoping Study.
- **Can near-shore areas for ballast water exchange be identified?**
  WGBOSV addressed this question by modifying it in a "best practice mode": Where will ballast water exchange do the least harm, i.e. identify sensitive versus less sensitive areas? Ballast water exchange should be kept to the essential minimum in protected water bodies. However, according to IMO's initiative to protect particular sensitive sea areas (PSSA) from adverse effects of shipping most of Europe's seas are identified as PSSA's already. Measures not permitted in PSSA's do so far not include provisions on ballast water operations. However, PSSA's clearly identify the uniqueness of certain seas.

With today's knowledge WGBOSV felt that in shallower waters no ballast water exchange zone can be identified in European coastal waters.

7.3 Scientific advice for ACME regarding the IGSS for the "post-scoping study" phase

WGBOSV discussed the work for the post scoping study phase and came to the following conclusion:

- The group seemed content with the objectives of the scoping study and were very eager to be kept informed of the findings of the Scoping Study. Therefore members were subsequently invited to comment on the first draft of the project in Summer 2005, either by correspondence or at the end of workshop meeting, which is being proposed for either the 31st of May or the 1st June 2005 in London.

Brian Elliott (United Kingdom), the overall coordinator of the scoping study, highlighted additional questions for discussion:

What are the management options in short sea and/or coastal shipping?

For vessels entering European coastal seas a big problem exists – the 200nm distance and 200m depth exchange limit is not applicable as routes are too short and/or in shallow waters and a deviation/delay of the vessel is unacceptable. A solution here may be a management option based on route based risk assessment granting exemptions.

Are risk assessment based exemptions the solution?

Initial discussion suggested that route based risk assessment has a future here. Environmental matching is not the answer within the biological province, in e.g. the North Sea, therefore a species based risk assessment is preferred.

More extensive discussions were had over the most appropriate type of risk assessment for this scoping study. The group felt that the risk assessment system employed should be more complex then just a simple port to port system based on physical or biological similarity. It was recommended that the strategy should adopt a species orientated risk assessment between ports concentrating on ‘headline’ non-indigenous species and those native species that are shown to cause harm. The importance of regular monitoring and updating baseline information throughout the region was also stressed during these discussions.

7.4 Recommendations

- The response for the CONSSO Issue Group on Sustainable Shipping (IGSS) report was originally planned for consideration by WGBOSV 2005 but owing to delayed project start should be considered at WGBOSV 2006.
- WGBOSV recommends that this effort needs support in terms of technical review of the draft scoping study and advice during post scoping period.

8 Code of Best Practice for Ballast Water Management (ToR c)

Ballast water management recommendations of e.g. USA, Russia, HELCOM, OSPAR via IGSS/CONSSO as well as the relevant IMO recommendations were summarised in last years meeting report. A world-wide summary of ballast water regulations was also provided.

At this years meeting the group discussed the following items relevant to ballast water management:

- **Phase out of ballast water exchange**
  Ballast water exchange is seen as an interim solution as scientific studies have proven its limited effectiveness and the water depth and distance from shore requirements as set forth in the IMO Ballast Water Management Convention cannot be met in inner-European shipping.

- **IMO Review of best available technology**
  The group looks forward to the results of the review of best available technology for ballast water treatment to be carried out at IMO MEPC53 in July 2005.

- **Applicability of IGSS scoping study findings within ICES Member Countries**
  The group believes that the findings of the scoping study team should be considered at next years meeting to assess whether or not the findings can be applied to all ICES Member Countries.

8.1 IMO

A summary of the IMO Ballast Water Management Convention was provided by Dandu Pughiuc by correspondence and was already noted in last years meeting report. He highlighted especially the current work on the guidelines related to the Ballast Water Management Convention.

8.2 HELCOM

As reported in last years meeting report Finland was nominated as the lead country to develop a HELCOM regional action plan regarding ballast water management in cooperation with the HELCOM Secretariat, GloBallast Programme and a Correspondence Group. The key objective of this initiative is the rapid and harmonized implementation of the IMO Ballast Water Management Convention. The GloBallast risk assessment approach may be taken as a base document to prepare a Baltic risk assessment initiative to design a ballast water management regime for each given port.

As the Baltic does not enable ballast water exchange according to depth limitations outlined in the IMO Ballast Water Management Convention the only option is to require ships on oceanic voyages to exchange the ballast before entering the Baltic. Ballast water releases in inner-Baltic shipping, which represents the majority of shipping in the Baltic, may also pose a risk to the environment, especially when connecting freshwater ports. Therefore, the development ballast water treatment measures should be promoted.

WGBOSV noted the findings of a recently held workshop on ballast water management, co-sponsored by HELCOM. A summary of this workshop is provided below and the full summary report is attached as Annex 13.

8.2.1 Report of the BSRP/HELCOM/COLAR Workshop on "Ballast water introductions of alien species into the Baltic Sea" 21-25 February 2005, Palanga, Lithuania

The workshop objectives aimed to:

1) assess the applicability of risk assessment and port baseline survey methodologies developed under the IMO GloBallast and other relevant projects for the Baltic Sea;

2) evaluate the research capacity, technical potential and financial resources needed for the risk assessment and the port baseline surveys;

3) elaborate common principles for the monitoring system of invasive species in the Baltic Sea;

4) develop a common information system for the Baltic Sea supporting the implementation of the IMO Ballast Water Management Convention.

HELCOM action to address ballast water issue

The Workshop discussed the draft HELCOM Recommendation "Measures to address the threat of invasive species transported via the ballast water of ships" (October 2004) elaborated in accordance with the IMO's BWMC. The Workshop welcomed the draft HELCOM Recommendation as being very valuable for the organisation of work to prevent ballast water mediated introductions of invasive alien species.

The Workshop also agreed that because of the geographical characteristics of the Baltic Sea (a mean depth of 55 metres; all areas deeper than 200 m are within less than 50 nautical miles to the nearest land) the requirements of the BMWC (Regulation B-4, paragraphs 1.1. and 1.2.) for conducting ballast water exchange cannot be met in the Baltic Sea. An evaluation of the suitability of designating areas in the Baltic where a ship may conduct ballast water exchange, in accordance with Regulation B-4, paragraph 2, must be made by the port states. Ballast water exchange within the Baltic may prevent the spread of freshwater invasive alien species from one freshwater Baltic port to another. However, the ballast water exchange should not be considered as the only effective measure for managing ballast water within the Baltic. Development of risk assessment methodology and other tools (biological surveys, monitoring, early-warning systems, appropriate treatment of ballast water) is extremely important for prevention of ballast water mediated introductions of invasive alien species.

The Workshop agreed that the internal Baltic ship traffic is not of primary interest for the risk assessments because alien species once settled in some part of the Baltic, are able to spread through natural means, if the environmental conditions (salinity, temperature, etc.) are acceptable, as well as through ballast water and other human-mediated vectors. Possibilities are very limited for effectively preventing secondary introductions through ballast water within the region and thus limit the advantages of using risk assessment procedures. However, there could be certain cases where the internal shipping risks should be analyzed, for example when extraordinary measures are required to prevent the spread of a particularly harmful species (such as a pathogen or toxic algae).

Common principles of the monitoring system of invasive species in the Baltic Sea

The Workshop took note of the information on the HELCOM data and assessment strategy and the ongoing review of the HELCOM COMBINE monitoring programme. The Workshop also noted that the input to the review process should be given via national contacts to MONAS and MON-PRO.

The Workshop indicated that it is important to report to HELCOM on findings of alien species at national monitoring stations which presently are not included into the HELCOM COMBINE system (e.g. county's monitoring, national fishery institutes' surveys, etc.).

For management of ballast water it is important to include other groups that are currently not monitored (e.g. pathogenic microflora, meiobenthos, resting stages, marine fungi, etc.). Special attention should be paid to the groups which are listed in the BWMC [Ballast Water Performance Standard (Regulation D-2)]. A common methodology should be developed for the monitoring of those groups.

Proposals for common information system for the Baltic Sea

The Workshop agreed that there is a need for a common information system for the Baltic Sea States supporting the implementation of the IMO Ballast Water Management Convention. The system should support risk assessment activities and decision making in Baltic Sea ports. It should also serve as a data source for other regions that may be potential recipients of Baltic Sea species. The system should also provide a basis for exchanging information and feed into an early-warning system.

The common information system should include:

- an early-warning system on new introductions and spread of invasive alien species and warning for outbreaks of harmful organisms which may affect the suitability of ballast water uptake (BWMC Regulation C-2);
- information for Baltic Sea countries and recipient countries outside the Baltic Sea region about the status of alien species etc.;
- information on water quality and abiotic conditions in Baltic harbours;
- a list of targeted or most unwanted species.

Whenever possible, such a common information system should benefit from the recent European initiatives, such as the FW6 IP ALARM and FW6 STREP DAISIE as well from the information system already existing in the Baltic Sea region, such as the Baltic Sea Alien Species Database, NOBANIS, etc.

The Workshop agreed that there is a need for an additional workshop in the end of 2005 – beginning of 2006 in order to:

- Agree on final risk assessment procedures;
- Develop a common structured procedure for species specific assessment to be used in developing a "black list" of harmful or potentially harmful alien species that are especially undesirable to be introduced to the Baltic Sea;
- Develop principles for an early-warning system concerning ballast water uptake in certain areas such as areas known to contain outbreaks of toxic (algal) blooms (BWMC regulation C-2)].

8.3 USA: Status of Ballast Water Legislation in the United States

The following update on the status of ballast water legislation in the United States was provided by Roger Mann (USA).

Mandatory ballast water exchange is currently required of vessels visiting U.S. ports. Regulation of ballast water discharge after treatment to reduce or eliminate introduction of contained biota remains a subject of active debate but no focused federal legislation has been passed to date. Ballast water treatment was addressed in a draft amendment to the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (submitted to the 107th Congress, Second Session of the US House of Representatives, September 18, 2002 as House Resolution H. R. 5396; and to the 108th Congress, First Session of the US Senate, February 19, 2003, under "Title I —Aquatic Invasive Species Management, Sec.104." Prevention of introduction of aquatic invasive species into waters of the United States by vessels" in the House version; and "Title I —Prevention of Introduction of Aquatic Invasive Species into Waters of the United States by Vessels" in the Senate version. Continuing awareness of the need to improve upon ballast water exchange has resulted in submission of a bill focused on ballast water legislation for consideration in 2005 (Senate Bill number 363, 109th Congress). The Bill proposes "To

amend the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 to establish vessel ballast water management requirements, and for other purposes." The Act may be cited as the "Ballast Water Management Act of 2005."

Subsequent text in the Act addresses the option of vessels to discharge ballast water to reception facilities that meet standards prescribed by the Secretary, in consultation with the Administrator of the Environmental protection Agency.

8.4 Conclusions

The following general conclusions can be made in relation to this ToR:

- The Code of Best Practice for Ballast Water Management initiative should not be limited to ICES member countries.
- An overlap with the relevant work of certain countries and NGOs, such as e.g. IMO, HELCOM and OSPAR via the Committee of North Sea Senior Officials (CONSSO) / Issue Group on Sustainable Shipping (IGSS) needs to be avoided.

8.5 Recommendations

- WGBOSV recommends working intersessionally to prepare a draft ballast water management code for review and finalization at next years meeting. WGBOSV recommends also to use the CONSSO report as a basis for a draft Code of Best Practice for Ballast Water Management.
- The outcome of the above mentioned initiatives developing ballast water management guidelines, especially the IGSS/CONSSO Scoping Study, should be considered when drafting the Code of Best Practice for Ballast Water Management.

9 Progress with Terms of Reference

9.1 Risk assessment approaches dealing with ship mediated invasions (ToR a)

- Completed
- New risk assessment projects are underway in e.g. Canada, Finland and the Netherlands. WGBOSV recommends revisiting this ToR once new information becomes available.

9.2 Responses to the CONSSO Issue Group on Sustainable Shipping on the Scoping Study on Ballast Water Management (ToR b)

- The response for the CONSSO Issue Group on Sustainable Shipping (IGSS) report was originally planned for consideration by WGBOSV 2005 but owing to delayed project start should be considered at WGBOSV 2006.

9.3 Code of Best Practice for Ballast Water Management (ToR c)

- Progress on this matter was made by reviewing the outcomes of related documents and workshops held prior to WGBOSV 2005
- An overlap with the relevant work of certain countries and NGOs, such as e.g. IMO, HELCOM and OSPAR via the Committee of North Sea Senior Officials (CONSSO) / Issue Group on Sustainable Shipping (IGSS) needs to be avoided.

- It is recommended that this ToR should remain on the agenda of WGBOSV and to consider the outcome of relevant initiatives prior to WGBOSV 2006.
- It is anticipated that a draft code will be prepared at the 2006 meeting of WGBOSV.

9.4 Review and report on the status of ballast water research including ballast water treatment and management as well as the limitations thereof (ToR d)

- Completed for 2005
- Several new and ongoing projects relevant to this ToR were announced at the meeting. It is recommended that this ToR should remain on the agenda of WGBOSV to follow up.
- To ease the reporting relevant to this ToR, WGBOSV suggests ICES to approve the draft format for WGBOSV National Reports (Annex 7)

10 Approval of recommendations

The recommendations from this years meeting were discussed in detail and approved (Annex 15).

11 Planning of next years meeting

Recognising that non ship mediated introductions into many areas have had implications that need to be addressed, WGBOSV has benefited from WGITMO input and recommends continued meetings in conjunction with this group for increased benefit to ICES Member Countries.

The invitation of Belgium to host next years meeting of WGBOSV was much appreciated by the group. The group suggested meeting in Oostende, Belgium for at least 3 days during the week beginning Monday, March 13 2006. It may be of interest to note that the next meeting of the IMO Marine Environment Protection Committee is planned to be held at the IMO Headquarters in London from March 20 to 24.

12 Closing of the meeting

The 2005 meeting of WGBOSV was closed on Friday, March 18 at 2.00 pm. There was consensus that there is an ongoing demand for the WGBOSV to meet on an annual basis. The chair thanked the host Anders Jelmert and the hosting organization Institute of Marine Research, Floedevigen Research Station, Norway. He also thanked all presenters and facilitators of round table discussions and last but not least the rapporteur Tracy McCollin, United Kingdom, for keeping the chair and the meeting organized.

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Annex 2: Terms of reference

2ACME05 The ICES/IOC/IMO Working Group on Ballast and Other Ship Vectors (WGBOSV) (Chair: S. Gollasch, Germany) will meet in Norway 14-18 March 2005 to:

(a) consider the scientific aspects of risk management of ballast water [OSPAR 2005/5] by

i. comparing and evaluating existing risk assessment and management approaches applicable to ballast water and their interlinkages, as exemplified by GloBallast risk assessments, the Australian DSS, the EMBLA system being developed by Det Norske Veritas (Norway) and the Slovenian risk assessment approach,

ii. considering how to develop:

1. criteria for the ranking of risks, i.e. to enable the determination of the likelihood of organisms transferred from one marine area surviving if transferred to another marine area (e.g. from tropical waters to the North Sea), or the likelihood of organisms surviving in ballast water / ballast tanks (for the duration of a voyage or between exchanges of ballast water/ cleaning of ballast tank sediment). Ultimately this should provide criteria for identifying "high risk" ballast water;
2. techniques for the rapid detection of non-indigenous species and for the possible containment/eradication of organisms transferred through ballast water and by other vectors. In this respect consideration should be given to sampling techniques and strategies.

(b) Prepare draft responses for the CONSSO Issue Group on Sustainable Shipping (IGSS) on

i. What is the most appropriate geographical approach for a Ballast Water Management Strategy (EU, ICES, OSPAR, HELCOM),

ii. Review and comment on a preliminary version of the Scoping Study prepared under IGSS,

iii. Draft scientific advice for ACME regarding the IGSS for the "post-scoping study" phase;

(c) draft a Code of Best Practice for Ballast Water Management;

(d) In the short term, to critically review and report on the status of ballast water research including: 1) the ballast water treatment and management, the limitations thereof , 2) risk assessment approaches dealing with ship mediated invasions

Annex 3: Agenda

Working Group on Ballast and Other Ship Vectors

Arendal Meeting 2005

Agenda

Monday, March 14, 2005
9:00 AM Opening of the Meeting

- Welcoming Remarks
- Brief Introduction of Host, Chairman and Rapporteur
- Logistics (telephone, FAX, Internet, photocopying, etc.)
  Anders Jelmert, Norway
- Review of Terms of Reference
- Review (changes, corrections, additions) and Adoption of the Agenda
- Reference to WGBOSV parent committees
  - ICES, IOC and IMO – Stephan Gollasch, Germany
- Cooperation PICES / ICES
  - Mark Wells, USA

9:45 AM Session I Risk Assessment (Terms of Reference (ToR) a)
***Facilitator* Keith Hayes, Australia**
Presentations

- Australian Risk Assessment Approach and DSS (15 mins)
  Keith Hayes, Australia
- Slovenian Risk Assessment Approach (10 mins)
  Matej David, Slovenia, presenter Tracy McCollin, United Kingdom

10:30 – 11:00 AM Coffee Break
Presentations

- Det Norske Veritas Risk Asessment Approach (Norway) (15 mins)
  Egil Dragsund, Norway
- Croatian – Norwegian Risk Assessment Project (15 mins)
  Marijana Katic Pecarevic, Croatia
- Port and Ballast Water Studies for Risk Assessment in the BITIS-Project (15 min)
  Ari Laine, Finland
- Recommendations Regarding the IMO Risk Assessment Approach (15 mins)
  Keith Hayes, Australia

12:30 – 14:00 PM Lunch

14:00 PM Session continues
Discussion Items:

- Design of a template to compare and evaluate existing risk assessment and management approaches
- Discussion on criteria for the ranking of risks, ultimately this should provide criteria for identifying “high risk” ballast water.

