Guidelines for collecting citizen observations on non-indigenous species (NIS)

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1. Background

1.1 Introduction

Monitoring of non-indigenous species (NIS) is required through several international agreements and guidelines, such as the EU Regulation on Invasive Alien Species (The European Parliament and the Council of the European Union 2014), European Union (EU) Biodiversity Strategy (European Commission 2011) and Marine Strategy Framework Directive (MSFD) of the EU (European Parliament Council 2008). However, most countries do not have governmental monitoring programs targeting the presence and abundance of NIS (Lehtiniemi et al. 2015), even though NIS monitoring is required by international legislations and is of great importance to national environmental management. Monitoring programs can be costly and often spatially and temporally limited (Delaney et al. 2008). Citizen observations can therefore improve the monitoring efforts by increasing the number of potential observers and therefore number of observations. Citizen observations are particularly useful in detecting seasonally occurring events, such as migration patterns, blooming events and areal ice thickness (Lovett et al. 2007; Tulloch et al. 2013; Kettunen et al. 2016), as well as new NIS, since public members have often been the first to discover new species (Lodge et al. 2006). In terms of aquatic NIS, citizen science (e.g. fishermen, beach goers, recreational boaters) can be a very useful tool in monitoring range expansion of invasive species (Lehtiniemi et al. In press).

Citizens usually are not using harmonized sampling methods and are often unequally spatially and temporally distributed. Observations cannot therefore replace more rigorous monitoring programs. Also, as citizen observations tend to produce presence only-type data, it may have limitations for use (e.g. for modelling). Furthermore, species that citizens can observe are usually macroscopic, easy to identify due to distinguishing features or they form mass blooms that attract attention (sensu Fitzpatrick et al. 2009). Hence, microscopic or cryptic species are not usually observed. Despite of these caveats, citizen observations can supplement monitoring programs in detecting NIS and add important insights of ranges of especially charismatic species with small cost and effort.

1.2 Purpose and aims

These guidelines aim to describe creating a citizen science platform to collect citizen observations of NIS (see example in www.vieraslajit.fi, Figure 1). The data collected can be used in the assessment of the HELCOM core indicator 'Trends in arrival of non-indigenous species' as well as in national reporting. Furthermore, citizen science platform can be utilized to raise awareness among local citizens about non-indigenous species and creating alerts of species that may potentially be invading into the area.

Figure 1. An example of NIS citizen science platform that is in use in Finland (www.vieraslajit.fi).

2. Monitoring methods

2.1 Monitoring features

1. Citizen observations should be collected with a website where observers report the NIS they have found.
2. Each country should have their own citizen science website that provides information on local NIS (including species identification material), potential new invaders, local legislation and an observation reporting tool in the native language(s).
3. The website should require certain mandatory parameters (e.g., contact information of the observer, photo of the organism, description of the sampling event) (Table 1).
4. The species name should be selected from a drop-down menu to remove potential errors with spelling and allow cross-language use of data.
5. Location of the observation should be mandatory to obtain georeferenced data and obtained from a pin on a map to remove errors related to different coordinate systems (Figure 2).
6. The reporting sheet can also include open fields for additional information that the observer can submit (Table 1).
7. The observations should go through a verification step where a local expert verifies identification based on a photo. Assigned experts receive an email when a new observation is submitted.
8. The website is connected to a SQL database that stores the given data.
9. The verified observations along with submitted photos (if allowed by the observer) should be shown on a map on the website for the public. This appears to be rewarding to the observers.
10. National citizen observation platforms should have an interface allowing gathering all observations into a pan-Baltic database (AquaNIS).

