**NEAES 7.01**

 15 FEBRUARY 2024

**Delivery 2023/24:** **Inventory of human activities related to NIS introductions**

**Introduction**

The North-East Atlantic Environment Strategy (NEAES) 2030 was adopted on 1 October 2021 in Cascais, Portugal. Contracting Parties developed an implementation plan to support work towards the Strategy implementation. The plan is a living document, setting out specific actions to achieve the NEAES Strategic and Operational Objectives. Operational Objective 07:02 of the NEAES states that “*By 2025 OSPAR will develop a coordinated management approach to ensure the number of non-indigenous species introduced via human activity is minimised and where possible reduced to zero*”.

In 2022, The Netherlands, with support from Germany, Denmark and France, formed a task group to work on a task that would have a significant impact on operational objective 07:02. Task 07:02:T1, “prevention and minimization of introduction of non-indigenous species by human activity addressing the main vectors of introduction by shipping with a focus on tasks related to ship biofouling” commits to producing an inventory of human activities related to non-indigenous species (NIS) introductions.

The introduction of aquatic species has been a revelation in augmenting food production around the world. NIS have been transferred to countries for a variety of purposes, including aquaculture, recreational fishing, the enhancement of wild stocks, for ornamental purposes, and for the facilitation of biological control against unwanted organisms such as mosquito larvae, vegetation, and phytoplankton.

Despite the positive impact in increasing food production, the negative impacts on the ecosystem and biodiversity have attracted worldwide attention. Major concerns over the introduction of Invasive Alien Species (IAS)include: prolific breeding, contamination of local genepools, disease transmission, predation or competition with native species, economic losses, habitat degradation and many more. This serves as a threat to food security and affects native ecosystems and biodiversity.

Nine main categories of human related pathways are known through which non-indigenous species may be introduced into the North-East Atlantic (Table 1) and are briefly described in the inventory below.

Table 1. Inventory of Human related vectors for NIS introduction in the NE Atlantic

| **1.Ballast Water** |
| --- |
| **2. Biofouling on commercial ships and recreational boats** |
| **3. Aquaculture** |
| **4. Canals** |
| **5. Recreational fishing/angling** |
| **6.Floating Marine Debris** |
| **7. Research and education** |
| **8. Improvement of wild stock** |
| **9. Infrastructure associated with renewable and non-renewable energy e.g.**  **Platforms for windmills and oil and gas mining.** |

**1.Ballast water**

Ballast water typically contains a variety of biological materials, including plants, animals, viruses, and bacteria which are often taken on board and transported from one region to another where they are discharged. The organisms transported may often include alien capable of causing extensive ecological and economic damages to aquatic ecosystems, coupled with serious human health issues often resulting to death.

The Marine Environmental Protection Committee (MEPC) of the International Maritime Organisation (IMO) recognized the importance of addressing Harmful Aquatic Organisms and Pathogens (HAOP) in the early 1990s, and since then, the weight of this issue in marine environmental protection has only intensified. In 2004, the [International Convention for the Control and Management of Ship’s Ballast Water and Sediments](https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships%27-Ballast-Water-and-Sediments-%28BWM%29.aspx) (BWM Convention) was therefore adopted by the IMO. This Convention requires ships in international traffic to manage their ballast water and sediments (Regulation B-3) to certain standards specified in the Convention (Regulation D-2), as well as keeping a ballast water record books and an international ballast water management certificate. There is a phase-in period for ships to implement their ballast water and sediment management plan, during which they are allowed to exchange ballast water (Regulation B-1) in the open sea under certain premises of depth and distance from the shore (Regulation D-1). The Convention entered into force 8 September 2017. Furthermore, the Guidelines for the control and management of ships´ biofouling to minimize the transfer of invasive aquatic species (Resolution MEPC.207 (62)) are currently being reviewed to ensure their effectiveness.

**2.Biofouling on commercial ships and recreational boats**

Biofouling is the accumulation of aquatic organisms such as microorganisms, plants and animals on surfaces and structures immersed in or exposed to the aquatic environment. In recent years biofouling on ships and recreational vessels is assumed to be the main vector for the transfer of NIS in NE Atlantic countries like Ireland and the Netherlands (Gittenberger et al., 2023ab). There are several factors that have an influence on the biofouling pressure experienced by a particular ship. These include the design and construction of the ship's hull and niche areas, as well as the ship's operating profile (including the routes it takes and the distance it covers) and its maintenance history.

In order to prevent the spread of NIS through biofouling on ships, there are several management options available. These options aim to reduce the risk and include utilizing the relevant regulatory framework (Appendix A) as well as cleaning hull and niche areas.

**3.Aquaculture**

Aquaculture is one of the main vectors for the introduction of NIS in the NE Atlantic. Management practices to minimize adverse effects of introductions and transfers of marine organisms for aquaculture are described by ICES and published in ’ICES Code of Practice on the Introductions and Transfers of Marine Organisms’ (ICES, 2005). The Code of Practice summarizes measures and procedures that can be taken into account when planning the introduction of NIS for aquaculture purposes. On the European level, the EC Council Regulation No 708/2007 concerning the use of NIS and locally absent species in aquaculture (EC, 2007) is based on the ICES Code of Practice.

