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2.2.7.3 Scientific aspects of risk management of ballast water

Request from OSPAR

This work was initiated by ICES in response to the OSPAR request on Risk Management of Ballast Water (OSPAR 2005/5), which asks to consider the scientific aspects of risk management of ballast water 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.*

Recommendations and advice

ICES recommends that OSPAR considers the development and use of environmental matching and species-specific risk assessment approaches for the determination of low-risk exemptions under Regulation A-4 of the recently adopted IMO Ballast Water Management Convention (see Summary).

Based on discussions around these risk assessment approaches, ICES was not able to provide clear recommendations on criteria for identifying "high risk" ballast water. However, ICES recommends that, if risk-based exemptions are granted by OSPAR and other Member Countries under Regulation A-4, their application should be limited to transits between ports located within areas that are characterized by a high degree of similarity in aquatic animal and plant species. However, the determination of an acceptable system documenting biological separation between coastal regions for the purpose of ballast water risk-based exemptions requires further scientific discussion within ICES and Member Countries.

Summary

ICES made significant progress in addressing scientific aspects of ballast water risk management through completion of a comparison and evaluation analysis of various risk assessment methods that are being developed or used around the world. According to this analysis, several types of risk assessment have been conducted on ballast water with varying scales of assessment and objectives. As a result, discussions within ICES focused mostly on the recently implemented IMO Ballast Water Management Convention, under which some provisions require a risk-based ballast water management approach. In particular, Regulation A-4 of this Convention allows Parties to exempt vessels from compliance to ballast water management procedures prior to discharge if an acceptably low risk can be discerned. ICES considers 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 into the receiving port. Two types of risk assessment are likely to achieve the stated goal:

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

In addition, under the IMO Ballast Water Management Convention, an exemption can be granted for up to five years for a ship that operates within a specified transit between two or more ports. While it was noted that states should inform

neighbouring states when an exemption is granted, ICES concluded that the only biologically defensible means to support an exemption over such a time period would be to limit its application to transits between ports located within a single bio-province (eco-zone). ICES also concluded that there is a need to review risk-based exemptions on a regular basis because of the current rate of invasions in many regions of the world (e.g. a newly introduced species was recorded every seven months in the North Sea and adjacent water bodies since the 1950s).

Some progress was made by ICES on the development of criteria for the determination and/or ranking of risks, mainly with respect to the two risk assessment approaches mentioned above. Some limitations or caveats were provided with regards to the use of environmental matching and species-specific risk assessment methods in support of Regulation A-4 of the IMO Ballast Water Management Convention. More specifically, it was concluded that Regulation A-4 exemptions should only be based on environmental matching risk assessments between freshwater (< 0.5 psu) and fully marine environments (> 30 psu), and on species-specific risk assessments for voyages within the same biological province. Under these limitations, environmental matching risk assessments should include spatio-temporal comparisons of salinity, as well as an assessment of native, cryptogenic or non-indigenous species that can tolerate wide ranges of salinity (euryhaline, diadromous species). As for species-specific assessments within a biological province, they should target non-indigenous and cryptogenic species in all port for which the exemption is sought as well as native species only present in the source ports, including those that may have socio-economic impacts. Based on these conclusions, a system that documents biological separation between coastal regions is needed to support ballast water risk assessment and related management. ICES recognizes the fact that several classification systems exist and no single system is sufficient for all species in all habitats (benthic, pelagic or neritic).

The issue of rapid detection of non-indigenous species was not addressed by ICES. However, ICES recognises that early detection of non-indigenous species and pursuant actions requires information about species distribution in coastal and port waters of ICES Member Countries. ICES agrees that a sampling or monitoring strategy is needed in this regard and proposes to review existing or developing sampling and monitoring strategies for non-indigenous species in order to recommend possible actions.

Scientific background

Scientific discussions around risk assessment approaches and methodologies focused on the 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. 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). Table 2.2.7.3.1 summarises ten risk assessment initiatives that were considered by ICES and for which the information was available. It should be noted that this table only covers the management of vessels (including ports and shipping routes). Other risk assessment methods are being used in Member Countries and around the world to identify ballast exchange areas, target species, etc.

Source of information

Report of the Working Group on Ballast and Other Ship Vectors (WGBOSV) (ICES CM 2005/ACME:04) and ACME deliberations.

Table 2.2.7.3.1 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 and 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	Management unit	Assessment unit	Assessment based on	Approach	Environmental 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 recommend 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

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