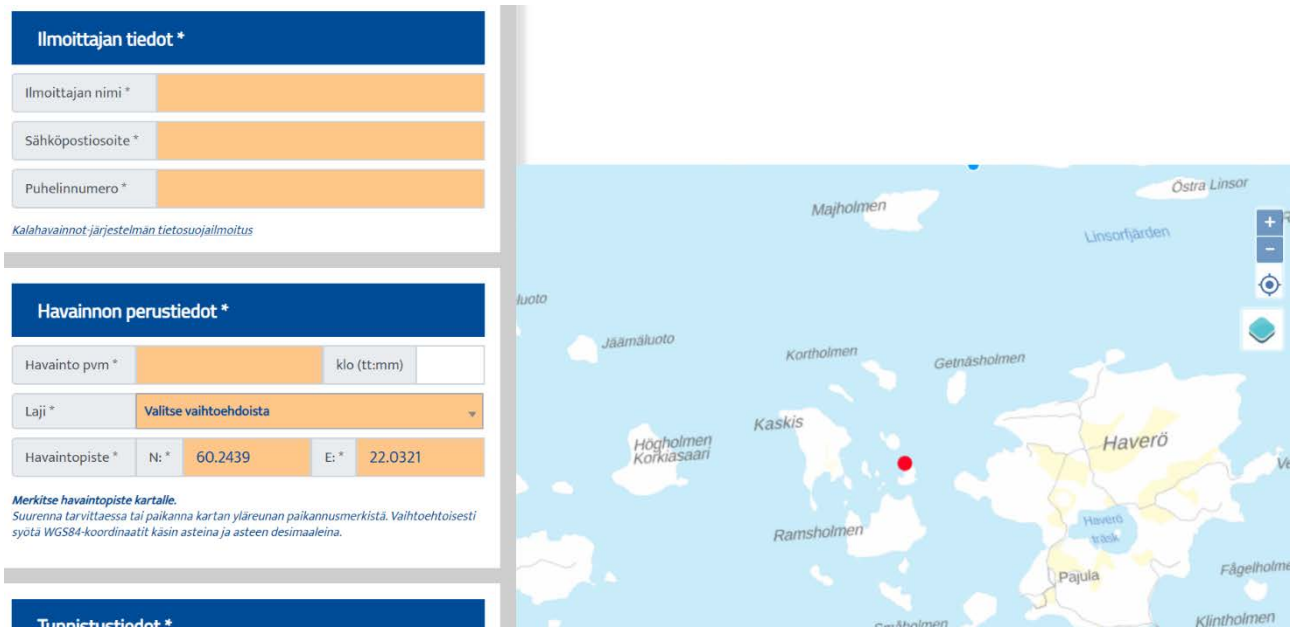

Figure 1. An example of the reporting tool (http://kalahavainnot.luke.fi/lomake). Mandatory fields are indicated with an asterisk and location (GPS coordinates) obtained from the pin (red dot) on the map.

Table 1. Information collected in the reporting tool.

Observation information	Additional information
Name of the observer	Photo attachment (add a file)
Email	Means of observation (e.g. trap, fishing net, visual perception)
Phone number	Number of individuals
Date and time of the observation	Mean length
Species	Sampling effort
Coordinates (extracted automatically from the map)	Has the species been cultured?
Name of the location, sea area	Invasion trend (Decreasing/increasing/stable)
	Life stage
	Other information

2.2 Time and area

Once the citizen observation platform is in place, collection of observations requires little effort and observations on aquatic NIS can be made everywhere within national waters and collected continuously. Experts assigned for verifying of the observations need to log in and verify observations periodically. Also, the reporting tool should be advertised to citizens frequently (e.g. when giving interviews or presentations to the public). Furthermore, materials about NIS (e.g. identification, legislation) need to be updated to the website periodically.

The citizen observation platform is maintained and organized locally by each country. The observations are then portrayed in pan-Baltic scale in AquaNIS.

2.4 Monitoring procedure

2.4.1 Monitoring strategy

Monitoring is conducted by collecting observations from citizens (e.g. fishermen, beach goers, recreational boaters) via a website. The website needs to be advertised whenever possible. The website should be available in native language(s) in each country to improve the usability of the platform to all. For improved species identification, the website should provide material for species identification, their potential habitats and make submitting a photo of the observed organism mandatory.

2.4.2 Sampling method(s) and equipment

The observations are collected through a reporting form connected to a SQL database. The website and the reporting form are simple to create and an example for source code can be retrieved from www.vieraslajit.fi and for the reporting form http://kalahavainnot.luke.fi/lomake. Any open map (e.g., Google, Open Street Map) can be used as the background map for the platform.

Experts verifying the observations receive an email when a new species is added. The verification step is critical for reliability of the data. Prior to verifying the observation, the expert should assure that the location of the observation is correct and matches the description. They should also verify the species identification of the observation based on the photo provided. If there are any questions, they should contact the observer for additional information. The verification work load should be divided amongst the national experts so that each expert only verifies observations on species they are familiar with.

2.4.3 Sample handling and analysis

The verified citizen observations will be shown on the map and collected into a database that should allow downloading the data in a generic format (e.g. csv or excel formats) for further use.

GDPR needs to be considered when storing citizens contact information.

2.5 Data analysis

Results are analysed in accordance to the needs of the HELCOM Core Indicator: ”Trends in arrival of new non-indigenous species”. Also, the data can be used in national reporting for e.g. MSFD and EU IAS Regulation requirements and in monitoring the spread of NIS (Lehtiniemi et al., in press).

3. Data reporting and storage

Each country maintains their own website that provides information on local NIS, potential new invaders, and a reporting tool in the native language(s). Data from the reporting form is gathered into an SQL database, also maintained locally. The database should have an interface to migrate observations to a pan-Baltic database such as AquaNIS, the database on aquatic non-indigenous and cryptogenic species. 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

The reported observations should be verified by national experts preventing storing of non-reliable observations into the databases. The functionality of the reporting tool should be verified at least twice a year. The website should have contact information for technical support in case the user encounters issues.

4.2 Quality control of data and reporting

Quality control of the data consists of verification of the observations (see above) as they are submitted and yearly inspections of the data.

5. Contacts and references

5.1 Contact persons

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5.2 References

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5.3 Additional literature

See www.vieraslajit.fi and the reporting tools there for reference.