Besides the unintentional spread of NIS with shellfish, species are also intentionally introduced. One of the best known intentionally introduced species is the Pacific Oyster (*Magallana gigas*), a species that was already introduced in European waters in the early 20th century. Nowadays, the Pacific oyster dominates aquaculture production in many OSPAR regions, and wild populations are increasingly becoming established. Species like the Pacific oyster that have a long history of aquaculture and are of economic value are excluded from the scope of the EU Regulation on the prevention and management of the introduction and spread of invasive alien species (IAS) (EU) No 1143/2014. The development of individual risk assessment and management strategies, including marine planning with socio-economic aspects and sustainable husbandry, should be increasingly utilized in the areas of economic interest.

Strict regulations to oppose introductions of fertile non-indigenous species, quarantine for farming species, mechanical control, and eradication through hand-collecting and fishing are further relevant measures.

**4.Canals**

Canals form an important pathway that allows the spread of NIS between geographically-isolated aquatic systems, such as the cross continental North Sea-to-Black Sea Rhine-Main-Danube Canal. Canals can facilitate or enable the transfer of organisms either via shipping, floating debris or by the organisms themselves passing through the canal (Gollasch et al. 2006). Management options may include salinity or temperature barriers in some canals that may suppress the transfer of organisms.

**5.Recreational fisheries and Angling**

Intentional or unintentional release of baitfish is the well-studied angler-related pathway of NIS. Marine live bait importation may be an important pathway for the introduction of NIS as well, but little is known about the diversity of species, or the numbers of individuals imported via this pathway. A recent study in the Netherlands, illustrated that various non-indigenous marine bait species, including mainly worms, are sold alive in Europe to recreational anglers. This highlights the risk to the NE Atlantic environment. Possibly this trade of baitfish can be better controlled and regulated in the future.

**6.Floating Marine Debris**

Floating plastic is a potential dispersal vector of marine species including NIS (Rech et al., 2016). It is the most common marine debris and is considered as one of the major threats to marine biodiversity. The global distribution, buoyancy, and high levels of colonization of plastic debris greatly facilitate the transport of microbial communities (Carson et al., 2013), algae, invertebrates, and fish to distant regions (Barnes, 2002). Marine plastic debris is not only a threat to marine wildlife, but also causes significant economic and ecological damage (Keswani et al., 2016) acting both as a vector for the primary introduction of alien species into remote regions, and as a secondary vector for the regional expansion of marine species.

Management options specifically include regional approaches, among which:

* To identify major debris generation points.
* Work with regional agencies to engage the responsible parties to reduce and eliminate debris at its source.
* Identify operations or generation points that consistently release the same type of debris (i.e. aquaculture or fishing operations).
* Identify new types of gear or new practices that will reduce or eliminate the release of the debris.
* Conduct beach and river sweeps.

**7.Research and education**

Many NIS have been used as material for research. Experiments for example have been conducted on *Alexandrium minutum* to try to increase their biomass and lipid production in bioreactors, with the goal of producing biofuels. When NIS are used in such research projects, one has to be careful that they do not escape into the environment.

**8.Improvement of wild stock**

The motives for introducing species in order to improve wild stocks are numerous, but mainly in freshwater environments: establishment of new food fisheries, filling “vacant niches,” stocking natural waters, providing forage for predators, restoration of fisheries, establishment of a wild stock, control of stunted species. In the marine environment examples are seagrasses, European flat oysters, and glass eels, which are introduced in regions to recover the original populations of these native species. Together with the transport of native species, NIS may travel along. Where NIS regulation tends to be strict and focus on transport for commercial purposes, transports for nature recovery purposes are not always that strict and may therefore form a higher NIS risk.

**9.Infrastructure associated with renewable and non-renewable energy e.g. Platforms for windmills and oil and gas mining**

Platforms for windmills and oil and gas mining can act as stepping stones for NIS that are primarily introduced in NE Atlantic waters by other vectors. When designing and building wind farms and

other similar structures, this risk should be considered.

**References**

Gittenberger, A.; Rensing, M.; Faasse, M.A.; van Walraven, L.; Smolders, A.A.J.; Keeler Perez, H.; Gittenberger, E. Non-Indigenous Species Dynamics in Time and Space within the Coastal Waters of The Netherlands. Diversity 2023, 15, 719. <https://doi.org/10.3390/d15060719>

Gittenberger, A.; Mirimin, L.; Boyd, J.; O’Beirn, F.; Devine, G.; O’Brien, M.; Rensing, M.; O’Dwyer, K.; Gittenberger, E. Marine Non-Indigenous Species Dynamics in Time and Space within the Coastal Waters of the Republic of Ireland. Diversity 2023, 15, 1019. https://doi.org/10.3390/d15091019

HELCOM/OSPAR HOLAS 3, Hazardous Substances, Marine litter, Underwater noise, Non-indigenous species, Thematic assessment 2016-2021

ICES (2005). ICES CODE of Practice on the Introductions and Transfers of Marine Organisms 2005, 30pp

REGULATION (EU) No 1143/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species

Minchin, D., Olenin, S., Daunys, D., Panov, V. (2008) Pathways of aquatic alien species in Europe: modes, trends and future spread. – ALARM (GOCE-CT-2003-506675) Project Deliverable 1.3.1.: 18 pp.

Minchin D., Gollasch S., Cohen A. N., Hewitt C. L., Olenin S. (2009) Characterizing Vectors of Marine Invasion // Biological invasions in marine ecosystems. Ecological, management, and geographic perspectives (eds.: G. Rilov, J. A. Crooks, Jeffrey A.). - 2009, Springer, Series: Ecological Studies, Vol. 204, p. 109-116, ISBN 978-3-540-79235-2, ISSN 0070-8356

Barnes DKA. 2002. Biodiversity: Invasions by marine life on plastic debris. Nature 416: 808–809.