

## **MARINE INVASIVE SPECIES**

Introduction of non-indigenous species is one of the most pervasive and irreversible impacts of human activities on natural ecosystems. In the marine environment, Marine Invasive Species (MIS) has been rated as one of the 4 greatest threats to the world's oceans- the other 3 being Land-based pollution, over-exploitation of the marine resources, and destruction of coastal and marine habitats.

Introductions of non-indigenous species have occurred for centuries on a global scale, often resulting in deleterious ecological, economic and social consequences.

Marine and aquatic ecosystems are particularly vulnerable to alien species invasions. Organisms can spread rapidly in aquatic environments and they are hard to detect. In addition control and eradication options, used in the terrestrial ecosystems, can not be used in aquatic ones. The reason why instruments that deal with Aquatic Invasive Species should focus on the prevention from introduction and early detection of introduced species.

A series of key international conventions and agreement recognized the importance of the threats of Alien Invasive species, and are playing an important role in the development of instruments to prevent, reduce and control the introduction and transfer of alien species. Most of these instruments are based on the application of the Precautionary approach.

## VECTORS OF INTRODUCTION:

There are numerous ways in which invasive species could be introduced in the marine environment through human activities (including ornamental trade, research, removal of barrier and opening of canals, stock enhancement...), although the two most important ones are Ships (through ballast water and sediments and hull fouling) and Aquaculture.

### **Shipping:**

Traditionally shipping has been considered as a major route of introduction of aquatic species. In addition, the drastic changes in the shipping industry over the past decades together with the deterioration of the environmental conditions in the coastal habitats are possibly leading to an increased opportunity for survival of alien species.

The amount of the transoceanic shipping has increased greatly. The use of anti-fouling paints and ballast tanks of large vessels became very common. These factors have favored transport of species in ballast tanks more than on hulls. However, the new legislations on restricting the use of TBT anti-fouling paints might increase the transport of fouling organisms.

### ? **Ballast waters and sediments:**

Ballast waters transport refers to the unintended transfer of living organisms contained in seawater carried in specialized ballast tanks by commercial vessels. It probably provides the greatest flow of neretic species globally.

Organisms may establish semi-permanent or permanent communities in the layer of water or sediment in the bottom of the ballast tank, leading to the release of the same non-indigenous species in multiple points.

Unfortunately, no current ballast water treatment method can completely eliminate the risk of introducing alien species, and the goal of managing ballast water is to minimize this risk.

The transfer of non-indigenous species via ballast waters is an international issue. The UN's International Maritime Organization (IMO), developed "guidelines for the control and management of ship's ballast water to minimize the transfer of harmful aquatic organisms and pathogens" and is working on providing technical assistance to developing countries to implement these guidelines through the "Globallast" project. The IMO is also preparing a new convention on ballast water.



? **Hull fouling:**

Although decreased over the last decades by the use of powerful anti-fouling paints, hull fouling is considered one of the main pathways/vectors in some regions (e.g. the South Pacific) mainly because of the large contribution of yachts (e.i. smaller non-commercial craft), the relative prevalence of hull fouling on them, and the many widespread places they go.

On the other hand, the use of TBT (Tributyl tin) in antifouling paints is decreasing, and their ban is internationally scheduled by 2003. This might lead to an increase of species introductions by hull fouling. In Australia, the decreased use of TBT paint has already been linked to increase fouling. The CBD COP6 discussions encouraged IMO to also deal with hull fouling, in addition to ballast waters.

***Aquaculture:***

Species introductions via aquaculture are of kinds: intentional (target species) and unintentional (associated species, e.g. epibionts, endobionts, parasites and diseases).

On a global level, 9.7% of aquaculture production comes from introduced species. This proportion varies among the regions and the target groups. 97.1% of crustacean production in Europe and 96.2% of fish production in South America is of introduced species.

There are many examples of established and invasive alien species that have been introduced as associated to aquaculture target species.

The FAO “code of conduct for responsible fisheries” in its “aquaculture development” section does refer to the introduction and transfer of alien organisms. The FAO has also produced a number of technical guidelines related to the application of the precautionary approach and alien species.

## **IMPACTS:**

Although many introduced species do not survive in their new environment, and may not cause damage, alien species have the potential to cause far-reaching ecological and economical impacts as well as on human health.

The role and impact of the alien species introductions both intentional and unintentional are still not well acknowledged for the marine environment and therefore are hard to predict.

In most cases, when introduced species severely disrupt the functioning of normal ecosystems, there's inter-dependence between ecological and economic impacts.

### ***Ecological***

Few organisms can survive in new aquatic environments because they can't find optimal conditions for their development.

Every introduction of alien species that becomes established, results in changes to the receiving ecosystems. In the absence of their natural predators, populations of invasive species can increase very quickly, threatening or even eliminating indigenous species. Introduced species might also prey on an already established food web or compete with indigenous for food or space.

### ***Economic***

Alien species may cause economic damage by eliminating economically profitable native species, taking over an area, causing severe damages to the ecosystem or carrying harmful pests.