15:30 – 16:00 PM Coffee Break

16:00 PM Session continues
Discussion
Working Group Findings
Drafting

17:00 PM end of day 1
Drafting Session

Tuesday, March 15, 2005

9:00 AM Session I continues
Presentation

- History and international cooperation of marine research
  Erlend Moksnes, Norway

***Facilitator* Keith Hayes, Australia**
Results from Drafting Session
Keith Hayes, Australia
Discussion on template prepared on day 1
Group Discussion

10:30 – 11:00 AM Coffee Break

11:00 PM Session continues
Discussion and Drafting

12:30 – 14:00 PM Lunch

14:00 PM Split into subgroups

Group 1 Risk Assessment	Group 2 Format of WGBOSV National Reports
• Discussion and Drafting	• Discussion and Drafting

15:30 – 16:00 PM Coffee Break

16:00 PM Session continues

- Communication of Working Group Findings to IMO Marine Environment Protection Committee (MEPC53)
- Drafting Session

17:00 PM end of day 2

Drafting Session in sub-groups

Wednesday, March 16, 2005

9:00 AM Session II Status of Invasive Species Research. How to update WGBOSV umbrella organizations best? (ToR d)

***Facilitators* Judy Pederson, USA & Stephan Gollasch, Germany**

Presentation

- Techniques for the rapid detection of non-indigenous species - Sampling techniques and strategies
  Judy Pederson, USA

Discussion Items:

- Containment/eradication of organisms transferred through ballast water and by other vectors - Sampling techniques and strategies.
  - Techniques for the rapid detection of non-indigenous species
    Judy Pederson, USA
- Agreement on "National Report" format (see example attached) on relevant research activities
  - Results from past and ongoing research initiatives (ballast water and other ship vectors)
  - Status report on previously introduced invaders
  - New records of invaders since last years WGBOSV meeting
- Regional Ecosystem Study Group for the North Sea (REGNS)

10:30 – 11:00 AM Coffee Break

11.00 AM Session continues
Presentations

- IMO Guideline G2 Ballast Water Sampling (for compliance control with IMO Convention)
  Stephan Gollasch, Germany
- Update on the spread of *Rapana* in the Chesapeake Bay
  Roger Mann, USA
- Hull fouling as vector for species invasions
  Chad Hewitt, New Zealand

Discussion

12:30 – 14:00 PM Lunch

14:00 AM Session III CONSSO Ballast Water Management Scoping Study - Issue Group on Sustainable Shipping (IGSS) (ToR b)
***Facilitators* Brian Elliott, United Kingdom & Stephan Gollasch, Germany**
Presentation

- Introduction to Objectives of Scoping Study on Ballast Water Management Strategy
  Brian Elliott, United Kingdom
- Introduction to the Scoping Study team
  Egil Dragsund, Norway

Discussion Items:

- Geographical approach for a European Ballast Water Management Strategy
- Review and comment on Scoping Study objectives
- Draft scientific advice for ACME regarding the IGSS for the "post-scoping study" phase – recommend next steps

15:30 – 16:00 PM Coffee Break

16:00 PM Session IV ICES Code of Best Practice for Ballast Water Management (ToR c)
***Facilitator* Stephan Gollasch, Germany**

Presentations

- Ballast water exchange data from ships approaching the US east coast
  Judy Pederson, USA
- The US approach on ballast water legislation
  Roger Mann, USA

Discussion Items:

- Phase out of ballast water exchange
- Identification of coastal ballast water release areas
- IMO Review of best available technology
- Applicability of IGSS scoping study findings within ICES Member Countries

17:00 PM end of day 3

Drafting Session in sub-groups

Thursday, March 17, 2005

9:00 AM Session V Ballast Water Treatment Systems
***Facilitators* Fred Dobbs, USA & Chad Hewitt, New Zealand**
Presentations

- Important aspects of testing ballast water treatment systems (20 mins)
  Anja Kornmüller
- The ETV Approach (20 mins)
  Fred Dobbs, USA
- Key West test facilities (15 mins)
  Ted Lemieux, USA

10:30 – 11:00 AM Coffee Break
Discussion continues

- The ETV Approach
- IMO Guideline G8 Approval Standards of Ballast Water Treatment Systems

12:30 – 14:00 PM Lunch
14.00 AM Risk Assessment Session continues

- Discussion and Drafting

15:30 – 16:00 PM Coffee Break
16:00 PM Session continues

- Drafting Session

17:00 PM end of day 4
Drafting Session in sub-groups

Friday, March 18, 2005

9:00 AM Summary of Working Group Findings

- Session III CONSSO Ballast Water Management Scoping Study
  Rapporteur Brian Elliott, United Kingdom
- Session IV Code of Best Practice for Ballast Water Management
  Rapporteur Stephan Gollasch, Germany
- Session II Status of Invasive Species Research
  Rapporteur Tracy McCollin, United Kingdom
- Session V Ballast Water Treatment Systems
  Rapporteur Fred Dobbs, USA
- Session I Risk Assessment
  Rapporteur Keith Hayes, Australia

10:40 – 11:00 AM Coffee Break
11:00 AM Summary of Working Group Findings continues

- Recommendations for next years meeting
- Concluding Remarks
- Planning of next Meeting

14:00 PM Adjournment of the 2005 Meeting of WGBOSV

Annex 4: Risk Assessment Approach in Slovenia

Submitted by correspondence (Matej David).

In the period from 01 July 2004 to 31 December 2003 the Faculty of Maritime Studies and Transport, University of Ljubljana (in cooperation with marine biologists, Public Health Institute, Port Authorities, Port of Koper, Port State Control, Ministry of Transport, Ministry of Environment) conducted a National research project "Harmful Introductions and Ballast Water Management in the Slovenian Sea". The project was financially supported by the Ministry of Education, Science and Sports and the Port of Koper. One of the aims of the project was to prepare a risk assessment (RA) for introductions of harmful aquatic organisms and pathogens as a framework for future ballast water management.

The project aimed to asses the likelihood that Invasive Aquatic Species (IAS) are present in the discharged ballast water, and, in the second stage, the likelihood that these will cause harm when discharged into the Slovenian sea.,.

To this end, data on ballast water discharges in the Slovenian Sea was assessed for the period from 1990 to 2002. These included quantity and sources of ballast water (BW) discharged. The quantity of BW discharged was analysed for different aspects such as volumes per year, day, ship, ship type and port terminal. The sources of the BW were analysed for (potential) presence of IAS and the length of voyage (time of BW in the tank before discharge – "quarantine time" important for organism survival). As result the list of source ports, quantities, and frequency of BW discharge per 12 year period was obtained. To support assessment of the presence of IAS in the discharged BW, sampling was conducted on ships discharging BW in the Slovenian Sea. BW samples were analyzed for the presence of harmful species and human pathogens (indicator species).

The results show that 95% of the BW source ports are Mediterranean ports. First indications were that Slovenian ports would be safe from non-indigenous species since the source of BW was from the "same" region. However, sampling results shown that 12 out of 15 samples contained IAS (4 of them non-indigenous). A desk study on the presence of IAS in the source ports also confirmed the presence of IAS, however only a small percentage confirmed the sampling results (i.e., species found in the BW were not in the available data on source ports). The closeness of source ports implied short quarantine times, and hence a high likelihood of organisms survival of voyages.

In the second stage of the project the likelihood that IAS, when discharged into the Slovenian sea, will cause harm, was assessed. After assessing the likelihood of IAS introduction, there was a need to assess their likelihood to survive in the Slovenian Sea and their capacity to cause harm. The potential of survival was assessed on the basis of environmental compatibility. For a more conservative approach, ports inside the Mediterranean were considered as environmentally highly compatible (excluding freshwater ports). This approach was meant to cover all potential IAS from identified source ports. In the next step, the list of potential IAS (in source ports) was prepared (based on scientific literature and different databases e.g., CIESEM atlas of invasives, CSIRO) as well as the list of IAS already recorded in the North Adriatic and Slovenian Sea. The capacity to cause harm based on the past experience (deductive approach based on the method of Keith Hayes, CSIRO) was applied to the lists. The IAS capacity to harm was divided into 16 groups of negative impacts (e.g., human health, damage to marine structures, predates native etc.). The IAS on the list were also connected with all possible vectors of their transport (based on Hayes's approach and all data collected).

It was generally concluded that there is high risk of introduction, mostly via secondary introduction, of IAS into the Slovenian Sea. In the second stage, the level of risk was assessed for different source ports, ship types, port terminals etc.

Based on results from this study, and in the light of the text of the new IMO ballast water convention it was recognized that BWM in Slovenia would be effective if based on "ship-to-ship" or "port-to-port" assessment basis. To this end a Decision Support System (including RA), coupled with an effective control measures (i.e., compliance monitoring) would be needed. In support to this, a new three year national research project "Decision Model and Control of Ballast Water Management in the Slovenian Sea" started on 01 July 2004. The main aims of the project are:

- to prepare a selective decision support model for ballast water management;

- to prepare a model for an effective control of ballast water management;

both to be implemented in Slovenia. The project was financially supported by the Ministry of Education, Science and Sports and Port of Koper. The main research institution is Faculty of Maritime Studies and Transport (University of Ljubljana).

Annex 5: Submissions of WGBOSV to IMO

INTERNATIONAL MARITIME ORGANIZATION

IMO

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Marine Environment Protection Committee
53rd session
Agenda item 2

MEPC53/xxx
xxx 2005
Original: ENGLISH

HARMFUL AQUATIC ORGANISMS IN BALLAST WATER

RECOMMENDATIONS ON BALLAST WATER RISK ASSESSMENT EXEMPTIONS RELEVANT TO GUIDELINE G7 AND REGULATION A4 OF THE BALLAST WATER MANAGEMENT CONVENTION

Submitted by the International Council for the Exploration of the Sea (ICES)

SUMMARY

Executive summary:	The purpose of this document is to support the development of risk assessment guidelines for Regulation A4 of the ballast water management convention. It identifies situations wherein risk assessment can be biologically meaningful, recommends scientifically robust risk assessment methods, recommends exemption periods and triggers for suspension or cessation of risk assessment-based exemptions. This document has been prepared during the recent meeting of the ICES/IOC/IMO Working Group on Ballast Water and other Ship Vectors (WGBOSV), on behalf of the International Council for the Exploration of the Sea (ICES). The content of this submission does not necessarily represent the views of ICES. The full meeting report of the 2005 meeting of WGBOSV will be available at www.ices.dk.
Action to be taken:	Paragraph 4
Related documents:	MEPC 52/2/4 and Annexes thereto

Introduction

1 In developing the International Ballast Water Management Convention, IMO's Marine Environment Protection Committee (MEPC), through its Ballast Water Working Group, developed a draft Guideline for risk assessment based exemptions (see also Regulation A4 of the Ballast Water Management Convention).

2 Assuming that the Risk Assessment Guideline (G7) will be a matter of discussion at MEPC53 ICES wishes to make a contribution summarizing the discussions at the most recent meeting of the ICES/IOC/IMO Working Group on Ballast and Other Ship Vectors (WGBOSV). The meeting was held from March 14th to 18th 2005 in Arendal Norway and with Stephan Gollasch, Germany as Chairman. Participants at the meeting came from the following countries: Australia, Belgium, Croatia, Finland, Germany, the Netherlands, New Zealand, Norway, Spain, Sweden, United Kingdom, and USA.

3 WGBOSV also reviewed Appendix 1 of the guideline entitled "Application Form to Port State". Here WGBOSV recommends considering to add another section on "Port Infor-

mation". This section could provide details on the presence on introduced aquatic species and an assessment of the potential harm for donor and recipient ports or region not managing ballast water between the two localities. WGBOSV believes this is key information when carrying out a risk assessment relevant to this guideline. For consistency reasons, WGBOSV also suggests to use the term "harmful algal bloom" throughout the document (see section 4 of Appendix 1 in MEPC52/2/4).

Action requested of the Committee

4 The Committee is invited to consider the annex of this document and to decide as it deems appropriate.

ANNEX
Recommendations on ballast water risk assessment exemptions

1 WGBOSV notes that the IMO Risk Assessment Guidelines are to support the International Convention on the Management of Ships' Ballast Water and Sediments. Specifically, Regulation A-4 allows Parties to exempt vessels from compliance with ballast water management prior to discharge, if an acceptably low risk can be discerned.

2 The risk assessment to support an exemption must therefore be able to determine the likelihood of unmanaged ballast water discharge causing at least one new species introduction into the receiving port.

3 An additional requirement includes identifying whether the species is known or suspected to impair or cause harm to the environment, human health, property or resources to aid in determining whether the species is "harmful".

4 Several types of risk assessment have been conducted on ballast water. Two types of risk assessment are likely to achieve the stated goal in Regulation A-4 – "determine the likelihood of unmanaged ballast water discharge causing at least one new species introduction (defined either as discharge, establishment, or spread) into the receiving port".

4.1 **Environmental matching risk assessments** compare environmental conditions in the donor and receiving port to determine if they are *sufficiently* different that any species found in the source port are unlikely to survive in the receiving port.

.1 In order for environmental matching to "determine the likelihood of at least one new species introduction (defined either as discharge, establishment, or spread) into the receiving port", the environmental conditions of the source *region* must represent the physiological tolerances of the species found in that region.

4.2 **Species-specific risk assessments** consider information about individual species and the environmental conditions in the receiving port.

.1 Species-specific risk assessments are most useful for a small suite of species and rapidly lose the ability to discern 'low-risk' scenarios with increasing numbers of species.

.2 Given that many species may cause harm when introduced to new locations and the uncertainties associated with the large numbers of native species that are present in a source region, we recommend that species-specific risk assessments should only be conducted where the source and receiving ports share a majority of native species. This will enable the focus of a species-specific risk assessment to be restricted to those species that are non-native in the source and receiving ports, and any unshared species that may be harmful.

5 A system is needed that documents biological separation between coastal regions. These regions are defined as *biological provinces* (bioprovinces[2]). We recognize that several

[2] Bioprovince = an area within which the animal and plant species show a high degree of similarity. Examples of the biological provinces of the world based on different approaches are provided in Figures 1, 2 and 3. Additional expertise is required in order to finalize a global system of provinces and boundaries between them to be used in ballast water management. We note that all boundaries between biological provinces overlap.

classification systems exist and no single system is sufficient for all species (see Figures below for examples). Determination and agreement of an acceptable system for the purpose of ballast water risk based exemptions requires significant scientific discussion to seek agreement and should be fit for purpose.

6 Risk Assessment Application

6.1 Some environmental overlap exists between all bioprovinces based on two relevant environmental parameters (temperature and salinity). This suggests that environmental matching between a source province and a receiving port will represent high risk in virtually all instances.

.1 One exception is noted: comparison of freshwater [<0.5 psu] and fully marine [>30 psu] environments. This exception will require a more detailed risk assessment outlined below.

6.2 Therefore in reviewing the use of both types of risk assessment, we recommend that:

.1 Neither environmental matching nor species-specific risk assessed exemptions under Regulation A-4 are scientifically justified for voyages that start and end between contiguous or non-contiguous biological provinces with the exception below.

.2 Regulation A-4 exemptions should only be based on:

a) environmental matching risk assessments between freshwater [< 0.5 psu] and fully marine [> 30 psu] environments,

b) species-specific risk assessments for voyages that start and end within the same biological province.

7 Risk Assessment Method

7.1 **Environmental matching risk assessment**

.1 Environmental matching risk assessment (between freshwater and marine environments) should include seasonal comparisons of salinity, taking into account:

a) depth stratification,

b) distance to fresh/marine water bodies,

c) tidal and anthropogenic influence on salinity regime,

d) seasonal freshwater influx.

.2 Environmental matching risk assessments (between freshwater and marine environments) should include an assessment of native, cryptogenic or non-indigenous species, taking into account:

a) species that require freshwater and marine environments to complete their life-cycle, including anadromous (e.g. Sea Lamprey) and catadromous (e.g. Chinese Mitten crab) species,

b) species that are capable of surviving in both freshwater and marine environments.

