

The use of DNA based methods for management in Swedish waters

SwAM, Environmental Monitoring Unit



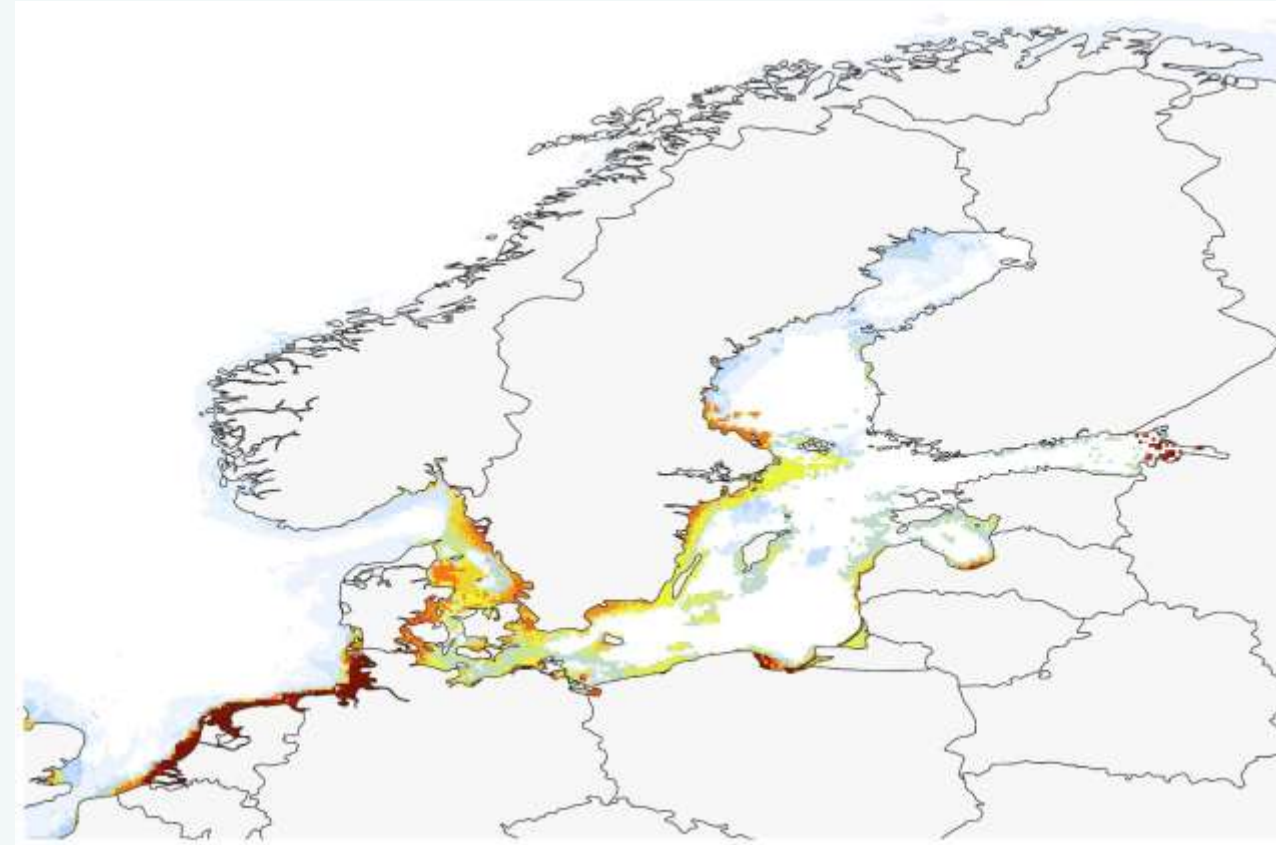
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Monitoring – Early Warning System on marine NIS

- » Citizen science since 2000 – NIS web app [Rappen.nu](https://appen.nu), the Swedish Species Observation System

- » National monitoring program since 2019 – trends in marine NIS/number of newly introduced NIS:
 - Assessments according to MSFD, Helcom, Oskar and the Swedish Environmental Codes
 - Helcom/Oskar Joint Harmonized Procedure Ballast Water Management Exemptions
 - Based on the Helcom guidelines for monitoring of NIS by “Rapid assessment”
 - Locations are based on a modelling of high risk areas – **hotspots** – of new introductions of brackish and marine species to Swedish waters.
 - 20 ports have been suggested in the North Sea and the Baltic Sea
 - Dec 2022 complementary modelling on scenarios of limnic species introductions in the Baltic Bay.
 - The hotspot model and results are available at:
[Report \(Swedish, English summary\)](#)
[Model at GitHub](#)



Testing and evaluating DNA based monitoring methods by metabarcoding

- » SwAM 2022: Settling panels and protocols for monitoring of hard bottom organisms as set up in Autonomous Reef Monitoring Structures – ARMS (University of Gothenburg and SeAnalytics AB)
 - 6 sites in the Skagerrak and the Kattegat
 - Settling panels as well as both settling panels and plankton samples eDNA
 - NIS that was not initially detected by inspection were identified by DNA.
 - 34 NIS were identified based on the molecular markers 18S and COI.
 - Species that have previously been reported as rare as well as new in Sweden are noticeable in
- » SwAM 2018: Evaluation and testing of traditional and DNA based methods (Marine Monitoring AB, SeAnalytics AB)
 - Brofjorden port, Lysekil, the Skagerak
 - The second largest port in Sweden and has Scandinavia's largest refinery
 - The traditional method found 212 taxa overall, of which 131 taxa (62 percent) could be identified to species level.
 - The DNA method (CO1) recognized 153 taxa, of which 119 taxa (77 percent) could be determined to species level.



National R & D on Monitoring of Marine Species by DNA

- » 8 Swedish research projects on DNA methods in environmental monitoring on species diversity the Environmental Research Grant 2019–2022
 - 7 on aquatic species
 - Results → Take home + Quality assurance and adapt → Implement operationally
- » Reproducible analysis of eDNA data – knowledge synthesis 2022
 - identify problems
 - potential for knowledge transfer from neighbouring fields that also handle large data sets”
- » Guidelines for monitoring and methodical practice, e.g. HELCOM, ISO standards for collection, policy and scientific reports, etc.



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Prerequisite for genetic monitoring programs

- » Methods and techniques for sampling and storages of DNA
- » Generating DNA barcodes for priority organisms and groups to identify species
- » Comparing and inter-calibration between traditional and DNA-based species identification
- » Guidelines and methodological standards for national monitoring programs
- » Examples ongoing research:
 - eDNA in environmental monitoring and the analysis of biodiversity (University of Gothenburg)
 - DNA-metabarcoding of marine phytoplankton (Umeå University)
 - Barcoding of freshwater organisms for improved assessment of biodiversity (Swedish University of Agricultural Sciences)
 - Autonomic techniques with traditional and DNA species identification for early warning of invasiv alien species (SeAnalytics and University of Gothenburg).

Implementation of DNA-based monitoring

- » 2023 SwAM and the Swedish EPA will present the intention (strategy) autumn 2023.
- » 2023 Drafting the first national methods standard for DNA based monitoring in marine water focusing on early warning and assessments indicators.
- » Decreasing scepticism among managers and authorities regarding reliability and applicability of indicators.
- » Needs of reproducibility in all steps.
- » Needs of securing and handling data and bioinformatics guidelines.
- » Many non-coordinated surveys and inventories by regional authorities and consultants of monitoring.



Thank you!

Questions?