Economical impacts could be very important in the case where social and health consequences occur or when important economical sectors (e.g. aquaculture, fisheries) are affected.

Another aspect of economical impacts is the costs of eradication that states and national agencies might spend attempting to control "pests" and restore natural species.

### ***Human health***

Cholera risk, Paralytic shellfish poisoning and Harmful algal blooms are public health concerns that have been associated with species introduction via ballast water.

It has been proved that ballast discharges from transoceanic vessels create a new dispersal mechanism to human pathogens and may be important in the worldwide distribution of microorganisms. The concentration of viable populations of bacteria (including *Vibrio cholera*), virus-like particles, and other microorganisms is high in ballast water tanks. Ballast water also contains species like toxic dinoflagellates that form resting stages and can wait long periods until favorable conditions for rapid growth are found in the new environment.

### **INTERNATIONAL RESPONSE (ORGANIZATIONS, INSTRUMENTS AND PROJECTS)**

Biological boundaries and ecosystems do not recognize political borders. Therefore, governing species introduction, especially in the marine environment, should be addressed at the international and regional level as well as at the national and local concern.

Many international conventions and organizations have references and programmes for Alien invasive Species. Below are the main initiatives on the global level.

#### ***Applicable Instruments:***

##### **- The Convention on Biological Diversity:**

During their 6th COP, Parties to CBD approved Guiding principles for the prevention, Introduction and Mitigation of impacts of Alien Species that Threaten Ecosystems, Habitats or Species, that focus on the prevention of entry of potential invasive species.

Alien Species is also a thematic area of the Jakarta Mandate relative to Marine and Coastal Biodiversity. A gap analysis of legal instruments, guidelines, procedure and actions addressing Alien invasive species in the marine environment has been presented in the 5th COP. This analysis highlighted the rarity of such action and the lack of programmes aiming the implementation and support of legislative measures.



- **ICES, code of practice on the introduction and transfers of marine organisms :**

The 1994 ICES Code of practice on the introduction and transfers of marine organisms have been recently revised in 2002. The 2002 code includes the concerns expressed in the previous version, adopts the FAO 1995 principles especially the precautionary approach. It includes updated definitions, an implementation strategy based on increasing awareness, and a risk evaluation approach.



- **FAO code of conduct on responsible fisheries:**

The 1995 FAO code of conduct on responsible fisheries does contain a whole section named "Precautionary Approach to Species Introduction".

This section refers to the ICES code of practice the introduction and transfers of marine organisms and deals with both intentional and unintentional introductions.



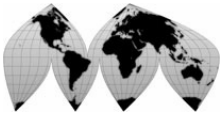
- **The International Maritime Organization (IMO):**

The IMO guidelines "for the control and management of ships' ballast water to minimize the transfer of harmful aquatic organisms and pathogens" address one of the main vectors of introductions of alien species into the marine environment. These guidelines, adopted in 1997 are totally voluntary. Control measures recommended by the guidelines focus on

- ? Minimizing the uptake of organisms during ballasting;
- ? Cleaning ballast tanks;
- ? Avoiding unnecessary discharge of ballast;
- ? Undertaking ballast water management procedures;

The IMO is also preparing a legally binding, international convention for the management of ballast water.

### ***Programmes, projects or initiatives:***



#### **- The Global Invasive Species Programme;**

The Global Invasive Species Programme (GISP) is a component of DIVERSITAS, an international programme on biodiversity science. It is coordinated by SCOPE, the Scientific Committee on Problems of the Environment, in conjunction with IUCN, the World Conservation Union, CAB International and the Convention on Biological Diversity (CBD).

The Programme aims to conserve biodiversity and sustain human livelihoods by minimizing the spread and impact of invasive alien species. GISP operates through a "Partnership Network" comprised of governments, intergovernmental organizations, non-governmental organizations, academic institutions, and the private sector.

In the first phase of GISP (Phase I; 1997-2000) a series of global assessments were realised, as well as a global strategy, a toolkit of best prevention and management practices, and an initial pilot database coordinated by IUCN Invasive Species Specialist Group.

The development of a Phase II implementation Plan was initiated in September, 2000. This Phase II initiatives reflect the findings and recommendations of a four-year assessment conducted in collaboration with major GISP stakeholders.



#### **- Global Ballast Water Management Programme (GLOBALLAST),**

IMO has joined forces with the Global Environment Facility (GEF), the United Nations Development Programme (UNDP), member governments and the shipping industry to assist developing countries to address the ballast water problem through a global project.

The project is titled Removal of Barriers to the Effective Implementation of Ballast Water Control and Management Measures in Developing Countries. It is more often referred to as the Global Ballast Water Management Programme, or GloBallast.

The broad Development Objectives of the programme are to assist developing countries to:

- ? reduce the transfer of harmful organisms from ships' ballast water;
- ? implement the IMO ballast water guidelines; and
- ? prepare for implementation of the new IMO Ballast Water Convention.

It is being run through 6 demonstration sites. Its activities comprise undertaking Ballast Water Risk Assessments to assess risk of introductions of marine species at each demonstration site.