7.2 **Species-specific risk assessment**

.1 Species-specific risk assessment (within a biological province) should identify:

a) the presence of all non-indigenous species (including cryptogenic species) in the ports or locations for which the exemption is sought,

b) the difference between non-indigenous species (including cryptogenic species) in the donor and receiving ports or locations,

c) those non-indigenous species (including cryptogenic species) that may impair or damage the environment, human health, property or resources.

d) those rare instances of native species in the source port not present in the receiving ports that impair or damage the environment, human health, property or resources.

.2 Species-specific risk assessment should be conducted on:

a) non-indigenous species (including cryptogenic species) that are present in the donor port or locations but absent from the receiving port or location; or

b) a list of actual or potentially harmful non-indigenous species (including cryptogenic species) agreed between the affected parties.

c) a list of harmful native species agreed between the affected parties.

.3 Species-specific risk assessments may estimate various events in the process of biological invasions. The two events recommended below are least sensitive to uncertainty - either of these should be used:

a) discharge of living organisms in the receiving ports or locations,

b) completion of the species' life-cycle in the receiving ports or locations.

.4 Species-specific risk assessments may consider multiple species. Exemptions should only be granted for assessments that consider ALL risk-assessed species as low risk.

7.3 Parties considering exemptions should consult any State that the Parties determine may be adversely affected by the species included, or explicitly excluded, in the risk assessment.

8 Other Considerations

8.1 Risk based exemptions should be reviewed every 12 months and no later than 24 months because of the current rate of invasions in many regions of the world (e.g. a newly introduced species was recorded every 7 months in the North Sea and adjacent water bodies since 1950s).

8.2 Provision for rapid [< 14 days] suspension, cessation or immediate review of the exemption should be made for circumstances such as:

.1 outbreaks or infestations of harmful aquatic organisms (including algal blooms) or pathogens in the donor port,

.2 detection of new non-indigenous species (including cryptogenic species) in the donor port,

.3 new evidence of harmful behaviour by any species in the donor port,

.4 significant and enduring change in environmental conditions in the donor and/or receiving ports or locations (e.g. diversion of fresh or saline water flow, new warm effluent discharge).

Appendix 1 Maps indicating various approaches on global bioregion mapping

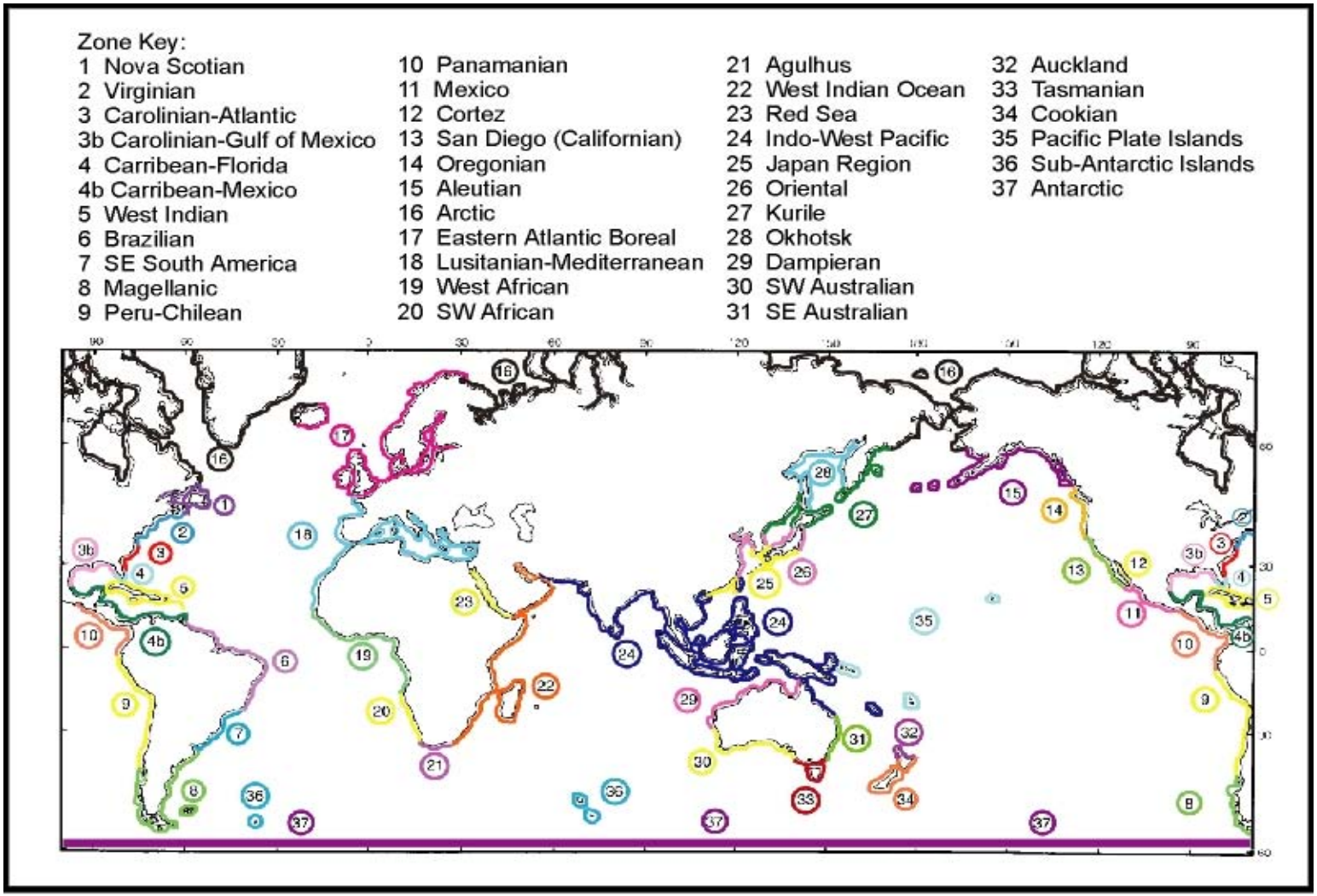

Figure 1 Bioregion mapping according to Watling and Gerkin (website accessed) based on Briggs (1953) and Springer (1982)

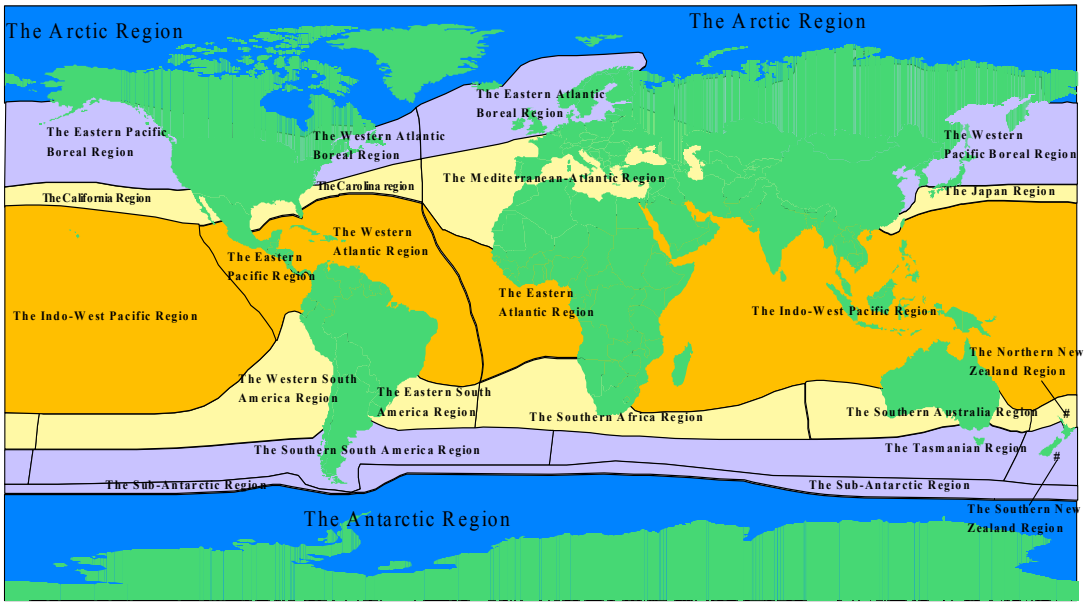

Figure 2 Bioregion mapping according to Briggs (1953) and Ekman (1974; 1995)

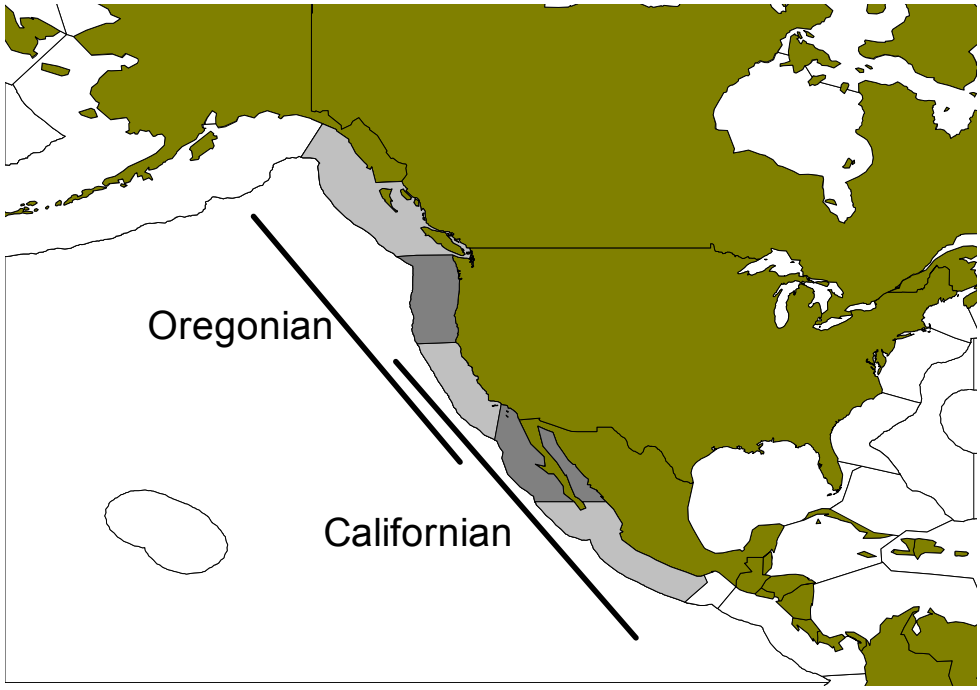

Figure 3 Overlapping provinces in the North Eastern Pacific based upon IUCN (Kelleher & Kenchington, 1992).

Annex 6: CONSSO/IGSS Scoping Study on Ballast Water Management in the North Sea

Scoping Study for the Implementation of a Regional Management Strategy for Ballast Water Management in the North Sea/North West Europe.

1. Background

The introduction of non-indigenous aquatic species through ship's ballast water and sediments has been an issue considered by the International Marine Organization (IMO) for at least 10 years. There have been many examples of non-indigenous species, such as toxic algae and larger species such as crabs, mussels and macro-algae being transported in this way, which if released in a favourable environment can cause a mass invasion that can be detrimental to natural biodiversity levels, water quality, environmental/human health and the use of the coastal zone (e.g. fishing, aquaculture, tourism etc).

Discussions at the IMO have resulted in the adoption of the International Convention for the Control and Management of Ships' Ballast Water and Sediments on 13th February 2004. To aid the implementation the IMO are working on a programme of guidelines over the next two years, with a planned review of the Convention prior to 2006, 3 years before the discharge standard for treated Ballast Water comes into effect. This Convention set deadlines for new ships to meet treatment standards based on limiting the number of organisms present in ballast water, with extended dates for the installation of treatment technology on existing ships.

The threat of non-indigenous species invasion in the North Sea has also been the subject of Articles in the Bergen Declaration of the 5th Ministerial Conference on the North Sea. In parallel to the IMO Convention, a Regional Ballast Water Management Strategy has been developed through discussion in the Committee of North Sea Senior Officials (CONSSO) – Issue Group on Sustainable Shipping (IGSS). This is attached in Appendix 1.

In order to move a regional strategy and the last action point forward, the United Kingdom are proposing this internationally funded scoping study to identify:

- the difficulties in implementing a regional management plan;
- the options and management tools available to implement such a plan (based on the principles, standards and guidelines in the IMO Convention);
- the environmental data and the monitoring strategies needed to inform, enable and implement a regional management plan;
- how such a regional management plan in the North Sea/North West Europe relate to the other Regional Seas Conventions around Europe (HELCOM (the Helsinki Commission) and the Barcelona Convention); and,
- different perspectives and concerns of countries in the North Sea/North West European Region regarding ballast water management.

During the discussions leading to this strategy the IGSS considered that the North Sea was too small an area to consider for a Ballast Water Regional Management Strategy. In order to gain a consensus on what region was appropriate, CONSSO have written to the OSPAR Convention (Oslo/ Paris Convention), HELCOM, the International Council for the Exploration of the Sea (ICES) and the European Commission to ask their views. At the present time no region has been defined, but all parties to OSPAR, HELCOM and CONSSO have indicated that they support some form of regional approach.

2. Aim

To advise members of OSPAR and CONSSO on the appropriate scope, geographical area and management tools needed to implement a Regional Management Strategy for Ballast Water Management in the North West Europe/North Sea to reduce the risk of non-indigenous species invasion in the region.

3. Objectives

The objectives of this scoping study are to:

- provide technical advice to member states of OSPAR and CONSSO on the implementation of a regional management strategy for the control of non-indigenous species invasion through ship's ballast water and sediments in the North Sea/North West Europe, from short sea shipping and vessels that have not been able to undertake ballast water exchange in line with the IMO Convention;
- identify appropriate management options for the development of a sustainable regional management strategy to address the risks of non-indigenous species invasion into, and the spread of existing invasive species in, the North Sea/North West Europe (depending on the area identified for a regional strategy by CONSSO, OSPAR and the European Union);
- identify the management tools available to implement a regional management plan in parallel to the development and ratification of the IMO Convention;
- address the feasibility of these management options and tools with respect to countering the risks from ballast water exchange in the North Sea/North West Europe, recommending how the threat of non-indigenous species invasion through ballast water should be controlled;
- identify the environmental data and the monitoring strategies needed to inform, enable and implement a regional management plan; and
- review the existing concerns, threats and research with respect to non-indigenous species invasion in the North Sea/North West Europe through ship's ballast water and sediments.

It should be noted that this scoping study should take account of:

- the Guidelines being developed to complement the IMO Convention;
- how the European Commission, HELCOM and the Barcelona Convention are planning to implement the IMO Convention; and,
- the individual concerns of countries in CONSSO and OSPAR regarding ballast water management.

This scoping study will involve research into the following areas and consideration of certain key issues:

- The requirement for ships to exchange ballast water, whenever possible, at least 200nm from the nearest land and in water at least 200m in depth, taking into account the Guidelines developed by the IMO. In cases where a ship is unable to conduct Ballast Water exchange in accordance with this, due to safety or time constraints, then vessels must exchange at least 50 nautical miles from the nearest land and at least 200m in depth;
- The application of a Port State's right to designate areas, in consultation with adjacent or other states, where a ship may conduct ballast water exchange with due respect of the IMO Guidelines, and areas where ships need to apply additional measures, as per Regulations B4 and C1 of the Annex to the IMO Convention;

- The condition that ships should not be forced to deviate or be delayed by ballast water management requirements in the IMO Convention;
- The application of a vessel or route based risk management approach and identification of management tools (including exemptions as described in Regulation A4 of the IMO Convention) that are relevant, or could be developed, to implement a regional management plan for ballast water and ballast water sediments;
- Control and mitigation options for vessels or short sea shipping routes considered to be at high or medium risk of transferring non-indigenous species in any risk based management approach;
- The appropriate level of environmental baseline monitoring;
- The level of environmental monitoring needed to maintain a regional management strategy;
- The enforcement of a regional management strategy;
- How to monitor the effectiveness of any regional management strategy;
- The application of Strategic Environmental Assessment methodology to any management regime;
- The economic, regulatory and legislative impact of a management regime on shipping and individual states; and,
- The relationship between a regional plan in the North Sea/North West Europe and parallel development in HELCOM and the Barcelona Convention.

4. Recommended Strategy

The only feasible options at the present time for regional management of non-indigenous species transfer through ballast water in the North Sea are :

- prior exchange of ballast water for vessels sailing through oceanic waters greater than 200nm from land and 200m depth process (or in cases where a ship is unable to conduct Ballast Water exchange in accordance with this, due to safety or time constraints, then exchange at least 50 nautical miles from the nearest land and at least 200m in depth); and
- management based on risk assessment for vessels trading within the North Sea, within coastal waters before entering the North Sea and vessels that cannot exchange ballast water for safety reasons, taking account of Port State's right to designate areas, in consultation with adjacent or other states, where a ship may conduct ballast water exchange with due respect of the IMO Guidelines, and areas where ships need to apply additional measures, as per Regulations B4 and C1 of the Annex to the IMO Convention;

Development of a scoping study to formulate a sustainable management approach to the regional management of non-indigenous species transfer through ballast water in North West Europe, to include:

- prior exchange of ballast water for vessels sailing through oceanic waters greater than 200nm from land and 200m depth process (or in cases where a ship is unable to conduct Ballast Water exchange in accordance with this, due to safety or time constraints, then exchange at least 50 nautical miles from the nearest land and at least 200m in depth);
- a risk assessment based approach for vessels trading within the North Sea, within coastal waters before entering the North Sea and vessels that cannot exchange ballast water for safety reasons.

