Guidelines for the monitoring of marinas

Approved by STATE & CONSERVATION 14-2021

1. Background

1.1 Introduction

The unintentional spread of marine non-indigenous species (NIS) by humans is a worldwide threat to aquatic biodiversity. Biofouling of ship hulls and leisure boats has been identified as one of the major vectors of this spread. Climate change may enable further NIS introductions and establishments as warmer regions often act as a source for marine NIS. Early detection of new NIS introductions requires extensive monitoring efforts, which is also required by the European Union and recognized by HELCOM Baltic Sea Action Plan in its Management Objectives for Maritime Activities, stating: "No introductions of alien species from ships".

1.2 Purpose and aims

NIS monitoring in major commercial ports has been guided by the Joint Harmonized Procedure of the HELCOM and OSPAR (HELCOM & OSPAR, 2013). However, monitoring of marinas has received less attention until now. PVC fouling plates and scraping samples have been commonly used to detect the presence of fouling species in a variety of coastal environments (Murray et al., 2011; Maraffini et al., 2017; Ulman et al., 2017; Outinen et al., 2019). They provide a standardized sampling method for fouling organisms, including macroinvertebrates and mollusks. Plastic fouling plates provide horizontal attachment surfaces for fouling organisms, whereas a hand-held scraping net can be applied to artificial vertical structures in marinas.

The aim of these guidelines is to provide instructions for the sampling of marinas in the Baltic Sea region. As recreational vessels do not use ballast water, the protocol concentrates on the detection of fouling species. The recorded data contributes to the assessment of the HELCOM core indicator 'Trends in arrival of non-indigenous species', which compares the regional diversity of NIS at temporal intervals to a baseline and evaluates the status relative to previous intervals.

2. Monitoring methods

2.1 Monitoring features

1. Monitoring with fouling plates and scraping net is used to detect non-indigenous fouling species associated with leisure boating and marinas.
2. The method does not require a boat and sampling can be conducted from the pier. The annual monitoring effort includes two visits at the site (deployment and retrieval for the plates). The sampling is recommended every three years per marina at minimum.
3. Taxonomical expertise is required for identification.
4. Fouling plates and scrape samples increase the likelihood of detecting rare species.
5. These monitoring methods at marina environments can reveal temporal trends in NIS abundances and patterns of secondary spread via leisure craft.
6. All recorded data on NIS need to be gathered in a database for introduced and cryptogenic species.

2.2 Time and area

The monitored marinas should be divided into two subareas; Inner and outer marina (Figure 1.) A minimum of one set of fouling plates and two scraping samples per subarea should be taken. Sampling should be conducted during summer when the seasonal succession of fouling organisms is at its highest. The optimum time window for sampling fluctuates annually and across different parts of the Baltic Sea. The fouling plates should be deployed during May or June and retrieved during August or September. The scraping samples should be taken only during the second sampling visit. A chronological order of the sampling sites should be maintained for comparable results. Sampling sites should be easily reachable and accessible from the piers. Entering the piers may require a permission from local authorities.

Figure 1. A marina divided into an inner (A) and outer subarea (B).
Map by Keep the Archipelago Tidy Association (Google, n.d.).

2.3 Monitoring procedure

2.3.1 Monitoring strategy

Due to the diverse nature of existing marinas, a high degree of flexibility and expertise is required. The aim is to concentrate on fouling organisms and establish a temporal rate of new observations per site with comparable effort. Depending on the surveyed site, the deployment time of the plates may differ. The minimum deployment time is 6 weeks due to relatively slow organism recruitment by the plates. However, deployment time can be extended according to the recommendations of national experts if necessary.

2.3.2 Sampling method(s) and equipment

Sampling with fouling plates should be conducted by deploying a set that includes two 15×15 cm PVC plates on different depths (Figure 2). Each set should be constructed of rope (approximately 5 metres), two plates and a brick as a weight at the bottom. The plates should have a hole in the center, and they should be adjusted to approximately 1 and 0,5 m depths measured from the water surface, and secured with knots and zip ties. The rope should be tied into pier structures or buoys at the surface.

The scraping samples should be taken with a hand-held scraping tool (Figure 3). The tool should have a net (0.1 cm mesh size), and a sharp blade attached for scraping vertical berth and pier surfaces or other structures present. The area of the surface sampled should be recorded for future reference. When scraping, the blade should be placed on the sampled surface in approximately 1.0 m depth and drawn upwards to the water surface. If there are no artificial surfaces present reaching to 1.0 m depth, the sample should be taken in depth closest as possible to 1.0 m.

