Baltic Marine Environment Protection Commission

Final report - HELCOM ALIENS 3 project

Tests of the harmonized approach to ballast water management exemptions in the Baltic Sea

Photo: Riikka Puntila

This is the final report of the HELCOM project *Harmonized Ballast Water Management Exemptions in the Baltic Sea (HELCOM ALIENS 3)*.

Published by:
HELCOM – Baltic Marine Environment Protection Commission
Katajanokanlaituri 6 B
FI-00160 Helsinki
Finland
www.helcom.fi

Editors:
Hermanni Backer and Marta Ruiz

Authors
Marta Ruiz, Riikka Puntila, Hermanni Backer and Lena Granhag

Proofreading
Satu Raisamo

Acknowledgements
The HELCOM ALIENS 3 project benefited greatly of feedback from attendees of the HELCOM-OSPAR TG BALLAST and other meetings, correspondance with experts as well as from students helping on the port sampling.

For bibliographic purposes this document should be cited as:

HELCOM 2014. HELCOM ALIENS 3 – Tests of the Harmonized Approach to Ballast Water Management Exemptions in the Baltic Sea. 56 pp.

Cover photo:

Riikka Puntila

HELCOM ALIENS 3
TESTS OF THE HARMONIZED APPROACH TO BALLAST WATER MANAGEMENT EXEMPTIONS IN THE BALTIC SEA

TABLE OF CONTENTS

1. Introduction

Transport and introductions of non-native species has been identified as one of the primary threats to the coastal ecosystems worldwide. Ships' ballast water has been identified as one of the main vectors transporting the species. Due to ongoing increase in shipping, number of non-native species arriving into the Baltic Sea is in steady increase.

The International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM convention) specifies a number of measures in order to prevent, minimize and ultimately eliminate the transfer of Harmful Aquatic Organisms and Pathogens through the control and management of ships' Ballast Water and Sediments.

However, under certain *low risk conditions,* the BWM convention Regulation A-4 enables a party to grant *exemptions* to any requirements to apply ballast water management for ships (regulation B-3) or additional measures (regulation C-1). Whether or not a specific case can be defined as falling under such low risk conditions requires a *risk assessment*. The overall framework related to these risk assessments is specified in G7 Guidelines for risk assessment under regulation A-4 of the BWM convention (IMO, 2007).

To provide the needed regional detail and ensure effective and harmonized regional implementation of the IMO BWM convention in the Baltic Sea, a regional guidance on such risk assessments for A-4 exemptions in the Baltic Sea was agreed in 2010 within HELCOM by the Baltic Sea coastal states and the EU (HELCOM, 2010).

Based on the 2010 guidance and other work the two commissions, HELCOM and OSPAR, agreed in October 2013 on more comprehensive, quantitative and detailed joint harmonized procedure on A-4 exemptions for the combined HELCOM and OSPAR marine area (HELCOM, 2013a).

As the first step in applying the joint harmonized procedure the applicant for an A-4 exemption should carry out alien species sampling in ports according to the agreed sampling procedure in order to enable a knowledge-based risk assessment. Alternatively the applicant should get access to the results of such surveys done by others. This information should cover each stopover port on the route for which the exemption is applied.

As the second step the applicant should submit the port survey data to a joint regional HELCOM-OSPAR database, established with the joint guidelines, and run the joint online risk assessment model on the data. The agreed risk assessment is based on matching the lists of species found in the stopover ports, a risk assessment algorithm and an agreed list of target species included in the joint guidelines and the tolerances of target species to environmental parameters.

Accordingly, the joint harmonized A-4 procedure includes besides a quantitative risk assessment model, a port sampling protocol to ensure comparability of data, a list of target species, an online decision support tool as well as common administrative procedures.

2. The HELCOM ALIENS 3 project

The overall aim of the project HELCOM ALIENS 3 (2013-2014)[1] was to provide HELCOM Contracting Parties with a possibility to gather further experience with, and provide improvements to, the implementation of the joint harmonized A-4 procedure.

It was a follow-up project of the HELCOM ALIENS 2 (HELCOM, 2013b) which developed many of the approaches underlying the joint harmonized A-4 procedure.

The project started its work during January 2013, and finalised in February 2014. The project was funded by special contributions by Finland and Sweden and by in kind contributions of the HELCOM Secretariat (facilities, working time and travel expenses).

The Project Coordinator Ms. Marta Ruiz and Project Researcher Ms. Riikka Puntila were employed as HELCOM ALIENS 3 project staff at the HELCOM Secretariat. The project was carried out under the supervision of the HELCOM MARITIME Professional Secretary Mr. Hermanni Backer.