- the identification of management measures to implement, monitor, enforce and regulate a management strategy on a regional basis.
- management options for vessels considered to be at high or medium risk of transferring non-indigenous species through their ballast water.
- ongoing environmental monitoring to identify any new non-indigenous species, monitor the spread of existing non-indigenous species and evaluate the effectiveness of the management system;
- the management of sediment in ballast water tanks and the risks associated with it.
- the use of Strategic Environmental Assessment
- the use of Regulatory Impact Assessment to evaluate the impact and costs of any management on each Government and the shipping industry.
- identification of the most appropriate geographical basis for regional management of non-indigenous species transfer through ballast water in North West Europe.
- evaluation of how a baseline monitoring scheme could be implemented in the region. Specifically to identify the risks to the North Sea environment and economy from key problematic species being transported through ballast water and those species already established in the region.

A letter to the European Union should be drafted to evaluate their level of interest in this issue, potential links to proposed/existing centralised reporting schemes and to investigate the possibility of using EU funds to undertake the studies needed during this regional management strategy development.

Development of a feasibility study to identify and develop a Contingency Plan identifying how the Governments involved in a regional management scheme should react to any new non-indigenous species invasion.

Annex 7: National Report Format for Update on Status of Invasive Species Research WGBOSV

Country

Author(s) and contact details

A Transport Vectors

- Results of ongoing research project(s), i.e. project title, host institute, contact details, co-ordinator, project duration, key objective(s), web site if available
- Planning of new research project(s), web site if available

1 Ballast
1.1 Biology of Ballast Water
1.2 Ballast Water Treatment
1.3 Ballast Water Sampling
1.4 Ballast Water Legislation/Regulations

2 Hull Fouling
2.1 Biology of Hull Fouling
2.2 Hull Fouling Treatment
2.3 Hull Fouling Sampling
2.4 Hull Fouling Legislation/Regulations

3 Sediments
3.1 Biology of Sediment
3.2 Sediment Treatment
3.3 Sediment Sampling
3.4 Sediment Legislation/Regulations

4 Sea Chests
4.1 Biology of Sea Chests
4.2 Sea Chest Treatment
4.3 Sea Chest Sampling
4.4 Sea Chest Legislation/Regulations

5 Others
(see Handbook of Invasion Vectors, prepared by WGITMO and published as ICES Cooperational Research Report)
5.1 Biology
5.2 Treatment
5.3 Sampling
5.4 Legislation/Regulations

B Invasive Species Management

1 Eradication Programmes
2 Management and Control of invasive species

C Risk Assessment Approaches

D Occurrence of New Ship-mediated Introduced Species

Taxon	Year of first record	Location of first record	Possible introduction vector*	Invasion Status**	Reference

*Duplication with WGITMO report if the vector is unknown
**When spreading see details in Section E

E Impact of Introduced Species

Economic (quantify if possible)
Ecological

F Other Relevant Information

Proactive monitoring

G References

Annex 8: WGBOSV National Report for Finland based upon the intersessionally agreed national Report Format

(The national Report Format was updated at the Meeting see Annex 7 for details)

Country: Finland
Author(s): Leppäkoski E, Laine AO, Paavola M and Pertola S (= 'the BITIS research group'); Lahdes, E. and Karjala L., Lehtiniemi M. (Finnish Institute of Marine Research)

A Transport Vectors
Results of ongoing research project(s), i.e. project title, host institute, coordinator, project duration, key objective(s)
Planning of new research project(s)

1 Ballast Water
1.1 Biology of Ballast Water

1.2 Ballast Water Treatment
Project title: MARTOB (end in June 2004)
Host institutes: VTT Technical Research Centre of Finland and Åbo Akademi University

Results:
Several reports to the Coordinator (University of Newcastle) and EU
Viitasalo S, Sassi J, Rytkönen J, Leppäkoski E (Submitted) Ozone, ultraviolet light, ultrasound and hydrogen peroxide as ballast water treatments - experiments with mesozooplankton in low-saline brackish water

1.3 Ballast Water Sampling
Project title: BITIS (Is the Biological Integrity of the Baltic Sea Threatened by Invasive Non-native Species?)
Host institute: Åbo Akademi University
Coordinator: Academy of Finland (Baltic Sea Research Programme BIREME)
Project duration: 2002-2005
Key objectives: Sampling of ships (oil tankers) calling Sköldvik (Porvoo, E Gulf of Finland); Both ballast water and ballast tank sediment sampling; The coupling of non-native dinoflagellates and harmful algal blooms in the Baltic Sea; Risk assessment of alien species and their vectors in Northern brackish and limnetic waters.

2 Hull fouling
3 Other Ship Vectors

B Invasive Species Management
1 Eradication Programmes
2 Management and Control of invasive species

C Impact of Invaders
Project title: BITIS (Is the Biological Integrity of the Baltic Sea Threatened by Invasive Non-native Species?)
Key objectives: Invasive species status of the northern Baltic Sea; The coupling of non-native dinoflagellates and harmful algal blooms in the Baltic Sea (especially *Prorocentrum minimum*); Impact of established alien species on biodiversity and ecosystem functioning (especially *Marenzelleria viridis* and *Cercopagis pengoi*).

Results:
Pertola S, Faust MA, Kuosa H & Hällfors G (2003): Morphology of *Prorocentrum minimum* (Dinophyceae) in the Baltic Sea and in Chesapeake Bay: comparison of cell shapes and thecal ornamentation. Botanica Marina 46: 477-486.

Hajdu S, Pertola S and Kuosa H. (2005). *Prorocentrum minimum* (Dinophyceae) in the Baltic Sea: morphology, occurrence -A Review. Harmful Algae 4: 471-480

Pertola S, Kuosa H and Olsonen R. (2005). Is the invasion of *Prorocentrum minimum* (Dinophyceae) related to the nitrogen enrichment of the Baltic Sea? Harmful Algae 4: 481-492

Planned projects:
Two final manuscripts will be submitted on the impacts of *Marenzelleria viridis* in early 2005. The bioturbation impact of *M. viridis* on sediment denitrification, sediment nitrogen and phosphorus concentrations and fluxes were studied in a laboratory experiment in October-November 2004. Results will be presented in two manuscripts in 2005. A preliminary scuba survey on the recent mass occurrence of zebra mussel near the nuclear power plant in Loviisa was conducted in autumn 2004 and will be studied in collaboration with the Radiation and Nuclear Safety Authority of Finland in 2005.

Project title: Ecology and physiology of invasive species (FIMR, Lahdes & Karjala).
The project consists of three subprojects. Two of these projects also belong under the project BITIS (see Laine and Pertola)
Key objectives:
The third subproject deals with the distribution and physiology of *Cercopagis pengoi* aiming to the evaluation of the role of *C. pengoi* in the Baltic Sea food web by measurements of the energy consumption and salinity and temperature tolerances.
Results:
Manuscipt: Does salinity tolerance and temperature predict the recent distribution of the invasive fish-hook water flea *Cercopagis pengoi* in the northern Baltic Sea; observations in the field and laboratory.
Presentation in the in the 13th International Conference on Aquatic Invasive Species in the title of *Cercopagis pengoi* in the northern Baltic Sea; Distribution and energetic significance

Planned projects:
Studies on the nutritive value and energy consumption of *Cercopagis pengoi* will be continued.

Project title: Effects of Baltic Sea changes on the mysid and Baltic herring populations (FIMR, Lehtiniemi)
Key objectives: Effects of *Cercopagis pengoi* on the feeding competition between mysids and Baltic herring.

Results: Manuscript: Predation risk alters the feeding rate and prey selection of *Cercopagis pengoi* and *Mysis* spp.
Planned projects: Feeding experiments will be continued.

D Risk Assessment Approaches
Project title: BITIS (Is the Biological Integrity of the Baltic Sea Threatened by Invasive Non-native Species?)
Key objectives: Risk assessment of alien species and their vectors in Northern brackish and limnetic waters
Results:
Pienimäki M and Leppäkoski E. 2004. Invasion pressure on the Finnish Lake District: invasion corridors and barriers. Biological Invasions 6: 331-346) is based on an environmental matching approach annexed with species specific data and vector analysis.

Helavuori M 2005. The dispersal of species to new areas from the northern Baltic Sea through Shipping. MSc Thesis (in Swedish), focusing on seasonal variation in availability of propagules (mainly Gammaridae) to be loaded with ballast water

Planned projects:
A method for salinity based risk assessment of alien species was developed and is presented in a submitted manuscript (Paavola, Olenin and Leppäkoski 200x). The salinity tolerance of alien species might be a good estimator of its potential to succeed in brackish water seas.

Port sampling was made in summer 2003, in order to detect new alien species and to conduct port profiles for future risk assessments. Results are presented in a manuscript during 2005.

E Occurrence of New Ship-mediated Invaders

Project title: BITIS (Is the Biological Integrity of the Baltic Sea Threatened by Invasive Non-native Species?)

Results:

Gammarus tigrinus was found for the first time in the northern Baltic Sea in Turku and Hamina in summer 2003 (Pienimäki M, Helavuori M and Leppäkoski E. 2004. First findings of the North American amphipod *Gammarus tigrinus* Sexton, 1939 along the Finnish coast. Memoranda Societatis pro Fauna et Flora Fennica 80: 17-19).

Palaemon elegans (cryptogenic, however) was found for the first time in Finnish waters in summer 2003 (Lavikainen T and Laine A.O. 2004. First record of the invasive prawn *Palaemon elegans* in the brackish northern Baltic Sea. Memoranda Societatis pro Fauna et Flora Fennica 80: 14-16).

Annex 9: WGBOSV National Report for Sweden based upon the intersessionally agreed national Report Format

(The national Report Format was updated at the Meeting see Annex 7 for details)

Country: Sweden

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Correction to the 2004 report
In Annex 7 about Ballast Water regulations in the Report by the ICES/IOC/IMO Working Group on Ballast Water and Other Ship Vectors held 22-24 March 2004 in Cesenatico, Italy it is stated that in Sweden "It is recommended by national Swedish law to follow IMO A.868(20)". This is not true and should be deleted in future compilations of national Ballast Water regulations.

A Transport Vectors

1 Ballast water

Swedish implementation of the International Convention for the Control and Management of Ship´s Ballast Water and Sediments
In November 2004 the Swedish Maritime Administration was given instructions from the Ministry of Industry, Employment and Communication to look into the consequences of a Swedish implementation of the International Convention for the Control and Management of Ship´s Ballast Water and Sediments (BWC). The report was finalized on February 25, 2005. The most obvious problem Sweden, as well as all the Baltic Sea states, faces is not having waters of at least 200 metres in depth where ships can conduct Ballast Water Exchange in accordance with the BWC Regulation B-4. According to Regulation B-4.2 port States may, however, designate areas, in consultation with adjacent or other States, as appropriate, where a ship may conduct Ballast Water Exchange in sea areas where the distance from the nearest land or the depth does not meet the parameters stated in Regulation B-4.1 (waters of less than 200 metres in depth and at least 50 nautical miles from the nearest land).

It is not evident if designated areas, where ships can conduct Ballast Water Exchange, have to be open to all ships, or if they can be established with terms of use which exclude certain ships, e.g. ships arriving from areas where it has been possible to conduct Ballast Water Exchange in accordance with the BWC. Even though Regulation B-4.2 mentions nothing about terms of use of designated areas for Ballast Water Exchange, such terms are mentioned in the draft Guidelines for Ballast Water Management and the Development of Ballast Water Management Plans (G4), paragraph 2.2.1.1[1]. If it is not possible to establish terms of use for designated areas, these areas might be used by ships arriving from areas, where it has been possible to conduct Ballast Water Exchange, and this increases the risk of introductions of harmful aquatic organisms and pathogens.

1 Latest version is available as IMO document BLG 9/11.

One concern is that the designation of areas for Ballast Water Exchange might cause more problems than they would solve. In the short run, this option could protect ports from introductions of harmful aquatic organisms and pathogens, but because of the circulation of water (and organisms) the designation of areas might not reduce the introductions of harmful aquatic organisms and pathogens in the long run. Furthermore, the designation of several areas for Ballast Water Exchange could lead to a situation where the ballast water (including organisms) discharged from one ship is taken up by another ship, which could enhance the spreading of organisms further. The possibility of designating areas for Ballast Water Exchange should not be ruled out completely, but before the designation of such areas, the consequences should be thoroughly investigated. This could be done with the help of oceanographic modelling simulating ballast water exchange.

It is of vital importance that the Baltic Sea states develop a common understanding and also a common strategy in relation to this problem.

The North Sea states face a similar problem which will be taken into consideration in the Scoping Study for the Implementation of a Regional Management Strategy for Ballast Water Management in the North Sea/North West Europe undertaken by Det Norske Veritas (DNV) and coordinated by the Maritime and Coastguard Agency (MCA) in UK.

1.2 Ballast Water Treatment

Ballast Water Management Systems on board Swedish Ship´s
Two Swedish ship´s are for the moment testing Ballast Water Management Systems on board. One system involves an advanced oxidation technology (AOT) which consists of a combination of ozone, two UV systems with different wavelength spectra and two different catalysts. The other system involves a chlorine dioxide treatment.

B Invasive Species Management

2 Management and Control of Invasive Species

Regional Ballast Water Action Plan for the Baltic
With Finland as leading country preparations for a Regional Action Plan for the Baltic Sea began in 2004. The issue was discussed briefly at HELCOM MARITIME 3 (26-28 October 2004). For the meeting the Secretariat had prepared a draft HELCOM recommendation, *Measures to address the threat of invasive species transported via the ballast water of ships,* emphasizing the importance of carrying out risk assessment in major ports as well as biological surveys and monitoring. Since a need for further discussions before adopting the draft recommendation was identified a BSRP/HELCOM/COLAR Workshop, "Ballast Water introductions of Alien Species into the Baltic Sea", was held in Palanga, Lithuania 21-25 February 2005. The workshop was attended by participants from all Baltic Sea states (the report was not finalized when this was written).

Dredging in an area where the introduced invasive red alga Gracilaria vermiculophylla occurs
The only site in the northern archipelago of Göteborg, where this alga was observed, was in a lagoon outside a marina at the southern end of the island Öckerö. This marina had during 2004 applied for permission to dredge in the lagoon for enlarging its capacities. The application was sent to the County Administration of Västra Götaland, who stated that since *G. vermiculophylla* had been found at that locality, as a first step the marina had to document its dispersal in the area to be dredged. Its degree of cover in the lagoon was recorded by a consultant in the beginning of autumn 2004. Secondly, since the alga did occur in the area to be dredged, the County Administration stated that the upper layer of mud with the alga should be removed before the dredging started. The application has now gone back to the regional Environmental Court ("Miljödomstol") under the Swedish Environmental Code where the issue will be on trial in March 2005. For impact of this species, see C 3.

C Impact of Invaders

1 The Ponto-Caspian predatory water flea *Cercopagis pengoi*

The Swedish studies in the northern Baltic proper contribute to a growing body of evidence, that this species can modify food webs and trophic interactions in invaded ecosystems. *C. pengoi* is zooplanktivorous and its invasion in the Baltic Sea has significantly changed the pelagic food web structure Gorokhova et al. 2005). The animal is a potential competitor with pelagic fish (YOY herring) for zooplankton, however, fish also exert a significant predation pressure on *C. pengoi*, thus relying on it as a valuable new valuable new food, especially during August- September (Gorokhova et al. 2004).

2 The American polychaete *Marenzelleria* cf. *viridis*

In the Gulf of Bothnia there has been a contemporary decrease in abundance of the amphipod *Monoporeia* during the time when *Marenzelleria* has increased, although it may not have been caused by the polychaee. However, the amphipods have still not recovered (Kjell Leonardsson, Umeå Univ., pers. comm.). An experimental study by Kotta and Ólafsson (2003) has shown that the amphipod had a lower growth rate in the presence of *M. viridis* being 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. In another experiment by Neideman et al. (2003) they tested if the amphipod, the more mobile species, would avoid areas where the more sessile polychaete is present in high numbers. The result was 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 of *M. viridis* as such could not explain the amphipod's choice of burrowing site.

3 The Asiatic red alga Gracilaria vermiculophylla

At Rivö, close to the harbour of Göteborg and being seen there in 2003, *G. vermiculophylla* in 2004 formed very dense mats surronding eelgrass plants. The species is very hardy and can survive out of water (if moist) for more than half a year and also grow in salinities as low as 2 psu (Nyberg & Wallentinus submitted). Fragments of less than half a cm can grow to new plants, thus vegetative reproduction is a shortcut to create new populations, and it easily breaks into new fragments. In an interview with a fisherman from Vallda Sandö, ca 30 km S of Göteborg, he claimed that eelgrass had disappeared in some areas where he was fishing (ca 20-30 km S of Göteborg). However, it was not observed in a large-scale survey of eelgrass beds in the northern and middle part of Bohuslän in the summer of 2004, although looked for.

