

Alien species in marine environment

Who do they are?

Many species ranges fluctuate naturally on a time scale of centuries to years as a result of alterations in climate or biological interactions. Human-mediated movement of species has been significantly accelerated in recent decades. Thus, an alien (also known as exotic, introduced, invasive, non-indigenous, non-native) species is any species intentionally or accidentally transported and released by man into a habitat outside its native geographical range: otherwise it could not be able to overcome environmental barriers (ocean waters, land massifs) separating its region of origin from new "locale".

Where is a problem?

These human-mediated invasions, often referred as "biological pollution", represent a growing problem due to the unexpected and unwanted impacts the nuisance species might cause to the environment, economy and human health. As a consequence, this is a rapidly growing research area in present days, stretching from "old fashioned" biogeography to molecular genetics, ecophysiology, experimental biology and even water treatment technology. A new international journal, "Biological invasions", was launched in 1999; every year new papers on invasive species problem appear in "Science", "Nature" and other prominent journals.

Effects on biodiversity

Effects of alien species on marine environment and native biodiversity are numerous. They include changes in resource competition (food, space, spawning areas); physical changes in habitat (reduced water movement, biogenic erosion of shores, alteration of bottom substrate); limitation of resources (nutrients, light, oxygen); detrimental changes in the trophic web due to introduction of a new functional group; harmful algal blooms; genetic effects on native species (hybridisation, change in gene pool, loss of native genotypes); drastic reduction of the population size or even extinction of native species.

Another aspect of invasive species problem is homogenization of world aquatic fauna: there are numerous examples of the same species, occurring now in Baltic, Black, Caspian Seas, estuaries of the North Sea, and at the both coasts of North America ("no isolation > no speciation > no biodiversity").

Effects on economy

Environmental changes induced by biological invasions often also cause economic impacts as well. For instance: invasive alien species can compete with and reduce commercial fish stocks; toxic blooms can effect aquaculture, erosion of shores can harm coastal installations. Invasive species may also directly effect: water abstraction (clogging of water intake pipes); aquatic transport (fouling of boats, buoys etc., including costs of cleaning and antifouling painting, which, in turn, harms the environment); tourism (massive accumulation on shores causing smell, discoloring of water, sharp shells); fisheries (clogging and fouling of fishing gears, damage of catches in nets); aquaculture (fouling of lines, cages, cultured mollusks, fish kills, etc.) as well as human health (newly brought infections, toxins in wild-harvested fish and shellfish, new intermediate hosts for human parasites, etc.).

Where they come from?

Alien aquatic species are mostly transported intentionally for stocking and aquaculture purposes or unintentionally with interregional and intercontinental shipping. The importance of ship transportation in the spread of invasive species has increased tremendously in recent time. Vessels provide habitats for a large variety of organisms, from viruses and microorganisms to various plants and animals, due to their transport of ballast water, sediments in tanks and hull fouling. Other vectors of unintentional introductions are accidental releases from public and research aquariums; transport of parasites and other unwanted organisms with target aquaculture objects; penetration of alien species via canals etc. Aquatic alien species tend to concentrate in coastal regions (estuaries, coastal lagoons, harbor areas)

The likelihood of an introduced species settling in new areas and creating problems depends on a number of factors. These are primarily related to the biological characteristics of the species and the environmental conditions to which the species has been introduced, including the properties of the invaded ecological community. Additional factors are climate, number of introduced specimens (size of founder population), native competitors and the availability of food as well as potential predators/grazers or disease agents.

How we can use this indicator in BIOMARE?

The number of alien species that have established themselves in a particular marine environment is already an indicator of biodiversity change. We may also identify distribution (range) of invasive species, changes they cause in native biological communities and environment. The measurable parameters are:

1. Number of alien species
 2. Abundance and biomass of alien species (ind./ m², g/m³, etc., as appropriate)
 3. Relative abundance and biomass of alien species (% of appropriate community)
 4. Rate of spread of alien species by area per given decade
 5. Documented events of ecological and economic impact
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This comment was based on many sources, among them:

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Leppäkoski, E. and Olenin, S., 2000. Xenodiversity of the European brackish water seas: the North American contribution. In: Proceedings of the First National Conference on Marine Bioinvasions. J. Pederson (ed.). Massachusetts Institute of Technology, Cambridge. January 25-27, 1999. Boston, USA, 2000: 107-119

Lövei, G.L., 1997. Global change through invasion. *Nature*, 388, 14 August, 627.

Olenin, S. and Leppäkoski, E. Non-native animals in the Baltic Sea: alteration of benthic habitats in coastal inlets and lagoons. *Hydrobiologia*, 1999, 393: 233-243.

Pimentel D., L. Lach, R. Zuniga, D. Morrisson, 2000. Environmental and Economic Costs of Nonindigenous Species in the United States. *BioScience* 50(1): 53-65.

Ricciardi A., W.W.M. Steiner, R.N.Mack, D. Simberloff, 2000. Toward a Global Information System on Invasive Species. *BioScience* 50(3): 239-244.

Internet sources (just few, there are much more of them)

[Baltic Sea Alien Species Database \(BMB WG on Non-indigenous Estuarine and Marine Organisms; CORPI Klaipeda University, Lithuania\)](#)

[Database on Introductions of Aquatic Species \(FAO UN\)](#)

[Directory of Non-native Marine Species in British waters \(JNCC, UK\)](#)

[ICLARM FishBase](#)

[Invasive Marine Pests Database \(CRIMP, Australia\)](#)

[Mediterranean Atlas of Exotic Species](#)

[National Marine and Estuarine Invasions Database \(SERC, USA\)](#)