The tasks developed within the project could be grouped as follows:

- **Carrying out pilot port surveys,** in the ports of Gothenburg (SWE), Kokkola (FIN), Hamina/Kotka (FIN) and Sköldvik (FIN), trying to cover a broad variety of size, uses and habitats, in order to further develop the port sampling protocol included in the Joint Harmonized A-4 Procedure;
- **Further developing the online decision support tool,** created within HELCOM ALIENS 2 project. The decision support tool and the integrated port survey database with target species lists was tested and developed to an operational regional system possibly to be administered by HELCOM and OSPAR Secretariats;
- **Drafting of the Joint Harmonized A-4 Procedure document** on behalf of the HELCOM Secretariat during spring 2013;
- **Providing general support to the HELCOM-OSPAR TG BALLAST**;
- **Elaboration of dissemination material,** on the importance of alien species and their introduction in the Baltic aquatic ecosystem via ballast water;
- **Organization of workshops,** for following up the activities to be developed within the project.

3. Overall Results of Port Surveys and improvement suggestions

In order to evaluate if exemptions from BWM can be granted, reliable risk assessments between the ports are a prerequisite. On the other hand, risk assessments rely heavily on available information of the port characteristics as well as species assemblages in the ports.

While testing the Guidance to distinguish between unacceptable high risk scenarios and acceptable low risk scenarios – a risk of spreading of alien species by ships on intra-Baltic voyages in the project "Pilot risk assessments of alien species transfer on intra-Baltic ship voyages", Gollasch et al. (2011) noted that such information was largely lacking from the Baltic ports.

[1] HELCOM ALIENS 3 "Test, further development and operationalization of the HELCOM biological survey protocols and A-4 risk assessments in the Baltic Sea" was approved by the 39th meeting of HELCOM Heads of Delegation in 2012.

As a result, HELCOM MARITIME (2011) identified the need for creating a harmonized sampling protocol for gathering information in the ports as required by risk assessments. Such a HELCOM Port Survey Protocol was developed and tested within the HELCOM ALIENS 2 project (2013b).

Prior to 2012 and the HELCOM ALIENS 2 and 3 projects only Estonia had frequent monitoring of non-indigenous species in the vicinity of the ports and there was no monitoring inside the actual port area. In addition, some individual port surveys and long term projects have been conducted in Poland (e.g. Walk et al. 2011), Lithuania, Germany (Buschbaum et al. 2010) and Finland (Paavola et al. 2008).

3.1 Tests of Port Survey Protocol

The Port Survey Protocol included in the HELCOM/OSPAR Harmonized A-4 Procedure adopted in 2013 was developed based on international literature, practical experiences and field sampling trials in Finland (Turku and Naantali) and Estonia (Tallinn) during summer 2012. However, it was clear that before it could be fully applied as a practical regional or international standard the sampling protocol required further testing in different ports in the Baltic and North Seas.

This is because ports in the Baltic and North Sea regions offer a great variety in environmental conditions such as salinity, temperature, traffic patterns and available substrates. Some sampling techniques perfectly applicable to some locations can be useless in others. Potential adjustments were required to assure for sufficient detection of all species present in all types of ports.

Within HELCOM ALIENS 3 project five ports representing a wide geographical scale (**Figure 1** and **Table 1a**) were surveyed and the performance of the protocol was critically reviewed. In parallel, the protocol was used and tested within the HELCOM BALSAM-project (Autumn 2013-) and independently in Germany by Geomar (**Figure 2** and **Table 1b**).

a)

Port	ID	Country	Year	Institution	# of sites
Port of Turku	TUR	Finland	2012	HELCOM	3
Port of Naantali	NAA	Finland	2012	HELCOM	3
Port of Tallinn	TAL	Estonia	2012-2013	EMI	3
Port of Gothenburg	GOT	Sweden	2013	Chalmers	3
Port of Kokkola	KOK	Finland	2013	HELCOM	3
Port of HaminaKotka	HAM-KOT	Finland	2013	HELCOM	6
Port of Sköldvik	SKO	Finland	2013	HELCOM	6
Total					27

b)

Port	ID	Country	Year	Institution	# of sites
Port of Liepaja	LIE	Latvia	2013	LIAE	3
Port of Gdynia	GDY	Poland	2013	UG	3
Flensburg	FLE	Germany	2013	Geomar	3
Kiel	KIE	Germany	2013	Geomar	3
Neustadt	NEU	Germany	2013	Geomar	3
Total					15

Table 1 - Ports sampled in the Baltic through parallel activities.

Figure 1 - Ports currently surveyed in the Baltic Sea area. Ports labelled with pink were surveyed within HELCOM ALIENS projects.

3.2 Overall performance of the Protocol and suggested improvements

The HELCOM ALIENS 3 project gathered user experiences and feedback from further sampling tests in 2013 and discussed the outcome in two workshops (see **Annex 1** and **Annex 5**).

Generally, the protocol appeared to function satisfactorily. Judging based on species accumulation curves (Hayek and Buzas 2010) sampling in all organism groups was adequate to detect even rare species. Approximately 6.7 % of all species detected in the ports were non-indigenous, although the proportion varied among the ports and within organism groups sampled.