4 The Japanese red alga Heterosiphonia japonica

This alga was first seen in the Koster archipelago in 2002 (Axelsson & Karlsson 2004). During 2004 it was very common on both sides of the Kosterfjord, being especially frequent on mussels (*Ostrea edulis* and *Modiolus modiolus*). Although being very frequent it is still not considered a real nuisance, but may have replaced some other red algae as an epibiont on mussels (Jan Karlsson, Göteborg univ., pers. comm.).

5 The Japanese brown alga *Sargassum muticum*

Sargassum muticum has started to occur within the fucoid belts also around Göteborg (IW pers. comm.), where previous mostly barren shores have been colonized. Its impact on barren grounds may in fact be positive as a shelter for small invertebrates and fish, while it could have a negative impact on fucoids, if becoming more common in that zone on rockys shores

D Risk Assessment Approaches

The risk assessments and analysis carried out within the research programme AquAliens are mainly focusing on endpoints and factors affecting dispersal, establishment and impact of aquatic species. Vectors are only covered indirectly.

E Occurrence of New Ship-mediated Invaders

a) *Gracillaria vermiculophylla* (Ohmi) Papenfuss 1967

1 Phylum: Rhodophyta Class: Florideophyceae Order: Gracilariales Family: Gracilariaceae. Previously also called *G. asiatica*, a name now treated as a synonyme
2 The islands of Rivö and Vargö, Göteborg archipelago, first seen in August-September 2003. The first site is very close to the harbour of Göteborg, where large scale dredging has been caried out for some years.
3 Most likely ships, small pleasure boats, fishing vessels or dredgers. Probably in ballast water/sediment or left sediment in dredger, but could also have been brought in moist fishing nets or have been stuck around anchor lines. No aquaculture site in the vicinity.
4 Established and spreading, also by small fragments
5 See C 3 above

b) *Aglaothamnion halliae* (F.S. Collins) Aponte, Ballantine & J.N. Norris 1997
1 Phylum: Rhodophyta Class: Florideophyceae Order: Ceramiales Family: Ceramiaceae
2 Identified for the first time in the late summer of 2003 in the harbours/marinas of Strömstad, Grebbestad and Rönnäng (the northern and middle parts of the province of Bohuslän; Bjærke & Rueness 2004, pers. comm.). It is not unlikely that the species has been in Sweden much longer but not being recognized, since it is small and quite similar to some native species of that genus.
3 Most likely pleasure boats, since it is known i S Norway since 1980, and has only been found in harbours and marinas. Although S Norway is not far from the Swedish sites, the currents go the opposite direction. However, if occurring on buoyuant material, it could have been brought by N or NW vinds.
4 Established. Nothing known on further dispersal, but could occur at more sites.
5 Probably having a small ecological impact, since the plants are small and it seems mainly to be restricted to harbour areas.

c) *Heterosiphonia japonica* Yendo 1920
1 Phylum: Rhodophyta Class: Florideophyceae Order: Ceramiales Family: Dasyaceae
2 Kosterfjord, N Bohuslän in the autumn of 2002 but not recognized until 2003 (see Axelsson and Karlsson 2004)
3 Most likely pleasure boats or ferries, since it is known i W and S Norway
4 Established and spreading in the Koster area. Probably spreading since it was also recorded from a very exposed offshore "shallow" area, Persgrunden, about 20-25 km south of Koster (Axelius and Karlsson 2004).
5 See C 4 above

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Annex 10: WGBOSV National Report for Spain based upon the intersessionally agreed national Report Format

(THE NATIONAL REPORT FORMAT WAS UPDATED AT THE MEETING SEE ANNEX 7 FOR DETAILS)

Country: Spain

Author(s): Jesús Cabal. Instituto Español de Oceanografía. Centro Oceanográfico de Gijón.

Studies on non native species in our country are very scarce and located in the space and time. In this sense more of the studies are related to macro-organisms than benthos macro algae, terrestrial plants, crabs and fishes. In the last years, the number the non native species has been increased, but at the moment there is no one institution or agency that coordinates this topic.

A Transport Vectors

1) Ballast Water:

Project: Programme for the Prevention and Control of Non Native Species of the Port of Barcelona.
Host Institute: The Port Authority of Barcelona
Coordinator: A. Palau
Project duration: 1999- ??
Key Objetives:

- Identification and evaluation of pathways of introductions.
- The application of preventive measures.
- Implementation of campaign to detect any non-native species that have been introduced.

Planning of new research project: Zooplankton non native species of the Port of Gijón (Biscay Bay). ORZOVAL.
Host Institute: Instituto Español de Oceanografía. Centro Oceanográfico de Gijón.
Coordinator: Jesús Cabal
Project duration: 2005-2008
Key Objectives:

- Identification of zooplankton species in the coastal area at the Port of Gijón. The main goal is to generate a baseline dataset on the zooplankton species in the study area
- Zooplankton species in the ballast water by cargo ships at the Gijón Port. Sampling the ballast water of the ships . Port of Gijon is located in the south of Bay of Biscay, a temperate sea, and more of the ship traffic is from ports located in temperate seas, so the risk of introduction of species with similar ecological characteristics is high.

2) Non native species:

Project: Algal Introductions to European shores (ALIENS).
Host Institute (in Spain): University of Oviedo
Coordinator (in Spain): Rico, J.M.; Flagella, M., Mineur, F., Buia, C. and Soria, A.
Project duration: 2004-2007
Key Objectives: ALIENS is a multidisciplinary project with several objectives:

- Explain the underlying ecological causes of the introduction, establishment and development of seaweed invasions on European shores.
- To generate a baseline dataset on the present status of seaweed introductions to European shores, and of future susceptibility to further introductions/invasions.

- To elucidate the genetic structure of various populations of selected invasive seaweeds in Atlantic and Mediterranean Europe, with a view to determining whether there have been multiple cryptic European introductions.
- To evaluate the economic impact of existing seaweed invasions on a European scale, comparing losses cost associated with prevention and eradication.
- To carry out the risk assessment and propose for invasive macro algae to be used in coastal zone management.

Project: Delivery Alien Invasive Species Inventories for Europe (DAISIE).
Host Institute (in Spain): CREAF
Coordinator (in Spain): M. Vila.
Project duration: 2005-2008
Key Objectives:

- To create an inventory of invasive species in Europe.
- To structure the inventory to provide the basis for prevention and control of biological invasions.
- To assess and summarise the ecological economic and health risks and impact of the widespread and/or noxious invasive species in Europe.
- To use distribution data and the experience of the individual Member States as a framework for considering indicators for early warning.

B Invasive Species Management

1 Eradication Programmes

2 Management and Control of invasive species
There are local programmes to control *Sargassum muticum* in the swimming areas of the beaches (i.e. Gijón municipality).

C Risk Assessment Approaches

D Occurrence of Non Native Species.

We are trying to collect data of the non native species found in the Spanish coastal waters over the last few years, in order to obtain a baseline of non native species.

TAXON	YEAR OF FIRST RECORD	LOCATION OF FIRST RECORD	POSSIBLE INTRODUCTION VECTOR	INVASION STATUS	REFERENCES
PHYTOPLANKTON					
Alexandrium taylori		Cataluña coast			Garcés *et al.,* 1999
Alexandrium catenella	1998	Barcelona Port	Ballast water	Established	Vila *et al.,* 2001
PROTOZOA					
Marteilia refringens	1975	Galicia	Aquaculture	Spreading	Figueras and Montes,1988 Riera *et al.,* 1993. Lama *et al.,* 1993
Bonamia ostrea	1982	Galicia	Aquaculture	Spreading	Polanco, 1984. Montes y Lama, 1993. Durfort, 1995
Perkinsus atlanticus	1983	Galicia	Aquaculture	Spreading	Gonzalez *et al.,* 1987. Riera *et al.,* 1995. Santmartí etal. 1995. Sagrista *et al.,* 1996
PHYTOBENTOS					

Caulerpa taxifolia		Mediterranean coastal area			Meinesz *et al.,* 1998 Aranda *et al.,* 1999
Caulerpa racemosa	1998	Mallorca			Ballesteros *et al.,* 2000
Acrothamniun preissii		Mallorca			Ferrer *et al.,* 1994
Antithamnion amphigenium		Mallorca		Spreading	Ribera and Soto 1992. Ballesteros *et al.,* 1997 Aranda and Solano 1999
Lophocladia lallemandii		South Mediterranean		Spreading	Soto y Conde 1988. Conde *et al.,* 1996. Patzner, 1999
Womersleyella setacea		Balearic Islands			Ballesteros 1993. Ballesteros *et al.,* 1997. Rindi and Cinelli, 1995.
Laminaria japonica		Mediterranean Sea			
Demarestia viridis	1984	Málaga			
Undaria pinnatifida		Biscay Bay			
Sargassum muticum		Biscay Bay			
Asparagopsis armata-Salkembergia rufolanosa	1930	Mediterranean Sea			
Asparagopsis armata-Salkembergia rufolanosa *	2003	Asturias (Biscay Bay)			
Colpomenia peregrina *		Asturias (Biscay Bay)			
Codium adherens *		Asturias (Biscay Bay)			
Grateolupia filicina		Mediterranean Sea			
Bryopsis plumosa		Mediterranean Sea			
Polysiphonia elongata		Mediterranean Sea			
Codium fragile		Mediterranean Sea			
Colpomenia peregrina		Mediterranean Sea			
Chrysymenia whrightii		Mediterranean Sea			
Mastocarpus stellatus		Mediterranean Sea			
Hypnea musciformis		Mediterranean Sea			
PLANTS					
*Spartina versicolor**	1997	Asturias (Biscay Bay)			Bueno Sanchez, 1997. Torre Fernández, 2003
ECHINODERMATA					
*Diadema antillarum**		Canarias Islands			
MOLLUSCA					
Ruditapes			Aquaculture		

philippinarum					
Crassotrea gigas			Aquaculture		
Gibbula albida	1981-1984	Galicia	Aquaculture		Rolán *et al.,* 1985
Gibbula adansoni		Galicia	Aquaculture		Rolán, 1992
Cyclope neritea		Galicia			Sauriau, 1991. Rolán ,1992
Crepidula fornicarta		Galicia			Blanchard, 1997
Dreissena polimorpha (Zebra Mussels)	2001	Ebro estuary	Unknown		C. Altaba (ICES/IOC/IMO SGBOSV, 2002)
CRUSTACEA					
Megabalanus tulipiformis		Bay of Biscay			Kish, 1958
Eriocheir sinensis	2001	Guadalquivir estuary	Ballast water Hull fouling		
Hemigrapsus penicillatus	1994	Laredo (Bay of Biscay)			
FISH					
Fundulus heteroclitus	1973-1976	Southwestern			Bernardi *et al.,* 1995. Gutierrez-Estrada *et al.,* 1998.

*New records species in this area.

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Annex 11: WGBOSV National Report for New Zealand based upon the intersessionally agreed national Report Format

(THE NATIONAL REPORT FORMAT WAS UPDATED AT THE MEETING SEE ANNEX 7 FOR DETAILS)

Chad L. Hewitt, Biosecurity New Zealand, PO Box 2526, Wellington 6001, New Zealand

Context
The finalisation of the Biosecurity Strategy (2003) and subsequent decisions by cabinet have resulted in a significant realignment of biosecurity delivery within central government. Biosecurity New Zealand (BNZ), launched in November 2004, is an agency embedded within the Ministry of Agriculture and Forestry (MAF), however has the obligation of delivering biosecurity across all aspects of central government and coordinating delivery with Regional Councils (local government). The final structure has organised Directorates around intervention points (e.g., Pre-clearance, Post-clearance and Policy and Business Development [including Strategic Science]) rather than sectors (e.g., Animal pests, Plant pests, Forestry, Marine, Conservation, Health). Marine biosecurity delivery was officially transferred from the Ministry of Fisheries (MFish) to Biosecurity New Zealand on 1 November 2004.

The Marine Biosecurity Strategic and Operational Plans have been agreed and signed off by the Biosecurity Chief Executives Forum (MAF, MFish, Department of Conservation and Ministry of Health) and form the basis of marine work plans within the BNZ Directorates.

A Transport Vectors

1 Ballast Water

1.1 Biology of Ballast Water

No current research activity on the biology of ballast water.

1.2 Ballast Water Treatment

No current research activity on development of treatment methods but research on efficacy and evaluation of treatment methods, specifically open-ocean ballast exchange, is occurring.

Ongoing research projects:

a) Investigation of Tools for Verification of Ballast Water Exchange

Funding Agency: Biosecurity New Zealand (Project Manager: Liz Jones)

Research Provider: Smithsonian Environmental Research Center (PI: Dr Greg Ruiz)

Project Duration: 2 yrs

Key Objectives:

1. Using identical methods to those established by SERC researchers in the North Atlantic, determine physical oceanographic tracers of coastal and open ocean waters.
2. Evaluate the efficacy of these tracers on vessels transiting from Port Phillip Bay, Victoria Australia to New Zealand ports by comparing various degrees of open-ocean ballast water exchange.
3. Evaluate the efficacy and use of the hand-held instrument developed under contract for the US Coast Guard in determining full open-ocean ballast water exchange.

1.3 Ballast Water Sampling

Ongoing research projects:

a) Investigation of Slippage Rates associated with Ballast Water Exchange

Funding Agency: Biosecurity New Zealand (Project Manager: Marine Risk Analyst)

Research Providers: TBD

Project Duration: 2 yrs

Key Objectives:

1. Using samples collected in the SERC project, determine the presence (and densities) of the Unwanted Organisms *Asterias amurensis*, *Carcinus maenas* and *Sabella spallanzanii*, in a) uptake water, b) un-exchanged water, and c) water that has met a full open-ocean ballast water exchange.

2 Hull fouling

Ongoing research projects:

a) Hull Fouling Assessment of International Vessels

Funding Agency: Biosecurity New Zealand (Project Manager: Marine Risk Analyst)

Research Providers: New Zealand Dive and Salvage (Commercial Merchant Vessels), Kingett Mitchell Ltd (Fishing and Commercial Passenger Vessels), NIWA-Cawthron (Recreational Vessels)

Project Duration: 2.5 yrs

Key Objectives:

1. To determine the identity (species), status (native, cryptogenic, non-indigenous and known from NZ, non-indigenous and not known from NZ), extent (categorical levels of fouling, percent cover and location) of biofouling occurrence on international vessels visiting New Zealand using a consistent sampling regime and methodology (Appendix 1).
2. To determine the relationship between non-indigenous species presence on vessels and the extent of biofouling, measured both as biomass and according to categorical 'Levels of Fouling' currently used by NIWA (Floerl 2004 available on request).

b) Vessel biofouling as a vector for the introduction of non-indigenous marine species to New Zealand: Management Tools

Funding Agency: Biosecurity New Zealand (Project Manager: Marine Risk Analyst)

Research Provider: NIWA-Cawthron (Recreational Vessels)

Project Duration: 2.5 yrs

Key Objectives:

1. To determine the factors influencing the presence of NIS and the extent of biofouling on vessels through: development of a questionnaire (in collaboration with MFish Marine Biosecurity Group staff), completion for all sampled vessels and subsequent analysis.

Planned research projects

c) Hull Fouling Assessment of Domestic Vessels

Funding Agency: Biosecurity New Zealand (Project Manager: Marine Risk Analyst)

Research Providers: TBD

Project Duration: 2 yrs

Key Objectives:

1. To determine the identity (species), status (native, cryptogenic, non-indigenous and known from NZ, non-indigenous and not known from NZ), extent (categorical levels of fouling, percent cover and location) of biofouling occurrence on domestic vessels leaving New Zealand ports for the sub-Antarctic Islands under New Zealand protection using a consistent sampling regime and methodology (Appendix 1).
2. To determine the relationship between non-indigenous species presence on vessels and the extent of biofouling, measured both as biomass and according to categorical 'Levels of Fouling' currently used by NIWA (Floerl 2004 available on request).

3 Other Ship Vectors

Results from research projects

The extent to which sea-chests pose a threat has been investigated by the Cawthron Institute under Foundation for Research, Science and Technology (FRST) public good science funding (Dodgshun & Coutts 2002).

B Invasive Species Management

1 Eradication Programmes

The paper by Wotton and Hewitt (2004) outlines the current Incursion Response regime in place for marine biosecurity in New Zealand. Transfer to BNZ has also created opportunities for synergy with existing delivery contracts used in terrestrial and freshwater systems. Emergency response plans have been developed for all of the Unwanted Organisms currently identified, and active (primary ports of entry) and passive (information sheets, 0800 INVADERS freecall number) monitoring efforts are underway to aid in early detection.

Ongoing research projects:

a) Incursion Response Tool Development

Funding Agency: Biosecurity New Zealand (Project Manager: Brendan Gould)

Research Provider: Cawthron Institute (PI A Coutts)

Project Duration: 1.5 yrs

Key Objectives:

1 To determine the efficacy of wrapping wharf piles with plastic at killing various species of flora and fauna.
2 To determine the efficacy of using dredged sediments as a capping medium for killing various species of soft sediment flora and fauna.

