OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic, and

Helsinki Convention on the Protection of the Marine Environment of the Baltic Sea Area

Meeting of the Joint HELCOM/OSPAR Task Group on Ballast Water Management Convention (BWMC) and Biofouling (TG BALLAST 11-2020)

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Updates on monitoring of non-indigenous species in Swedish marine waters

Presented by the Swedish Agency for Water and Marine Management (SwAM)

Issue: This document presents updates on the Swedish monitoring program which is based on a new habitat modelling for selecting hotspots for monitoring locations.

Action requested

1. JTG-Ballast is invited to;

    a. take note of the information and encourage interested institutions, especially in neighbouring countries, to make use of the test systems.

Background

2. Sweden has in 2019 launched the national monitoring program on non-indigenous species in marine waters according to the MSFD descriptor D2 Non-indigenous species (NIS). This is a part of the national surveillance system on NIS. The new marine monitoring program is based on survey methods developed within JHP and HELCOM Guidelines for non-indigenous species monitoring by extended Rapid Assessment Survey (eRAS). The start of surveying systematically with targeting methods for NIS was in 2013 when Sweden was participating in the HELCOM Aliens 2 project. The Gothenburg harbour was one of the North Sea ports that was investigated when testing and evaluating different qualitative and semi-qualitative survey methods as a first step in applying JHP for exemption of ballast water treatment. The new Swedish monitoring program aims to rapidly detect new introductions of invasive alien species (IAS) and to record distribution of NIS in different basins in accordance with MSFD and EU's IAS regulation. The methodology follow the eRAS concept, in order to be an efficient and long-term management support to detect and prevent the spread of IAS in Swedish waters, as well as in the North Sea and the Baltic Sea. The data from monitoring program can be used as a complement for the application of exemption granting for ballast water management systems, and can therefore not replace the port survey protocol in JHP. For good governance SwAM decided to develop the program in two steps by first designing efficient monitoring for 20 locations with high risk for introduction of new species, or hotspots. In a second step, the sampling

design will be developed for further improvements regarding methods as well as sampling design in time and space. In addition we support the international research and development project Marine Biodiversity Observation Network (MBON) consisting of Autonomous Reef Monitoring Structures (ARMS) for developing sensor and predicting abilities of benthic and planktonic NIS for an early warning system (Obst et al. *in press*). Genetic sensing coupled to predictive modelling seems to have a very high potential to effectively deal with the impact of NIS by forecasting introductions and spread with better predictions and confidence in an autonomous system.

A commitment to develop a monitoring design based on risk of introductions has been carried out by the national contracted consultant Marine Monitoring AB. The methodology is based on the calculation of a total invasion risk for 34 target species, or doorknockers, which are analysed individually and collected in relevant ecological groupings such as freshwater tolerant species, marine species or benthic species. The analysis includes three factors: Geographical distribution of suitable habitats calculated using distribution models for each species; species-specific risk assessment; and introduction risk in connection with ship traffic and water currents. The result of the analysis is published as an open source model that can be reused and further developed by anyone, and is compliant with the commitments documentation at GitHubs web site.

The results indicate two separate dispersal patterns for IAS in Swedish marine environments; the spread of marine species along northern European coastal waters and the spread of freshwater tolerant species across the European continent. These two pathways were analysed separately and the results support an even distribution of monitoring stations along the Swedish coast between Strömstad on the North Sea and Gävle in the Bothnian Sea, with a focus on the areas identified by the marine models on the west coast and the areas identified by the freshwater models on the east coast. The most suitable monitoring sites are port areas. The model is relatively basic on shipping impact and hydrodynamics. Therefore, a further developed model combination with the approach by Denmark using Same-Risk-Area Assessment Model (SRAAM) could be interesting path for further development. In addition SwAM plan to extend the habitat modelling of species with only a freshwater tolerance that may be introduced into the Bothnian Sea, the Quark and the Bothnian Bay.

In addition to the current monitoring program, the surveillance system with monitoring focusing on marine NIS also includes coastal recipient monitoring programmes of nuclear power plants and pulp mills and by citizen science on NIS.

The reports on the Swedish monitoring of marine NIS are availed at the websites of SwAM and GitHub:

- Information on SwAM's monitoring on NIS in the marine environment:
  https://www.havochvatten.se/overvakning-och-uppfoljning/miljoovervakning/marin-miljoovervakning/frammande-arter.html

- MBON and ARMS:
  ASSEMBLE Plus project ARSM-MBON webb site: http://www.arms-mbon.eu/
  Obst et al. *in press*. A Marine Biodiversity Observation Network for genetic monitoring of hard-bottom communities (ARMS-MBON). Front. Mar. Sci. doi: 10.3389/fmars.2020.572680.

- Methods development and evaluations:

  Bergkvist, J. et al. 2020a. Provtagningsdesign för övervakning av främmande arter – Övervakning i marin miljö (report in Swedish): https://www.havochvatten.se/data-kartor-och-rapporter/rapporter-

och-andra-publikationer/publikationer/2020-10-09-provtagningsdesign-for-overvakning-av-frammande-arter.html.

Bergkvist, J. et al. 2020a. Vidareutveckling och test av övervakning av främmande arter: Extended Rapid Assessment Survey eRAS (summary in English): https://www.havochvatten.se/data-kartor-och-rapporter/rapporter-och-andra-publikationer/publikationer/2020-10-09-vidareutveckling-och-test-av-overvakning-av-frammande-arter.html.

Bergkvist, J. et al. 2020. Test och utvärdering av ny övervakning av främmande arter i hamnar och utsatta områden (summary in English): https://www.havochvatten.se/data-kartor-och-rapporter/rapporter-och-andra-publikationer/publikationer/2017-06-07-test-och-utvardering-av-ny-overvakning-av-frammande-arter-i-hamnar-och-utsatta-omraden.html.

Sundberg, P. et al. 2018. Utvärdering av ny övervakning av främmande arter – Metodjämförelse mellan traditionell och DNA-baserad identifiering (Summary in English): https://www.havochvatten.se/data-kartor-och-rapporter/rapporter-och-andra-publikationer/publikationer/2018-08-23-utvardering-av-ny-overvakning-av-frammande-arter.html.

Granhag 2016. Metoder för övervakning av främmande arter – Protokoll för provtagning i hamnar och farleder (report in Swedish): https://www.havochvatten.se/data-kartor-och-rapporter/rapporter-och-andra-publikationer/publikationer/2016-09-21-metoder-for-overvakning-av-frammande-arter.html.

- GitHub, IAS Hotspot Model: https://github.com/biomobst/IAS_hotspot_model.