The majority of mechanical difficulties arose in benthic sampling due to hard structures often present in the ports. Similarly, good hand operable benthic sampling equipment was difficult to obtain.

Another significant matter brought to discussion was the necessity of using a small vessel in sampling. Originally, the Protocol was designed to be completed from the docks due to traffic restrictions in many of the ports. However, based on the feedback many samples are easier and faster to obtain from a vessel than from the dock. Regardless, the minimum requirement will include sampling from the dock due to the fact that use of a vessel is impossible in many locations. Use of vessel is highly encouraged in case it is approved by the port authorities.

Also, modifications to the analyses of the fouling plates were suggested. Lindeyer and Gittenberger, (2011) introduce a photograph-based method for analysing of fouling plates, which would decrease the analysing time and allow easy cataloguing the fouling plate assemblages.

Finally, clarification regarding what is the minimum requirement by the Protocol and what is additional information was discussed. As an example SCUBA diving is included as a non-mandatory, optional, method in the Joint Harmonized A-4 approach but has been misunderstood as a requirement in recent publications. Minimum requirements should be expressed more clearly in the future editions of the Protocol. All suggested detailed improvements to the sampling protocol are listed in **Appendix I**.

3.3 Cost estimates of port surveys

Within the HELCOM ALIENS 2 project, statistics of work hours related to the port surveys were collected. **Table 2** shows the number of different sample types to be taken at each sampling site. Effort based on completed port surveys within the HELCOM ALIENS 3 and HELCOM BALSAM projects in three countries are presented in **Table 3**, both as man hours (hrs) and estimated costs (€).

The effort estimations in Table 3 cover all work related to the port surveys (including travels), sample analysis and production of finalized data files. In an application covering two ports the effort required to produce the port survey data necessary by the joint harmonized protocol is estimated to be on average in the order of 700 man hours.

Based on such effort estimations one can estimate the costs of surveys. However, the cost of surveys in euros depends naturally heavily on the salary level of the home country of the sampling institution. As an example salary costs in Denmark are four to five times the costs in Latvia, Lithuania, Estonia or Poland (see **Table 4**). The size of the port may also increase the costs, possibly requiring additional sampling sites in some very large ports.

The estimated costs in Table 3 are expressed as total costs in euros (€), including all overhead and employer costs. The HELCOM ALIENS 3 project surveys were conducted in cooperation with environmental authorities and universities. Using purely commercial consultants and laboratories would likely increase the costs. However, even in such cases the incurred costs depend on the nationality of the consultant.

Please note that the effort and cost estimations do not include any additional work that may arise in the application process itself, such as compilation of the application file. However, due to the mandatory use of the online decision support tool for the risk assessment according to the harmonized procedure the effort and incurred costs in such additional work is likely much lower than those related to sampling.

Sample type	Spring samples		Fall samples		Total
Phytoplankton	1 x 20µm net	1 x water	1 x 20µm net	1 x water	4
Zooplankton	1 x 100µm net	1 x 500µm net	1 x 100µm net	1 x 500µm net	4
Zoobenthos			3 x benthic grab		3
Fouling plate			3 x plate (15x15cm)		3
Scraping fouling sample			Approx. 3-6		3-6
Mobile epifana (traps)			6 traps (3 box, 3 minnow)		6
Total	**4**		**19-22**		**23-26**
Plus:					
Pathogens			1 x 0,5l water sample		1

Table 2 – Number of the different sample types to be taken at each sampling site.

		Finland	Sweden	Poland	Average
Survey/site	€	1000	500	500	700
	hrs	13	11	13	12
Analysis/site	€	3400	4600	1000	3000
	hrs	60	97	68	75
Data management/site	€	100	100	200	100
	hrs	2	3	7	4
Other costs	€	300	500		400
Total/site	**€**	**4800**	**5700**	**1700**	**4200**
	hrs	75	111	88	91
Total/port (3 sites)	**€**	**14400**	**17100**	**5100**	**12600**
	hrs	224	332	264	273

Table 3 –Costs recorded from completing port surveys in three countries represented as man hours (hrs) and costs (€). Costs have been rounded to the nearest hundredth.

Country	EUSBSR Seed Money Facility Standard hourly salary rate, including all direct and indirect costs (EUR)
Belarus	13.00
Denmark	53.00
Estonia	12.00
Finland	34.00
Germany	39.00
Latvia	11.00
Lithuania	10.00
Norway	45.00
Poland	14.00
Russian Federation	18.00
Sweden	47.00

Table 4 - Standard hourly salary rates in the Baltic Sea region covering all costs of one effective working hour (in euro) (EUSBSR Seed Money Facility, 2013).