Planned research projects

The Asian portunid crab, *Charybdis japonica*, was introduced to Auckland Harbour in 2000, most likely associated with ballast water transport. Upon detection and subsequent delimitation survey, it was determined too well established to eradicate. Subsequent monitoring of the population has demonstrated that the population appears not to have has a successful recruitment event with no new small size classes appearing. Similarly, the population appears to have remained largely restricted to its original area of incursion (two crabs have been detected outside of this region). This poses an opportunity to develop community based fish-down techniques to underpin a control and potential eradication programme. The current intent is to

develop a Request for Proposals to undertake a fish-down experiment using community groups. Of greatest concern is the potential for significant by-catch of native crabs, consequently information sheets and training workshops will be an intrinsic component of the activity.

An ongoing program for developing incursion response tools is underway. Investigations will include examining and trialling the efficacy of heat treatment sterilisation on native substrates (developed as part of the Stewart Island *Undaria* eradication programme; see below) and the trialling of vacuum-controlled brush-cart cleaning devices (developed independently by Auckland Divers and New Zealand Dive and Salvage).

2 Management and Control of invasive species

Biosecurity New Zealand has vested responsibility for coordinating management and control of introduced species in all environments. Currently no National Pest Management Strategy exists for a marine organism; however the ongoing management of the Japanese alga, *Undaria pinnatifida*, requires significant coordination.

The Department of Conservation (DoC) has had an ongoing eradication programme against *Undaria* on Stewart Island (south of the South Island). *Undaria* was established on Stewart Island in March 1997, in an area of mussel culture and small fishing vessel traffic. The programme physically removed plants over a seven year period (1997 – 2004) at a total expenditure of NZ$2.8 million. The programme successfully reduced sporophyte numbers to near zero, however the total area of infestation was increasing. In 2003/04, Cabinet requested that further *Undaria* expenditure be prioritised within the whole-of-government budget process. This bid was not supported and has resulted in the cessation of the Stewart Island Programme.

Cabinet has also agreed to allowing commercial harvest of *Undaria* as long as it is in support of an eradication or control program, or it is a by-product of another pre-existing commercial activity (e.g., an established mussel culture).

C Impact of Invaders

Results from research projects

The Cawthron Institute under FRST funding has undertaken a formal investigation of *Undaria* impact (Forrest and Taylor 2003). This investigation could not detect a significant impact of *Undaria* on native community assemblages, however indicated that the power of the experiment was low, and that the impact is likely to vary across environmental gradients (e.g., exposure) that were not assessed.

Ongoing research projects:

a) Parasites and pathogens of introduced decapod crustaceans

Funding Agency: Biosecurity New Zealand (Project Manager: Marine Risk Analyst)

Research Provider: Caterbury University

Project Duration: 2 yrs

Key Objectives:

1. To determine the identity (species), status (native, cryptogenic, non-indigenous and known from NZ, non-indigenous and not known from NZ), and extent (% of population) of parasite and pathogen occurrence in the introduced decapod crustaceans detected in New Zealand.
2. To determine the extent to which the identified parasites and pathogens are detected in native decapod populations, specifically congerneric and co-occurring species.

D Risk Assessment Approaches

A significant workplan has been developed for marine biosecurity delivery in the BNZ Risk Analysis Team that includes the identification of high risk species, an evaluation of relative risks between and within vectors (e.g., ballast water, hull fouling, aquarium trade, aquaculture), and an evaluation of relative risks associated with pathways (trading routes). This work will largely be conducted by BNZ staff, however some work will be outsourced such as the hull fouling evaluations and questionnaires identified above.

In addition, the Risk Analysis Team responds to requests for risk assessments as part of its core business. These requests include an assessment of risks associated with the request to import a species not covered under an existing Import Health Standard (IHS) (e.g., live microalgae for aquaculture food), the development of a new IHS, or undertaking an Organism Impact Assessment (OIA) as part of an Incursion Response.

Ongoing research projects:

The Cawthron Institute has developed a risk-based decision support framework for setting management priorities under funding from the Foundation for Research, Science and Technology (FRST) public good science fund. This framework is further described in an in press paper (Forrest et al in press).

NIWA has also developed a habitat classification model to aid the identification site selection for monitoring programs. The model uses the overlap between target species environmental requirements and spatially explicit information about port regions to determine probable overlap. The model will be more fully described in the final reports for surveillance activities and in a paper currently in preparation by G Ingles.

F References

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Appendix 1 to New Zealand National Report

Vessel Sampling Design

In order to guarantee congruency between tenderers and across vessel types, the following sampling design has been prepared. Tender proposals that identify deviations from this design will be considered only under exceptional circumstances.

Vessels will be divided into three regions (bow, amidships, stern) regardless of vessel size. Bow and stern regions should be sampled at least 1m from the bow or stern. Sample areas within each region should include near surface (0.5m) and inside (where feasible) and outside dry docking support strips. Quantitative samples (quadrats) should be at least 0.04m^2 (20cm X 20cm), replicated at least three times per sample area, collected photographically (digital or still at a 1:6 ration to guarantee taxonomic usefulness) and then scraped for subsequent wet weighing and identification to species level. Methods to prevent damage to the hull (e.g., plastic scrapers, etc…) should be explicitly identified in the tender.

Vertical (surface to keel) video transects should be conducted in each region and of gratings, sea chests, thrusters, or any other aggregation of fouling. Qualitative samples from these regions should be collected as available with coupled photographic stills, and identified to species level.

Rough sorting to type should be conducted and voucher specimens (at least one of each type) for individual vessels are to be developed for further identification to species. Taxonomists under separate contract with NIWA will identify this material to species and the vouchers will be deposited in a collection under MFish discretion. The taxonomic results will be provided to the original tenderer(s) in their entirety as a spreadsheet file to enable tenderer(s) to undertake the final analysis.

Annex 12: Abstracts from talks delivered at the meeting

ETV Program and testing of surrogate species

Dobbs, Fred (USA)

Dobbs began with a presentation prepared by Tom Stevens (NSF International stevenst@nsf.org). The ETV program was designed to promote marketplace acceptance of environmental technologies that protect human health and the environment. This is achieved by generating objective, third-party performance data for the environmental technologies. The ETV Program evaluates (e.g., measures, estimates, tests) and verifies (e.g., confirms, substantiates) how well various treatment technologies perform given a specific set of conditions and parameters. By using standard test protocols written with stakeholder input, vendors are assured of a "level playing field". Participation in the ETV Program is voluntary and, as the results of the verification test are made publicly available, is intended for commercial-ready technologies only, as the ETV Program is not intended as a research tool for technology performance. The results obtained during testing will be published, regardless of the performance of the technology. The ETV Program does not certify (e.g., warranty or guarantee) any of the technologies it tests, and is not to be mistaken for an approval process.

In the context of the ETV Program's verification of ballast-water treatment technologies, Dobbs next presented ETV's plans and ideas about: definitions of technology; protocol development; testing approach; challenge conditions and their objectives; water quality challenge matrix (since modified); list of surrogate species (since modified); biological challenge conditions; testing approach and measurements; examples of in-line and in-tank treatment diagrams; discharge toxicity tests; viability measurements; and research needs.

One of the research needs identified by the ETV program is to select surrogate species to be used in its verification of ballast-water treatment technologies. In the latter portion of his presentation, Dobbs described a recently begun research project for which he is project manager. The project is entitled, "Screening of surrogate species for ballast water treatment". It will entail a comprehensive series of experiments with the intent of yielding a short list of surrogate organisms. The expectation is that inactivation of surrogate species by a given technology will represent the response of a much broader group of organisms that cannot be tested for logistical and financial reasons.

The project's team of principal investigators consists of a phytoplankton ecologist with extensive experience in harmful algae and their cysts, (Don Anderson), a marine bacteriologist (Russ Herwig) and a zooplankton ecologist (Jeff Cordell) who have previously worked together to test ballast-water treatment technology, a protozoologist (Andrew Rogerson) who also is engaged in testing treatment technology, and a marine microbial ecologist (Dobbs) whose research group has studied ballast-tank microbiology since 1996.

Each principal investigator has expertise with one of the identified classes of surrogate organisms (bacteria, heterotrophic protists, phytoplankton, and zooplankton). This expertise includes the ability to culture many of the species to be tested, including manipulating some to produce resistant resting stages, or to collect appropriate organisms from natural waters.

Testing procedures will be standardized so that the exposure experiments can be conducted in each principal investigator's laboratory, thereby ensuring the health of the surrogates during testing and subsequent viability testing. It is important to remember the objective of this testing is to evaluate species for their representative nature, not to test fully the efficacy of treatment stressors.

Relevant Factors in the Engineering & Design of Test Facilities for Testing Ballast Water Treatment Devices

Lemieux, Edward (USA)

The Naval Research Laboratory has been tasked with constructing an Environmental Technology Verification (ETV) Test Facility for the testing of ballast water treatment technologies. A full-scale test facility has been designed and constructed in order to support this task and is presented in the following. Additionally, the current document discusses the factors which are required for consideration in the both the design of such facilities and the testing of technologies. With regards to the former, such topics as piping arrangements, sensor technologies, sampling methods and statistical rigor are considered. Some results are discussed from efforts to determine the most appropriate means for injection of surrogate organisms and the relative resultant mortality and recovery of these systems. Furthermore, sampling wand geometries for in-line pipe sampling were interrogated to identify the sampling method which would result in the most representative sample. Finally, this presentation discussed the necessity for a high degree of control of the various physical parameters for proper qualification type testing and the need for comparability amongst test facilities.

Biosecurity in New Zealand

Hewitt, Chad (New Zealand)

New Zealand has a comprehensive research and management program for marine biosecurity delivery. This includes risk assessment of species, vessels and trading pathways and the development of management options (including voluntary Codes of Practice and Regulations). We are currently investigating the risks associated with hull fouling and sea-chests and identifying the options for managing hull fouling risks. Hull fouling research is investigating the numbers of non-native species not present in New Zealand waters, which are present on the hulls of vessels from recreational, fishing, commercial passenger and commercial merchant sectors. This research programme will be completed in 2008. We are simultaneously investigating the relationship between vessel behaviour (e.g., last hull cleaning, last dry docking, vessel speed) and measured risk (e.g., numbers of non-native species not present in New Zealand waters, which are present on the hulls of vessels).

New Zealand has also established voluntary Code of Practice to limit hull fouling associated transfers of species from the New Zealand main Islands to the subAntarctic Islands under New Zealand jurisdiction. This Code of Practice is being updated and is available on request. In addition, New Zealand has undertaken research to determine the efficacy and associated risk from in-water cleaning, cleaning by careening, in uncontained dry-dock and in contained dry-dock. The results of this study, while limited to a single season, indicate that the majority of organisms do not survive physical removal either through mechanical, cold or warm freshwater, cold or warm seawater, or steam cleaning. These results are informing the development of approval standards for cleaning locations or stations and the development of underpinning regulations.

Important aspects of testing Ballast Water Treatment Systems

Kornmüller, Anja. (Germany)

The experiences in testing of Ballast Water Treatment (BWT) Systems derive from the R&D-project “Modular processes of sediment removal and disinfection for BWT onboard” by ELGA Berkefeld and its subsidiary RWO Marine Water Technology as well as from the Working Group 2.11.4 “Treatment of Ballast Water” of the Committee 2.11. “Protection of

Marine Environment" of the Standardization Centre for Vessel and Marine Technology (NSMT / DIN, Hamburg, Germany).

- Testing of BWT should be carried out under realistic conditions with natural water, which represents the water quality and conditions found during ballasting operations. Most ballasting operations take place in harbours and estuaries.
- The concentrations in test water proposed in the "Draft Guidelines for Approval of Ballast Water Management Systems" (G8, MEPC 53/2) are too low and therefore hard to find in reality. Especially the very low Total Suspended Solid (TSS) concentrations are critical, because they don't give challenging conditions for the mechanical separation step.
- In the proposed test water the upper value in Particulate Organic Carbon (POC) limits the addition of test organisms for testing the biological efficiency, because the test organism itself contains POC.
- Likewise there is no reason for limiting the Dissolved Organic Carbon (DOC) because both high POC and DOC concentrations make the test water harder to treat, especially for the disinfection step.
- In reality much higher TSS concentrations were found at three different test locations in Germany with up to 600 mg/L TSS far above the proposed test water.
- Type approval under too low and unrealistic TSS endangers the later malfunction of BWT systems onboard, because most single mechanical separators are not capable of treating TSS above 150 mg/L, which results in frequent back-flushing and low ballast water production. The consequences in ship operations would be longer lay times or a necessary resizing of the BW pumps, piping and BWT.
- Sufficient dosing and sampling systems for test organisms have to be included in the above mentioned G8 to guarantee that the test species are not damaged by the dosing system (e. g. using an aerated (not stirred!) dosing tank and displacement pump) and are reproducible taken by the sampling system (sampling pipe inside the main piping due to the often lighter density of algae).
- Before and after the sampling points distances with undisturbed flow have to be included in the test installation.
- For evaluation of the biological efficiency of a BWT system, it is recommended to add test species in numbers higher than proposed by G8 in the influent to the treatment system to be able to determine the effluent numbers above the detection limit and with a low standard deviation. The biological efficiency can only be judged by the influent and effluent numbers of species. A percent removal gives no information on the compliance with the Performance Standard D2 for BWT.
- Altogether, an agreement on realistic guidelines for land-based testing and type approval is needed to guarantee the function of BWT systems later onboard.

Port and ballast water studies in Finland to assess risk of introductions

Leppäkoski[1] Erkki, Laine[2] Ari, Pertola[2] Sari, Pienimäki[1] Marjo (Finland)

[1]Åbo Akademi University

[2]Finnish Institute of Marine Research

This presentation summarizes ongoing studies in the BITIS-project ("Is the Biological Integrity of the Baltic Sea Threatened by Invasive Non-native Species?" funded by the Finnish Academy of Sciences for 2003-2005 within the Baltic Sea Research Programme BIREME). The project is focused on (1) introduction of alien phytoplankton species (dinoflagellates) and their potential for harmful algal blooms, (2) invasion history and impact of established invertebrates on biodiversity and ecosystem functioning, (3) biological risk assessment of port areas, including vector capacity of shipping, and (4) dissemination of information.

Analysis of potential invaders to the Finnish Lake District.

A risk assessment for the Finnish Lake District has been conducted by comparing environmental characteristics of the area with ecophysiology of some known NIS established in nearby areas (Pienimäki & Leppäkoski 2004). The data was combined with shipping statistics to analyze the vector availability for these species. The main invasion barriers for species penetrating to the area are low temperature, low pH, low Ca concentration and isolation. The Lake District is connected to the Gulf of Finland only via the relatively narrow and shallow Saimaa Canal. Six out of the 29 assessed species turned out to have a high probability of being introduced and established in the Saimaa area in the near future. These are *Anguillicola crassus* (Nematoda), *Potamothrix heuscheri* (Oligochaeta), *Potamothrix vejdovskyi* (Oligochaeta), *Hemimysis anomala* (Mysida), *Cercopagis pengoi* (Cladocera) and *Gmelinoides fasciatus* (Amphipoda).

Ballast water transport to Finnish coastal waters: analysis of shipping patterns and vector potential.

Risk evaluation of NIS being transported to Finnish coastal waters will be based on vector availability and environmental matching. Vector analysis is done using shipping statistics to estimate BW transport. Ranking of potentially high-risk BW transport will be based on environmental matching (salinity and temperature conditions) between donor and recipient areas. Based on the preliminary results of a questionnaire carried out in 2003 in four coastal ports in southern Finland, the main BW donor areas are the Baltic Sea ports, the North Sea area and eastern coast of North America.

Sampling of ballast water and sediment accumulated in tanks has been carried out to characterize the biological assemblages of ships calling the Gulf of Finland. Onboard sampling was started in 2003 and will continue until the end of 2005. Sampling is focused on oil tankers, which are the largest source of BW. The BW transport is expected to increase in the near future due to increasing export of crude oil from new ports in the eastern Gulf of Finland. Up to now, 23 vessels arriving from ports outside the Baltic Sea have been sampled. BW sampling includes basic environmental variables (salinity, temperature, oxygen and nutrient (N, P, Si) concentrations). Qualitative and quantitative phytoplankton and zooplankton samples have been taken using net hauls and water sampling with a hand pump. Qualitative sediment samples have been taken for dinoflagellate cyst germination studies and macrozoobenthos analysis. Preliminary results indicate abundant living copepods but also chaetognaths, mysids and young fish in ballast waters. Small dinoflagellates (*Heterocapsa rotundata* & athecate species) that are difficult to identify dominated in ballast tank sediments in contrast to more diverse port sediments. Polychaetes seem to be the most common macrozoobenthos in tank sediments but also amphipods, decapods and isopods have been found. The final results on shipping vectors and ballast tank sampling will be available by the beginning of 2006.

Port biological surveys.