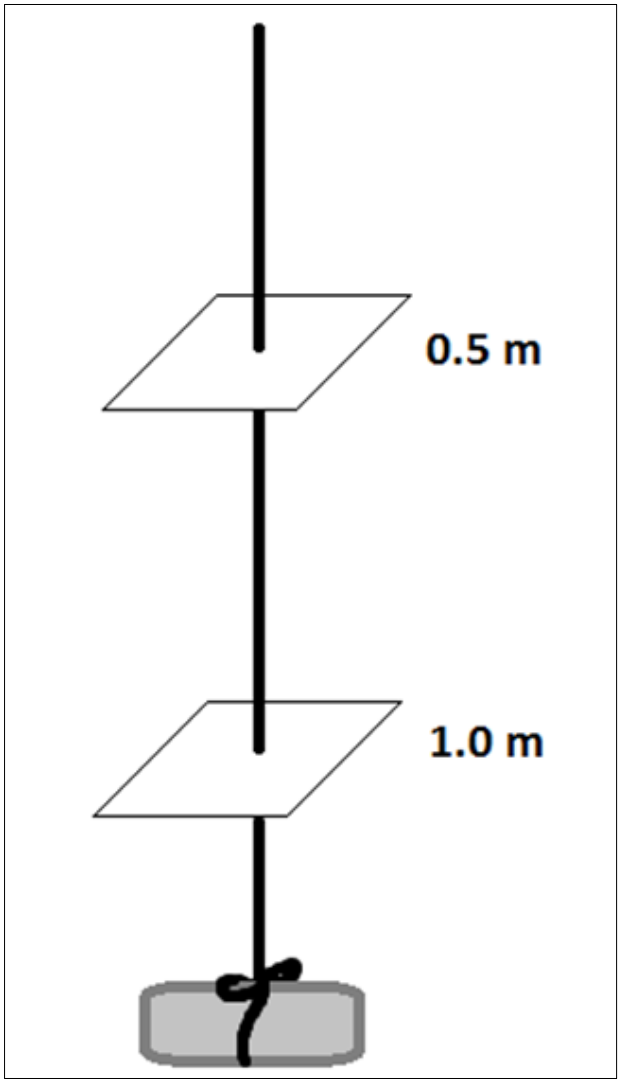

Figure 2. The fouling plate set. *Figure 3. A hand-held scraping tool.*
Illustration and photo by Keep the Archipelago Tidy Association.

2.3.3 Sample handling and analysis

During the second sampling visit, the plates should be carefully lifted and placed individually into labelled and re-sealable plastic bags with small amount of *in situ* -water. The contents of the scraping net should be rinsed carefully into similar plastic bags. All samples should be transported in a cooler. The transported samples can be preserved in ethanol and stored in a fridge, or stored in a freezer without preservation.

The fouling rate of the plates should be determined by placing a grid on the plate, dividing the area to four sub-quadrats of the same size (7.5 x 7.5 cm). The fouling rate of the plate should be then analysed using 5% intervals (Dziubińska and Janas, 2007). In addition, the plates should be photographed to illustrate the regional fouling pressure. All samples should be carefully examined in the lab with stereomicroscopes. Organisms should be identified to the species level, or lowest taxonomic level possible. Species present should be listed and if possible, the abundances of NIS should be recorded. Identification should be done using established taxonomic keys and available literature. Identification procedures of rare and novel species can be time consuming and require correspondence with taxonomic experts. Specimens of concern should be preserved (alcohol, formalin/seawater etc.) and stored. For potential genetic analysis of controversial specimens, storage in ethanol may be preferable.

3. Data reporting and storage

All collected data should be gathered into national monitoring databases. In addition, new non-indigenous species records should be reported to AquaNIS (AquaNIS, 2015). The use of AquaNIS as a central data storage for HELCOM NIS data is currently under discussion.

4. Quality control

4.1 Quality control of methods

All samples should be analysed by local experts in a quality assured laboratory. If an unknown species is detected for the area, it should be photographed and preserved for further analyses (preferably in 96% ethanol for genetic analyses). ISO/IEC quality assured laboratories are relatively rare. Other proofs of quality assurance can be accepted also, as for example participation in HELCOM quality assurance projects such as ZEN QAI and PEG intercalibration are considered quality assured. In addition, laboratories approved by national administrations are considered quality assured.

5. Contacts and references

5.1 Contact persons

Maiju Lehtiniemi (maiju.lehtiniemi@ymparisto.fi), Atte Lindqvist (atte.lindqvist@pssry.fi), Jutta Vuolamo (jutta.vuolamo@pssry.fi), Okko Outinen (okko.outinen@ymparisto.fi)

5.2 References

AquaNIS. Editorial Board, (2015) Information system on Aquatic Non-Indigenous and Cryptogenic Species. World Wide Web electronic publication. www.corpi.ku.lt/databases/aquanis. Version 2.36+. Accessed 2020-04-07.

Dziubińska, A. & Janas, U. (2007) Submerged objects - a nice place to live and develop. Succession of fouling communities in the Gulf of Gdańsk, Southern Baltic. *Oceanological and Hydrobiological Studies* **36**: 65–75.

Google (n.d.) Kasnäs. Retrieved from: https://www.google.com/maps/place/Kasn%C3%A4s/@59.9198416,22.406502,365m/data=!3m1!1e3!4m5!3m4!1s0x468ced28348f5c47:0xa00b553b98f6440!8m2!3d59.92633!4d22.4143973.

HELCOM, OSPAR, (2013) Joint Harmonised Procedure for the Contracting Parties of OSPAR and HELCOM on the Granting of Exemptions Under International Convention for the Control and Management of Ships' Ballast Water and Sediments, Regulation A-4. Available from: http://jointbwmexemptions.org/ballast_water_RA.

Maraffini, M. L., Ashton, G. V., Brown, C. W., Chang, A. L., Ruiz, G. M. (2017) Settlement plates as monitoring devices for non-indigenous species in marine fouling communities, Management of Biological Invasions, 8:4, 559–566.

Murray, C. C., Pakhomov, E. A., Therriault, T. W. (2011) Recreational boating: a large unregulated vector transporting marine invasive species, Diversity and Distributions, 17, 1161–1172.

Outinen, O., Forsström, T., Yli-Rosti, J., Vesakoski, O., Lehtiniemi, M., (2019) Monitoring of sessile and mobile epifauna – Considerations for non-indigenous species. Mar Pol Bul 141, 332-342.

Ulman, A., Ferrario, J., Occhipinti-Ambrogi, A., Arvanitidis, C., Bandi, A., Bertolino, M., Bogi, C., Chatzigeorgiou, G., Cicek, B. A., Deidun, A., Ramos-Esplá, A., Kocak, C., Lorenti, M., Martinez-Laiz, G., Merlo, G., Princisgh, E., Scribano, G., Marchini, A. (2017) A massive update of non-indigenous species records in Mediterranean marinas, PeerJ, 5:e3954.