4. Detailed results of port surveys

To the date, ten ports in the Baltic Sea have been surveyed using the "Joint HELCOM/OSPAR Guidelines for the Contracting Parties of OSPAR and HELCOM on the Granting of Exemptions under the International Convention for the Control and Management of Ships' Ballast Water and Sediments, Regulation A-4". These include the Port of Tallinn, in Muuga Estonia, Port of Liepaja in Latvia, Port of Gdynia in Poland and the Port of Gothenburg in Sweden. Also, Ports of Turku and Naantali in Finland were surveyed in 2012. Most data obtained are now stored in the online decision support tool mentioned in Section 5 of this report.

Sampling in each of the ports was carried out following the Guidelines as closely as possible. In all ports, contrary to the suggestions in the Guidelines, benthic samples were preserved using ethanol instead of formalin and sieved with 1 mm sieve, which also corresponds to national monitoring guidelines.

On the average, 9 species of non-indigenous origin were detected from the ports, more from the southern than the northern ports (**Figure 2**). The proportion of non-indigenous species varies between locations and especially between organism groups, but frequently the most species of non-native origien were detected among fouling species, which is mainly due the fact that the majority of fouling and benthos species are non-indigenous. Where NIS in the mobile epifauna are present, their proportion in the sample is often large, since the sampling method is targeted to catch them.

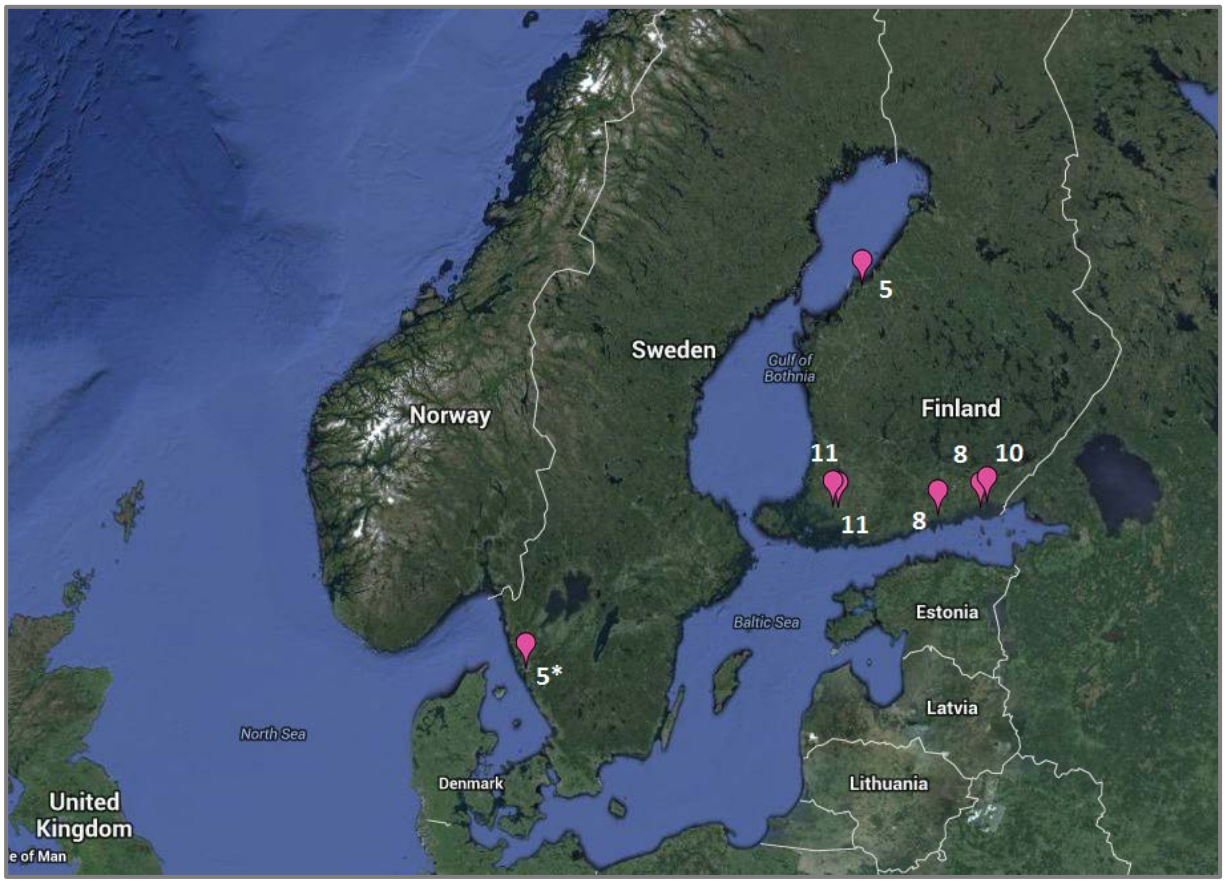

Figure 2 - Number of non-indigenous species (NIS) detected from the ports. Plankton samples are not yet analysed from the Port of Gothenburg and hence the number of NIS only refers to non-indigenous species detected in benthos, fouling organisms and mobile epifauna.