A port biological survey was conducted as a case study in four ports in southern Finland in 2003. In general there is no monitoring focused on port areas in Finland and consequently very little information on port biological communities. The aim of the survey was to characterize port areas as recipient and donor areas for introductions. A comparision of communities in ports and in natural habitats was made. Invertebrate communities in littoral and on artificial substrates were compared by sampling port structures, buoys, man-made shoreline, and natural reference shores. It was found that the fouling communities were more similar between ports than the natural littoral assemblages in reference areas. *Gammarus tigrinus* was found in two ports, which is the first record of this invasive amphipod in the northern Baltic. Soft-bottom macrozoobenthos was sampled in port basins and the communities were compared to nearby areas by using data from existing monitoring studies. Relatively rich fauna was found in port basins but the community structure in all areas differed from each other, which indicate the need of locally focused studies. The polychate *Marenzelleria viridis* was the only NIS re-

corded in ports but the species is currently widely distributed and common also elsewhere in the coastal areas.

References

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Status of the *Rapana venosa* invasion in the Chesapeake Bay, Virginia.

Mann, Roger and Harding, Juliana M. (USA)

The Asian rapa whelk, *Rapana venosa*, was first observed in the Chesapeake Bay, Virginia, USA in 1998. *R. venosa* is native to the Sea of Japan and Golf of Bohai. It was introduced to the Black Sea in the 1940's and has since spread eastward across the Mediterranean. A focused discussion of world wide status of this species is given in Mann et al (2004). The suspected vector to the Chesapeake Bay is ships ballast water transport of larval stages from Black Sea origins. We have collected Chesapeake Bay *R. venosa* as part of collaborative program with commercial fishermen since 1998. Fishermen are paid $5 per live animal and $2 for each dead animal collected. Collection location information is provided and archived. *R. venosa* have been collected in increasing numbers in each year during the 1998 –2004 period. Total number of live specimens collected now exceeds 10,000. Breeding of the species in Chesapeake Bay is demonstrated by changes in the demographics of collected specimens with gradually increasing numbers of smaller specimens (recruitment) and decreasing representation of large (>160 mm length) individuals (suspected mortality from old age) in recent collections. Little range expansion has been observed with the vast majority of the collections remaining in the original range of observations as reported by Mann et al (2004). Harding and Mann (in review) note a modest (early 2005) range extension to the north to Tangier Island within the Chesapeake Bay, and upstream within the James River. The former collections are very limited in number and from a region that was previously unexploited by commercial fishermen – they may represent part of the original invasion. No evidence of breeding has been found in the Tangier location, but the sample size is so small that conclusive statements cannot be made. Upstream movement in the James River is, again, to a region that was previously unexploited by fishermen. This upstream incursion probably coincided with several years of low river flow and atypical high salinity; however, a high flow year in 2004 probably resulted in lower salinities at critical high summer temperatures and retraction of the range to former limits. The collaborative program will continue through at least calendar year 2006.

Literature cited

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Ballast water issues in Croatia

Pećarević, Marijana, Lovrić, Josip and Bratoš Cetinić, Ana (Croatia)

The Norwegian – Croatian project "Ballast water issues for Croatia: Possible usefulness of Nowegian experience and expertise" was carried out during the year 2004. The chief purpose of the Project was to assist Croatian authorities in considering and evaluating (1) the risk of

introducing invasive and non-native species with ballast water (2) technical risk control options (3) regulatory options for the ballast water issues Croatia may deal with.

The major part (about 74%) of Adriatic Sea coast belongs to Croatia but, because there is more import of cargo than export and the ballast water voulme dischared is low, Croatia plays only a minor role in today's ballast water situation in the Adriatic Sea. However, there is increased concern over ballast water in connection with the plans for oil pipeline integration projects in the region and oil export from port of Omišalj. Croatia currently faces ballast water issues in two respects: firstly, in relation to all of its export ports, where an examination on this matter is needed and both technical and regulatory solutions are required, and, secondly, in relation to a particular location – the port of Omišalj, which may experience an intensive and progressive tanker export traffic.Croatia is then left with three possible scenarios:

1. no oil export, general traffic

2. 5 million tonnes oil export + general traffic

3. 15 million tonnes oil export + general traffic

The ballast water risk assesment is made up of several vectors: ballast water volume, quality and frequency of introduction. Ballast water volume and the number of vessels discharging ballast water will increase as a consequence of a natural growth in general vessel traffic recorded in all Croatian ports during the last few years. Most of the vessel taffic and ballast water will remain local, from the Mediterranean and other Adriatic ports. But, if Omišalj becomes an oil export port, the ballast water volume will increase drastically. The majority of the ballast waters will arrive from completely different locations, probably from North America and North-West Europe. Huge changes in ballast water volume and origin will significantly increase the risk of introduction of non-native species.

Ballast Water Exchange is impossible in the Adriatic Sea due to depth and distance limitations. Therefore, alternate ballast water exchange zones must be considered, as well as land-based reception facilities. Croatian authorities are planning the implementation of the IMO Ballast Water Management Convention, but first of all detailed monitoring programmes on exotic species in Adriatic Sea have to be conducted. Also, information regarding the potential impacts of invaders and risk assessments are needed to identify vessels from critical areas. A precautionary approach in order to prevent unwanted impacts needs to be given high priority because certain invaders may cause negative influence on coastal environments, but also on two very important sectors in Croatia - tourism and fisheries. Creation of a regional network including all countries along the Adriatic sea is needed for a mutual benefit of all involved parties and for avoiding duplication of efforts and research. Hopefully, regional efforts will result in a minimization of future species introductions and preservation of the Adriatic sea.

Ballast Water Risk Assessment – The DNV approach used for Croatia based on the DNV EMBLA method

Dragsund, Egil (Norway)

EMBLA is a ballast water risk assessment method developed by DNV over a period of 4 years – 1999 - 2002. The initial purpose of EMBLA was to develop a method to be used by ship owners and authorities as an internet based decision support system for ballast water exchange on specific voyages. The last year (2004) we started a revision of the method in compliance with Regulation A-4 in the IMO BW Convention and the Risk Assessment Guideline G7. A final version is expected to be finalised in the end of 2005.

The EMBLA system encompasses following main modules (preliminary version used in the Croatia project):

1. **Target Species List**. This is a list of unwanted or hazardous species that a country, region or port does not want introduced. Hence the target lists is specific for the geographical area under consideration. Target species are either defined by the port/country/region or selected in EMBLA by a comparison of the lists of non-indigenous species (NIS) in the donor port and the receiving port. All NIS are characterised with the following parameters in the database: potential known negative impact (environmental, economic, human health), amendable to management and ballast water as vector. The target species list shall contain maximum 15 species.
2. **Ballast Water Log** for a specific vessel. This is a database with data like number and type of ballast tanks (peak, wing, double bottom and hold) and the ballast tank volumes is stored. The module is built generically, hence the at anytime requested combination of ballast water (volume, origin and date of origin) in the vessel can be made available.
3. **Port data base** with associated environmental data (temperature & salinity, monthly average, minimum, maximum) and biogeographic provinces. The current version uses the Briggs-Ekman biogeographic provinces.
4. **Risk Assessment** is carried out for all BW tanks onboard a vessel in two stages depending on the voyage;
    a. *Environmental matching* when the vessel is going from one biogeographic region to another. In the Briggs-Ekman system the world is divided in four major temperature regions; tropical, warm temperate, cold temperate, Arctic/Antarctic. Endpoint of risk assessment is qualitative (high, medium, low)
    b. *Species specific assessment* for voyages within a biogeographic province. The total probability of survival of Target Species is calculated in EMBLA as a function of survival during each of the ballast water operational stages (uptake, transfer, discharge, receiving environment). To the extent possible the different life stages of the Target species should be assessed differentiating on seasonal variations of life stage occurrence in donor port areas with seasonal conditions in recipient port. Endpoint of risk assessment is quantitative.

The purpose of the Croatian risk assessment was to provide a knowledge base for evaluating alternative ballast water management options for today traffic patterns in the Adriatic Sea and future maritime traffic scenarios. Most of the BW discharged in Croatia and other Adriatic Sea countries today originate from the Adriatic Sea or the Mediterranean Sea. Several existing plans for oil export from ports/terminals in the Adriatic may change this picture. Large volumes of BW will come from other biogeographic regions.

EMBLA environmental matching as well as species specific risk assessment was used to calculate risk for specific routes by using generic vessels in the EMBLA database. All results was categorised in three levels (high, medium, low) and all routes ranked by using volume and frequencies of ballast water discharges (Risk level x BW volume x BW discharge frequency). The probabilities for implementing BW exchange (200nm/50nm from the coast in water greater than 200m depth) on the ranked routes were discussed together with alternative options for ballast water management.

Early Detection/Rapid Response

Pederson, Judith (USA)

The purpose of early detection is to identify populations that pose an economic or ecological risk, but have not yet spread beyond a delimited region. A restricted distribution may permit eradication or other management actions that reduce or contain populations to a restricted area. A rapid response may be taken to eradicate or attempt to eradicate the population. Implicit in this action is a rapid assessment of the potential economic and ecological costs, a willingness to take action, the likelihood of success, an acceptance of consequences of actions,

and anticipated outcomes if no action is taken. The assessment and response requires a coordinated effort on the part of government, the public and often the private sector.

Early detection involves being able to identify new introductions that are in early stages of establishment, preferably before dispersal. This in turn requires monitoring to identify new populations, verified taxonomic identifications, vouchers for continued verification, and awareness of potential vectors and species that may arrive. Monitoring for early detection is challenging. Species may be localized, small, and inconspicuous for several years and frequently they are misidentified. Active monitoring programs are those that are dedicated to identifying nonindigenous species whereas passive monitoring programs may be conducted for other purposes (e.g. water quality or biodiversity). Few agencies commit to active marine invasion monitoring programs that are suitable to provide early detection.

A decision to implement a rapid response implies that a risk assessment has been undertaken in a timely fashion. The rapid risk assessment has several built in conditions: e.g. a definition and acceptance of the goals, information on the life history of the species in question, information on treatment alternatives, a "command" group that has authority and can coordinate activities, and the likelihood of success. Implied in a risk assessment is that information is readily available for species of concern and lessons learned from other attempts to eradicate.

A rapid response generally implies eradication is attempted. Potential treatments include chemical, physical, and biological options that are targeted for specific taxa or species. A list of available treatments and the organisms or taxonomic group that they target is available from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) [http://www.marine.csiro.au/crimp/reports/Toolbox.pdf]. In addition, case studies indicate how decisions were made, problems encountered during implementation, and level of success. The application of any treatment will usually cause harm to the community and thus, could involve significant discussion by interested parties. One recommendation to allow the rapid actions often needed to eradicate or delimit the undesired species is to have pre-approved treatments by permitting or licensing agencies. Another suggestion is to have training of those likely to participate comparable to oil spill response teams and forest fire fighters. All actions should include sessions on lessons learned to inform those responsible for future actions.

Developing and implementing Early Detection/Rapid Response programs for ICES countries would necessitate meeting many of the elements described above. Cooperation between neighboring countries would add an additional layer of complexity and commitment. Geographic Information Systems mapping should be explored as a tool for assisting with introduced species detection or potential spread.

Biological testing on board vessels

ten Hallers-Tjabbes, Cato (the Netherlands)

The liability of the ship owner/shipper for ensuring the proper functioning of a BW treatment system, is not clear in the BW Convention. DE (Design & Equipment Committee of IMO, February 2005) advised including biological testing on shipboard, to test whether the treatment system works on a ship in full operation. In an earlier debate in MEPC a concern was the availability of automatic testing methods in order to carry out such tests.

Flow cytometry as adapted for oceanic research purposes has qualities that render it appropriate for use in ballast- water treatment testing, both on land and at sea. The method can identify particles of 1µm and more and can detect viability with a linked technique. Flow cytometry is fast and capable of multiple measurements; data can be adequately processed for research and testing purposes.

The method is robust and can operate for extended periods when mounted on a ship without adjustment. The price is fair (30-50 K Euro/Unit) and production can be rapidly increased if need be.

Ballast Water Management – The French Involvement

Daniel Masson (France) by correspondence

With a coastline of 5,000 km and large aquaculture facilities in close proximity to major ports, France is particularly concerned of releases of unmanaged ballast water. It was recently calculated that approx. 22 million cubic meters of ballast water are discharged annually in French ports. In 2001 a ballast water survey on 30 ships arriving in 5 major ports was undertaken. Half of the ships sampled carried potentially noxious bacteriae (e.g. *Clostridium*, *Vibrio*, *Pseudomonas* spp.) and potentially toxic phytoplankton taxa (e.g. *Heterosigma*, *Dinophysis*, *Pseudonitzschia* spp.) on board. Dinoflagellate cysts have been found in sediment samples from ballast tanks.

France was involved in the EU MARTOB Project on ballast water treatment technologies. A small pilot scale system was developed to mimic ballast tank conditions. More efforts should be spend in the design and testing of prototype ballast water treatment technology. French vendors are currently developing candidate technologies.

Future work relevant to biological invasions may include:

- Public awareness addressing the problems of biological invasions to all stakeholders involved,
- An assessment of the economies at risk (i.e. coastal fishing and aquaculture) from the impact caused by introduced species, and
- Forming of a French working group to deal with ballast water issues:
    - preparation of ballast water management strategies,
    - control and sampling studies, and
    - involvement in international working groups.

Annex 13: Report of the BSRP/HELCOM/COLAR Workshop on "Ballast water introductions of alien species into the Baltic Sea" 21–25 February 2005, Palanga, Lithuania

This summary is an edited version of the full meeting report. For additional information, please contact Sergej Olenin, Klaipeda University at serg@gmf.ku.lt

Introduction

Many of the invasive alien species present in the Baltic Sea originate from ship ballast water introductions. The role of shipping as a vector of introduction is constantly increasing. Presently, the IMO Ballast Water Management Convention (BWMC) is open for ratification, and if properly implemented, the BWMC will minimize the risk of further shipping mediated biological invasions. The implementation of the IMO BWMC in the Baltic Sea area will require a large number of scientific advice and administrative decisions.

Aims of the Workshop:

1) to assess applicability of the risk assessment and port baseline survey methodologies developed under the IMO GloBallast and other relevant projects for the Baltic Sea;

2) to evaluate the research capacity, technical potential and financial resources needed for the risk assessment and the port baseline surveys;

3) to elaborate common principles for the monitoring system of invasive species in the Baltic Sea;

4) to develop a common information system for the Baltic Sea supporting the implementation of the IMO BWMC Convention.

Participants of the Workshop
The Workshop was attended by 22 participants from all Baltic Sea countries as well as from Ukraine and Norway. Also HELCOM, the GEF-UNDP-IMO GloBallast Programme and the ICES/IOC/IMO Working Group on Ballast and Other Ship Vectors (WGBOSV) were represented.

Need for regional cooperation
In accordance with the IMO BWMC article 13 "Technical assistance, co-operation and regional cooperation" the Workshop stressed that cooperation within the Baltic Sea region is crucial for minimizing the risk of ballast water mediated introductions of invasive alien species into the Baltic Sea region. Development of methodologies for port baseline biological surveys and risk assessment, design of alien species monitoring programmes, early-warning system and exchange of information would be most effective, both financially and scientifically, if done in cooperation, between states both within the Baltic Sea region and outside it.

HELCOM action to address ballast water issue
The Workshop discussed the draft HELCOM Recommendation "Measures to address the threat of invasive species transported via the ballast water of ships" (October 2004) elaborated in accordance with the IMO's BWMC. The Workshop welcomed the draft HELCOM Recommendation as being very valuable for the organisation of work to prevent ballast water mediated introductions of invasive alien species.

The Workshop also agreed that because of the geographical characteristics of the Baltic Sea (a mean depth of 55 metres; all areas deeper than 200 m are within less than 50 nautical miles to the nearest land) the requirements of the BMWC (Regulation B-4, paragraphs 1.1. and 1.2.) for conducting ballast water exchange cannot be met in the Baltic Sea. An evaluation of the suitability of designating areas in the Baltic where a ship may conduct ballast water exchange,

in accordance with Regulation B-4, paragraph 2, must be made by the port states. Ballast water exchange within the Baltic may prevent the spread of freshwater invasive alien species from one freshwater Baltic port to another. However, the ballast water exchange should not be considered as the only effective measure for managing ballast water within the Baltic. Development of risk assessment methodology and other tools (biological surveys, monitoring, early-warning systems, appropriate treatment of ballast water) is extremely important for prevention of ballast water mediated introductions of invasive alien species.

Risk assessment of ballast water mediated introductions
The Workshop stressed that the main benefits of carrying out risk assessment are:

- High risk ships can be identified through risk assessment and special measures can be applied for the management of their ballast water (for example treatment, exchange of ballast water in designated areas outside the Baltic or treatment at land-based ballast water and sediment reception facilities).
- Measures can be adopted to reduce or ameliorate the risks identified in risk assessments.
- Knowledge about the risk of invasive species can be used to support concerted action in other international fora, e.g. IMO and EU.