4.1. Port of Kokkola, Finland (2013)

Port of Kokkola is to the date the northernmost port sampled using the Guidelines. It is also the largest dry bulk traffic port in Finland ant the third largest port in Finland. The All Weather Terminal (AWT) allows loading of weather sensitive cargo throughout the year. The port is also continuously growing, especially in Hopeakivi and Deep port area. Traffic consists largely of international vessels, many of them large Panamax or cape size type vessels.

Port sampling in Kokkola was conducted on 08.05.2013 and 01.-02.08.2013 by a team of two people. A total of three sites were sampled and altogether 55 biological samples were collected. All sampled sites were active berths: general port, All Weather Terminal and Hopeakivi/Deep port.

Methods

Sampling was carried out following the Guidelines closely at each of the sites. In Kokkola benthic samples were taken with a Petersen- type benthic grab, which was more suitable for mixed type bottom substrates than the Ekman grab used in the previous year of sampling in Naantali and Turku. Equipment malfunction while sampling at site 2, All Weather Terminal, prevented benthic sampling at the site 3. Plankton samples were obtained with 150 µm (zooplankton) and 20 µm (phytoplankton) nets. Phytoplankton were also analysed from 300 ml water samples.

Results

Altogether 182 taxa of native origin and 5 of non-indigenous origin were identified from the samples (Appendix III). The northern location may explain the low number of non-indigenous species found in the port. Most non-indigenous species were found among the fouling organisms (3 species).

Proportionally most non-indigenous species were found among the benthos (25%) and the fouling organisms (14%). All detected non-indigenous species are common and already present in most of the Baltic Sea. Thus, it is most probable that their presence would not prevent granting exemptions.

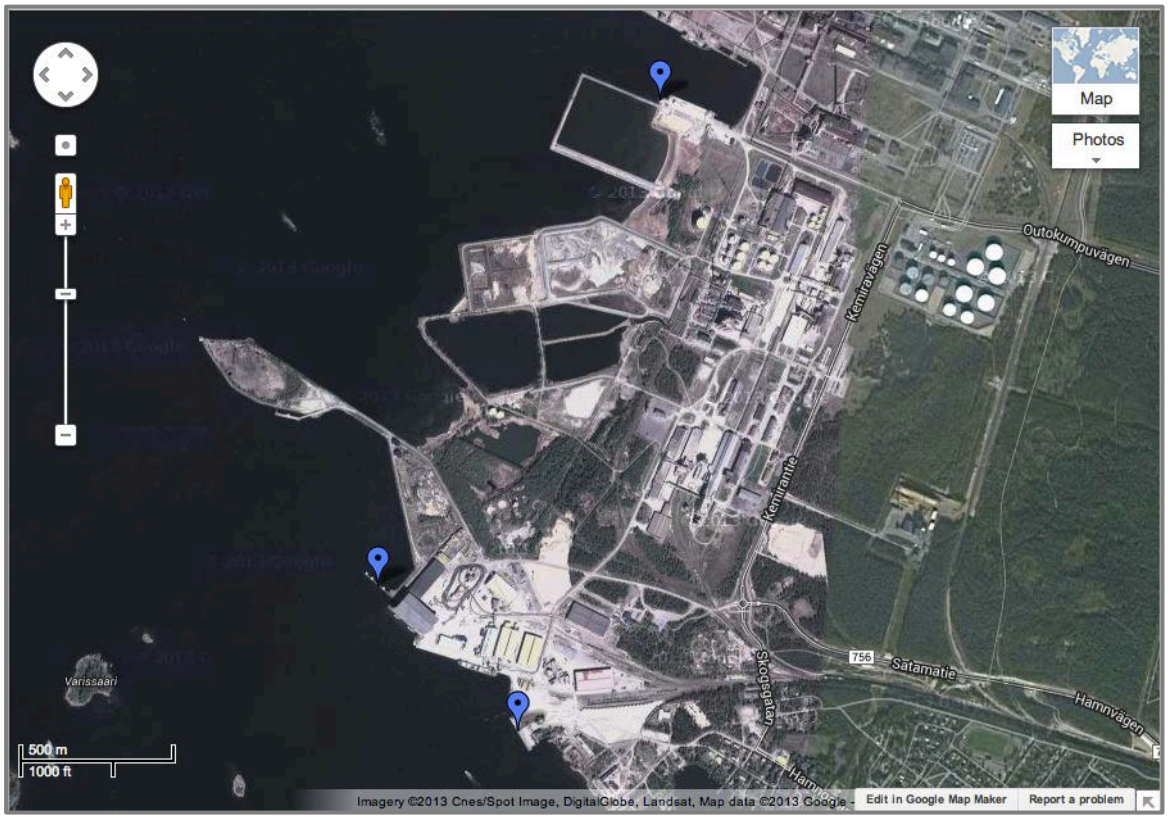

Figure 3 - Sites sampled in the Port of Kokkola.

4.2. Port of HaminaKotka, Finland (2013)

HaminaKotka is the largest universal, export, container and transit port in Finland. It is located in three distinct locations, Kotka Mussalo, Kotka Hietanen and Hamina. The port has frequent traffic to

many major European seaports. It serves all types of cargo: containers, RoRo, liquid bulk, dry bulk, LoLo, gas, project shipments and passenger traffic.

Sampling inn HaminaKotka was conducted on 29.04.2013 (spring bloom) and 05.-07.08.2013 (summer maximum) by a team of two people. A total of six sites were sampled: two in Mussalo, two in Hietanen (Kotka) and two in Hamina. All sites sampled were active berths and altogether 113 biological samples were collected.

Methods

Sampling was carried out following the Guidelines closely at each of the sites. In HaminaKotka benthic samples were taken with a Petersen- type benthic grab. In Mussalo container berth the substrate was rocky and no benthic samples were obtained. Plankton samples were collected with 150 µm (zooplankton) and 20 µm (phytoplankton) nets. Phytoplankton were also analysed from 300 ml water samples. Unfortunately, some phytoplankton samples from HaminaKotka had not preserved properly and were unidentifiable. Still, enough samples were analysed for obtaining representative data from the port.

Results

From the port located in Kotka, altogether 191 taxa of native origin and 8 of non-indigenous origin were identified (see Appendix III). Most non-indigenous species were again found among the fouling organisms (6 species) and zooplankton (3 species). Proportionally most non-indigenous species were found among the mobile epifauna (50%) and the fouling organisms (25%). High proportion in the mobile epifauna is mainly explained by the low native diversity in the samples, due to the fact that the sampling method is chosen to effectively catch non-indigenous species.

From the port located in Hamina, altogether 133 taxa of native origin and 10 of non-native origin were identified. Most non-native species were found among the fouling organisms (5 species) and benthos (4 species). Proportionally most non-indigenous species were found among the benthos (40%) and the fouling organisms (15%). Also, abundance of NIS in fouling organism samples is high due to the fact that barnacles are the most abundant fouling species without any native competition.

Most NIS detected from the ports have already been detected in most parts of the Baltic Sea. The only potential target species (which would be taken into account in risk assessments for exemptions from the BWM convention) is the zebra mussel, *Dreissena polymorpha*.