The Workshop discussed experiences from the IMO GloBallast, DNV, and BITIS projects for assessing the risks of introductions with ballast water. The Workshop noted that although risk assessment is a very valuable and essential tool, it could become a resource consuming activity. The Workshop agreed that a common approach to risk assessment within the Baltic Sea region is needed and recommended that future work be based on:

- An analysis (present and future) of shipping patterns in the Baltic Sea, which includes the origins of ballast water and the spatial and temporal patterns of discharge within the Baltic in order to quantify and understand the possible risks to the Baltic [2005-2006].
- An environmental similarity analysis for the Baltic Sea region should be performed to identify potential source regions of alien species that are of high risk [2005-2006].
- Methodologies for risk assessment should be evaluated to determine which methodology is best suited for the Baltic Sea region. This evaluation should be based on the outcome of the analysis of shipping patterns, the environmental similarity analysis and the results from full-scale pilot studies from the Baltic Sea region.
- Risk assessments should be made for areas/ports of special interest (applying the principles of the IMO guidelines)

The Workshop agreed that there is a need for an additional workshop in the end of 2005 – beginning of 2006 in order to:

- Agree on final risk assessment procedures incorporating experience and knowledge collected during actions 1, 2 and 3 to the methodology of risk assessment;
- Develop a common structured procedure for species specific assessment to be used in developing a “black list” of harmful or potentially harmful alien species that are especially undesirable to be introduced to the Baltic Sea;
- Develop principles for an early-warning system concerning ballast water uptake in certain areas such as areas known to contain outbreaks of toxic (algal) blooms (BWMC regulation C-2)].

The Workshop agreed that the internal Baltic ship traffic is not of primary interest for the risk assessments because alien species once settled in some part of the Baltic, are able to spread through natural means, if the environmental conditions (salinity, temperature, etc.) are acceptable, as well as through ballast water and other human-mediated vectors. Possibilities are very limited for effectively preventing secondary introductions through ballast water within the region and thus limit the advantages of using risk assessment procedures. However, there could be certain cases where the internal shipping risks should be analyzed, for example when extraordinary measures are required to prevent the spread of a particularly harmful species (such as a pathogen or toxic algae).

Port Baseline Surveys

The Workshop agreed that the port baseline surveys should be carried out by the Contracting Parties. The aim of the surveys should be: a) to provide necessary baseline data on the alien species composition, distribution and abundance in ports and adjacent areas for the risk assessment procedure and b) to outline the reference conditions in ports and adjacent areas to be used in development of an early-warning system, future monitoring of alien species and for the ecosystem management systems.

Common principles of the monitoring system of invasive species in the Baltic Sea

The Workshop took note of the information on the HELCOM data and assessment strategy and the ongoing review of the HELCOM COMBINE monitoring programme. The Workshop also noted that the input to the review process should be given via national contacts to MONAS and MON-PRO.

The Workshop indicated that it is important to report to HELCOM on findings of alien species at national monitoring stations which presently are not included into the HELCOM COMBINE system (e.g. county's monitoring, national fishery institutes' surveys, etc.).

For management of ballast water it is important to include other groups that are currently not monitored (e.g. pathogenic microflora, meiobenthos, resting stages, marine fungi, etc.). Special attention should be paid to the groups which are listed in the BWMC [Ballast Water Performance Standard (Regulation D-2)]. A common methodology should be developed for the monitoring of those groups.

Proposals for common information system for the Baltic Sea

The Workshop agreed that there is a need for a common information system for the Baltic Sea States supporting the implementation of the IMO Ballast Water Management Convention. The system should support risk assessment activities and decision making in Baltic Sea ports. It should also serve as a data source for other regions that may be potential recipients of Baltic Sea species. The system should also provide a basis for exchanging information and feed into an early-warning system.

The Workshop took note of the information that GloBallast Risk Assessment Methodology included a port-to-port environmental matching process and has developed a database on the port environmental parameters for more than 350 major ports around the world and the data would be available for the Contracting Parties for non-commercial use. It will be advantageous if similar regional database is developed for the HELCOM area. The Workshop underlined the value of such data for the risk assessment process and agreed that the HELCOM information system should be designed to be compatible with the GloBallast database.

The common information system should include:

- an early-warning system on new introductions and spread of invasive alien species and warning for outbreaks of harmful organisms which may affect the suitability of ballast water uptake (BWMC Regulation C-2);
- information for Baltic Sea countries and recipient countries outside the Baltic Sea region about the status of alien species etc.;
- information on water quality and abiotic conditions in Baltic harbours;
- a list of targeted or most unwanted species.

Whenever possible, such a common information system should benefit from the recent European initiatives, such as the FW6 IP ALARM and FW6 STREP DAISIE as well from the information system already existing in the Baltic Sea region, such as the Baltic Sea Alien Species Database, NOBANIS, etc.

Research capacity, technical potential and financial resources needed for the risk assessment and the port baseline surveys

HELCOM could, through initiating projects, provide valuable assistance to the Baltic Sea States in developing the first stages of risk assessment methodologies and the common information system for the Baltic.

Development of the various measures for implementing the BWMC (risk assessment, port baseline studies, environmental monitoring, etc.) will require allocation of national resources. A common approach within the Baltic region is crucial for success. It is, therefore, important that the HELCOM action plan on ballast water management is adopted and that decisions by relevant HELCOM working bodies are taken as soon as possible.

Regional Introductory Training Programme on Ballast Water Management

The Workshop recommended that HELCOM together with the IMO GloBallast programme organize a regional introductory training course for port administrators, environmental and fisheries administrators as well as NGOs. The GloBallast programme has developed an Introductory Training Course for ballast water management and may methodologically assist in the organisation of such a workshop (contact person: Dr. Jose Matheickal, GEF/UNDP/IMO Global Ballast Water Management Programme, London, jmatheic@imo.org).

Annex 14: Summary of the PICES XIIIth Annual Meeting, Session S5

Session S5 (I-day MEQ Topic Session, co-sponsored by ICES)

Natural and anthropogenic introductions of marine species

Co-convenors: William P. Cochlan (U.S.A./PICES), Yasuwo Fukuyo (Japan/PICES) and Stephan Gollasch (Germany/ICES)

Background

Species introductions are among the most prevalent of human activities affecting natural ecosystems. In the marine environment, introductions, including most aquaculture initiatives, have resulted in both positive and negative effects. The transport of invasive species, such as phytoplankton, is thought to stem from range extensions associated with fluctuating oceanographic conditions (e.g., El Niño), severe storm events (e.g., typhoons), and human activities (e.g., ballast water). The impact of transport processes on species distributional changes in North Pacific waters is not fully understood. Relative to the terrestrial environment, the study of introductions, and the potential for new species to become invasive, is in its infancy in marine systems. Emerging work includes introduction vectors, life history characteristics of invasive species, ocean conditions responsible for invasions, ecosystem resistance to invasion, and potential for eradication or mitigation of introductions once established. This session will seek to answer three fundamental questions: 1) What is known about different transport mechanisms? 2) What is the magnitude of ecological and economic effects arising from the transport of species? and 3) What steps can be taken to minimise real or potential effects of existent and future invasive species? The current session is particularly timely given that the IMO Ballast Water Management Convention was signed in February 2004, and is now awaiting ratification.

Summary of presentations

The session consisted of eleven oral presentations and one poster, representing authorship from five PICES nations: Canada, Japan, Korea, Russia and the United States, and six non-PICES nations: Australia, Germany, Ireland, Italy, Mexico and New Zealand, as well as ICES. Despite the broad range of invasive topics selected for this session, the attendance was modest. A late cancellation of one oral presentation permitted careful discussion and additional questions for each of the talks; an opportunity well received by those in attendance. The session's presentations were organised around 1) the case histories of invasives, including both pelagic and benthic organisms 2) descriptive and mathematical analyses of invasive vectors and their relative importance in various marine systems, and 3) management of invasion vectors, followed by discussion of any aspect of the session and consideration of future workshop ideas.
After brief introductory remarks by one of the co-convenors (S. Gollasch), the first invited speaker (G. Hallegraeff; Australia) discussed the role of ship's ballast water in spreading harmful algal bloom (HAB) species in Australian coastal waters, including the presence of culturable *Pseudo-nitschia* diatoms and *Pfiesteria piscisida* dinoflagellates in ballast waters. His presentation also discussed the special problem of invasive cysts, methods to determine the if these invasive cysts have firmly established themselves in new environments, and the treatments to remove invasive species in ballast waters or destroy their viability. The next two speakers continued with case histories of invasive species, including the seaweed *Undaria pinnatifida* and their molecular identification (S. Uwai; Japan), and a Russian study of the invasive success of benthic species (polychaetes and phoronids) in the more ecologically stressed and contaminated regions of the Peter The Great Bay (T. Belan).

Majorie Wonham (Canada), our next invited speaker, discussed the various hypothesis used to describe the apparent increase in marine biological invasions. Using existent data sets (from six independent marine systems), she demonstrated that often more than one model (linear, exponential and exponential) can describe temporal invasion trends, and outlined the difficulty

of interpreting species invasions without consideration of both introduction rates and survival probabilities. Stephan Gollasch (invited ICES speaker), posed the question whether ballast water was the key vector for aquatic species invasions. His presentation reviewed the relative importance of the various vectors for species introductions in twelve marine regions around the world, and demonstrated that hull fouling, ballast water and aquaculture were the most important vectors in all regions considered. However, his analysis also showed that relative importance of these vector is regionally specific, and that hull fouling, not ballast waters, was the dominant vector in 60% of the regions considered; a conclusion which suggests that increased international regulation of ballast water introductions will not necessarily eliminate or decrease species invasions in all regions. Dan Minchin (Ireland) continued with the theme of vectors, and showed the importance of small craft, (open boats, yachts and cruisers) in transporting invasive species, and how their relative importance has appeared to increase with the growing number of citizens capable of owning and operating such craft. His analysis also demonstrated the importance of marinas as exchange points for invasives from the primary vector of shipping to the secondary vector of small craft which further increase their range extension to areas inaccessible by shipping alone.

Yasuwo Fukuyo (Japan) in a series of back-to-back presentations outlined the IMO Ballast Water Management Convention, its history and articles, and most importantly the challenges present in obscure wording (e.g., viability) and the availability of reliable scientific methods to support the performance standards outlined in the Convention. A very promising technique (Special Pipe) designed in Japan to terminate ballast water organisms using shear stress and cavitation was described, and its tests of efficacy presented. Jennifer Boehme (U.S.A.) outlined a verification system to ensure that mid-ocean ballast water exchange procedures are actually conducted based on the optical characteristics of chromophoric dissolved organic matter (CDOM) present in the original ballast water. She showed that statistics could be effectively used to discriminate the variability of CDOM florescence in various oceanic and coastal regions, and that such an analysis could offer a verification system independent of port salinity. Scott Godwin (U.S.A.) outlined recent efforts to identify and control species introductions associated with hull-fouling - the principle invasive vector in Hawaiian waters, using a risk-management approach based on a relative fouling risk associated with various vessels and the dynamics of their arrival in Hawaiian ports. The final oral presentation by Stephan Gollasch was an introduction to the history, practices and work products resulting from the ICES efforts on the introductions of marine organisms. He concluded with a number of suggestions including the establishment of a PICES Working Group on Species Invasions (not limited to HABs), and the reciprocal attendance of PICES and ICES members at their annual meetings and working sessions. He urged PICES member countries to follow the 'ICES Code of Practice for the Introduction and Transfer of Organisms' when planning species introductions, and emphasised the need for both regional and global networks to most efficiently deal with biological invasions, given that an invasive species could originate from a non-PICES nation.

The session was concluded by a lively discussion led by Dr. Fukuyo where representatives of all PICES member countries in attendance agreed upon the establishment of a 'Working Group on Marine Invasive Species.' Such a working group will serve as a means to create awareness of the species invasion problem, encourage additional scientific research on the issue, and enhance funding opportunities dealing with marine invasive initiatives in PICES member countries, and eventually may support the timely ratification and implementation of the IMO Ballast Water Management Convention.

Annex 15: Recommendations

There was consensus that there is an ongoing demand for the WGBOSV and that the group should continue to meet, preferably in conjunction with WGITMO, in accordance with the terms of reference below.

In order to ease the collection of information relevant to WGBOSV's terms of reference the group has developed a new National Report format (see Annex 7 for details). ICES is requested to consider and approve the new report format. WGBOSV hopes that the submission of National Reports for future meetings will have the additional advantage of enabling standardised submission of information by members only able to participate by correspondence. The National Reports would facilitate ToR Review on the status of ballast water research (ToR d of the 2005 meeting of WGBOSV).

Recognising that non ship mediated introductions into many areas have had implications that need to be addressed, WGBOSV has benefited from WGITMO input and recommends continued meetings in conjunction with this group for increased benefit to ICES member countries.

It was recommended that the WGBOSV convene again in Oostende, Belgium for at least three days during the week beginning 13th March, 2006 to:

(a) continue its global review of shipping vectors through the participation of representatives from ICES, IMO, IOC, CIESM, BMB and PICES Member States and of invited experts.

(b) critically review and report on the status of ballast water research with an emphasis on new developments in ballast water treatment technology and its evaluation.

(c) provide advice to the International Maritime Organization.

(d) The planned response for the CONSSO Issue Group on Sustainable Shipping (IGSS) report was originally planned for consideration by WGBOSV 2005 but owing to delayed project start should be considered at WGBOSV 2006. At the next meeting the group recommends to:
- review and comment on the final version of the Scoping Study prepared under IGSS.
- provide advice for ACME regarding any " post-scoping" study phase.

(e) Consider using the CONSSO report as a basis for a draft Code of Best Practice for Ballast Water Management.

(f) Given the TBT ban by 2008 and the potential implications for hull fouling, including that on smaller vessels, the group felt that this could become an issue of increasing importance in ICES member countries. The group recommends to carry out an evaluation and review of existing and emerging hull fouling regulations and treatment options.

(g) Recognising that risk assessment requires information about species distribution in coastal and port waters of ICES member countries, a sampling or monitoring strategy is needed. We propose to review existing or developing port sampling and monitoring strategies for non-indigenous species and recommend possible actions.

Priority:	The current activities of this Group will direct ICES towards issues related to unintentional species invasions. As species invasions are considered one of the top four negative anthropogenic impacts on the oceans the activities of the Group are considered to have a very high priority. There was very strong and unanimous consensus by the Working Group on Ballast and other Ship Vectors to further facilitate and support initiatives on ballast water research and ship-mediated introductions especially as research initiatives are increasing on a global scale. The Working Group believes that its findings are of high value for groups such as the International Maritime Organizations´

	Ballast Water Working Group and relevant working groups within IOC and PICES.
Scientific Justification:	Global update on research initiatives currently underway is essential for exchange of information, mutual benefit and possibly joint cooperation and to identify knowledge gaps to be addressed in future research. This is necessary to maintain an overview of ongoing ship-mediated species introductions and to assess the relative importance of certain vectors. Information regarding new ballast water treatment options frequently appears expressing the need for appropriate evaluation of new techniques. Approval standards for Ballast water treatment systems will likely be approved before next years meeting (prepared by IMO in an intersessional activity lead by the Netherlands) and should be reviewed by the Working Group. Another IMO intersessional activity to prepare ballast water sampling guidelines for Port State Control is currently underway. A review of these guidelines by WGBOSV is suggested for next years meeting with the aim to submit a statement on this guideline to IMO MEPC 54 (Spring 2006). Consideration of hull fouling and other non-ballast shipping vectors is of equal importance for species invasion compared to ballast water in some areas. Hull fouling and other non-ballast shipping vectors also need to be considered as in some regions the number of introduced species being transported as fouling on ship hulls in the past is greater than in the ballast water of ships. The ban of TBT-containing antifouling paints was adopted by IMO. WGBOSV is concerned that hull fouling may become a more important vector for species invasions in the future particularly if alternative substances used in antifouling paints are not as overall 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 invasion vector. Ongoing interest of WGITMO in ship-mediated invasions was stated. Invasion vectors may overlap indicating the need to closely cooperate between working groups that target intentional introductions with others focussed on unintentional introductions. Some species may be spread by several different vectors (e.g. mussel larvae may be transported in ballast tanks, adult mussels as hull fouling of ships or as intentional introductions for aquaculture purposes). WGBOSV recommends that both groups meet "back to back" for mutual benefit.
Relation to Strategic Plan:	Related to objectives
Resource Requirements:	None required other than those provided by host country and national members.
Participants:	Participation of representatives from ICES Member Countries, IMO, IOC, PICES, CIESM, shipping agencies, and scientists from relevant research groups worldwide.
Secretariat Facilities:	None required
Financial:	None required
Linkages to Advisory Committees:	ACME
Linkages to other Committees or Groups:	WGITMO as well as to other related ICES Working Groups, such as Working Group on Harmful Algal Bloom Dynamics (WGHABD), PICES WG15 on Harmful Algal Blooms.
Linkages to other Organisations:	IOC, IMO, PICES, CIESM, BMB
Cost Share	ICES 100%