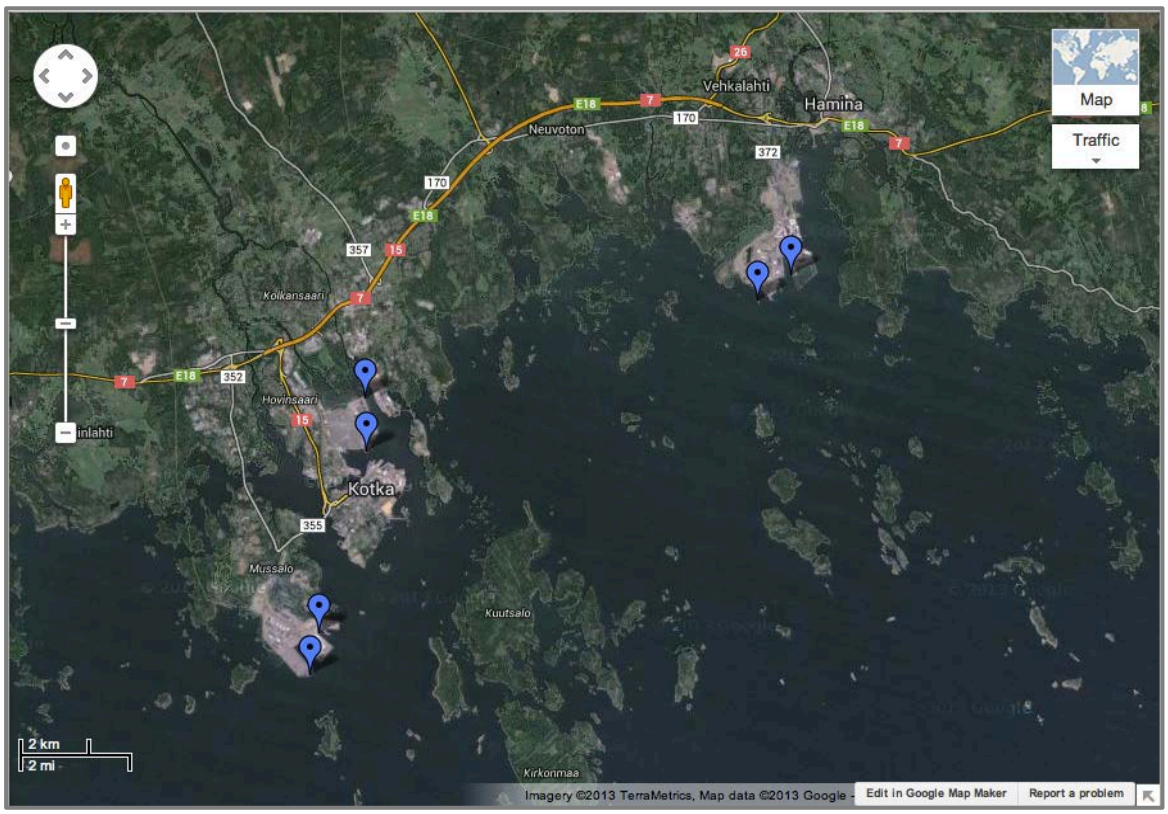

Figure 4 - Sites sampled in the Port of HaminaKotka.

4.3. Neste OYj, port of Sködvik, Finland (2013)

Port of Sköldvik is the largest port in Finland measured by tonnage of cargo. Yearly, 1200-1400 ships, mostly tankers, visit the port. The majority of the traffic is international. The port is owned and operated by NesteOil Ltd. being specializing on oil, liquid and gas transport. The port serves traffic to Neste Oil's refinery in the area, as well as other industry in the area (e.g. plastic and gas industry).

Sampling in Sköldvik was conducted on 24.04.2013 and 14.-15.08.2013 by a team of two to five people. A total of 10 sites were sampled. Altogether 140 biological samples were collected of six active berths and four open water reference sites. The port granted the use of a tugboat in sampling, which enabled sampling of the reference sites a bit further away from the berths.

Methods

Sampling was carried out following the Guidelines closely at each of the sites. In addition, plankton and benthic samples were collected from four reference sites located approximately 50 meters from the shore. In Sköldvik benthic samples were taken with a Petersen- type benthic grab. Substrate in the southernmost site was rocky, but two satisfactory samples were obtained. Plankton samples were obtained with 150 µm (zooplankton) and 20 µm (phytoplankton) nets. Phytoplankton were also analysed from 300 ml water samples.

Results

Altogether 213 taxa of native origin and 8 taxa of non-indigenous origin were identified from the samples. Most non-native species were found among fouling organisms (5 species) and zooplankton (3 species).

Proportionally most non-indigenous species were found among the mobile epifauna (50%) and fouling organisms (50%). However, this is explained mainly by the low native diversity of native species in these samples and the dominance of non-indigenous acorn barnacle *Amphibalanus improvisus*.

Most of the NIS found in the area are already widely distributed in the Baltic Sea. However two species found in the port may be potential target species (which would be taken into account in risk assessments for exemptions from the BWM convention). These are the round goby, *Neogobius melanostomus* and Conrad's false mussel, *Mytilopsis leucophaeata*, both found at several sites in the port.

Reference samples showed that there was little difference whether the samples were obtained near to the docks or bit further from them. However, sampling, especially for benthic samples, was much easier using the boat.

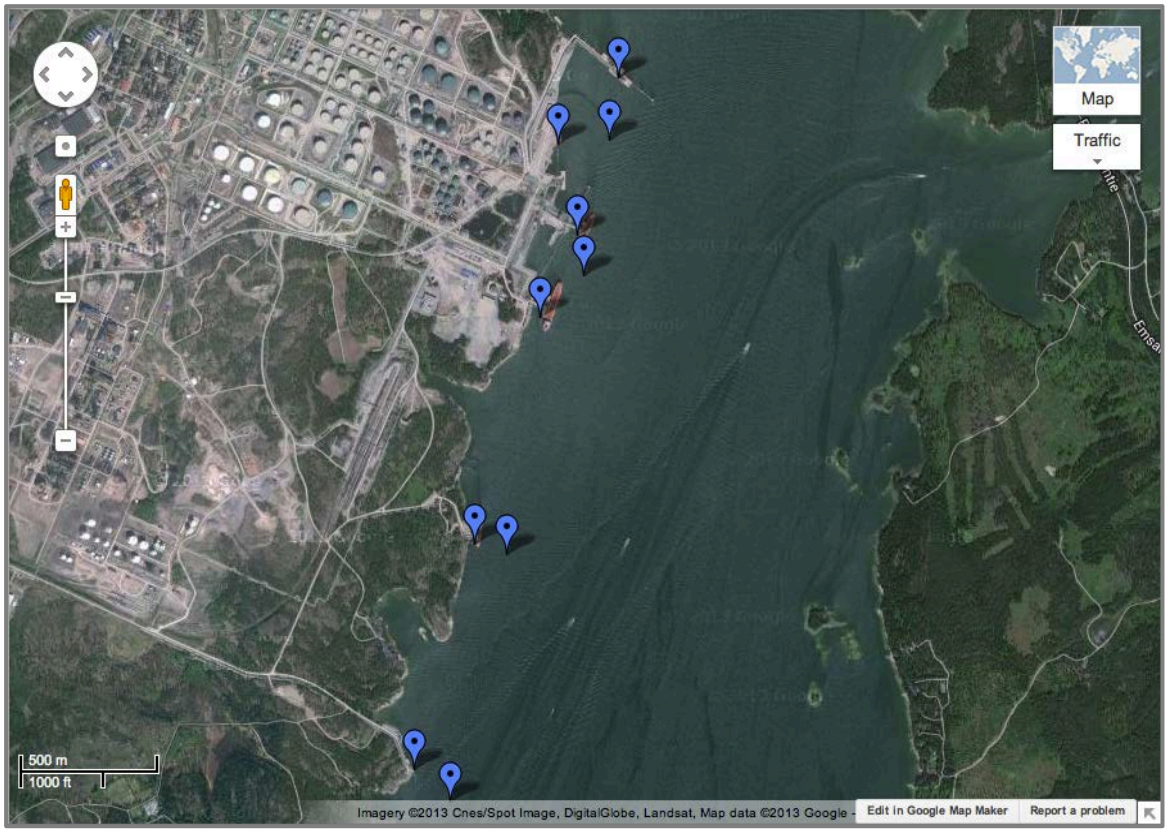

Figure 5 - Sites sampled in the Neste OYj port in Sköldvik.

4.4. Port of Turku, Finland (2012, no spring sampling)

Port of Turku has frequent passenger and ro-ro traffic especially to Stockholm, Sweden. It also ships containers, bulk and oil products. The port is located in the mouth of river Aurajoki, which impacts the water salinity in the area.

Sampling was conducted on 15.-18.08.2012 with a two-to-four member team where a total of 3 sites, all representing active berths (Passenger terminal, Bulk port and Oil port), were sampled. Altogether 51 biological samples were collected.

Methods

Sampling was carried out following the Guidelines closely. In Turku no spring sampling was conducted. Benthic samples were taken with an Ekman- type benthic grab. Plankton samples were obtained with 150 µm (zooplankton) and 20 µm nets. Phytoplankton assemblages were also analysed from 300 ml water samples.

Figure 6 - Sites sampled in the port of Turku.

Results

In the sampling altogether 97 species of native origin and 11 species of non-native origin were found (Appendix III). Most non-native species were found in fouling organisms (10 species) and benthos (6 species).

Proportionally most non-native species were found among the mobile epifauna (40%) and fouling organisms (33%)

4.5. Port of Naantali, Finland (2012, no spring sampling)

Port of Naantali is a home for frequent passenger and ro-ro traffic, bulk (grains, coal, gypsum etc.) cargo.

The nearby located Fortum and Neste Oil have their own docks and they also harbor frequent traffic. Sampling was conducted on 20.-22.08 2012 by a two-to-four member team. A total of three sites were sampled and altogether 42 biological samples were collected. All sampled sites were active berths (Bulk dock, ferry terminal and ro-ro/container terminal).

Methods

Sampling was carried out following the Guidelines closely at each of the sites. In Naantali no spring sampling was conducted. Benthic samples were taken with an Ekman- type benthic grab. Benthic sampling was somewhat cumbersome due to the bottom formations and substrates. In some parts, only hard substrates were found and in others the bottom was covered with coal and/or other

material fallen from the docks. Plankton samples were obtained with 150 µm (zooplankton) and 20 µm nets. Phytoplankton assemblages were also analysed from 300 ml water samples.

Results

A total of 74 species of native origin and 11 species of non-indigenous origin were found in the samples (Appendix III). Most non-native species were found in the fouling organisms (9 species) and in zooplankton (6 species). Furthermore 5 species or non-indigenous origin were found in the benthic samples.

Proportionally most non-indigenous species were found among the mobile epifauna (50%), fouling organisms (32%) and zooplankton (32%).

Figure 7 - Sites sampled in the Port of Naantali.

4.6. Port of Gothenburg, Sweden (2013, no spring sampling)

Port of Gothenburg is the largest port in Scandinavia. There are terminals for containers, ro-ro, cars, passengers as well as oil and other energy products. There is a large variation in salinity in the harbor from fresh to saline water (up to 32 PSU) in the inner part as the River Göta Älv has its outflow in Gothenburg harbor.

Two areas were sampled in the Port of Gothenburg, the inner and the outer areas. Three sites were sampled in each of the two areas during the summer (on 28.06.2013 and 11.09.2013) by a team of two to three people. A total figure of 122 biological samples was collected, 102 of them were analysed and 20 stored. No sampling was conducted during spring time. Analyses of the samples were conducted for benthic infauna (five sites), mobile epifauna (three sites) and fouling panels (five sites). However, no analysis for phytoplankton, zooplankton nor pathogens was conducted.

Sampling for pathogens is taken in the harbour area at bathing sites during the summer season (approximately 2 km from the outer sampling sites).

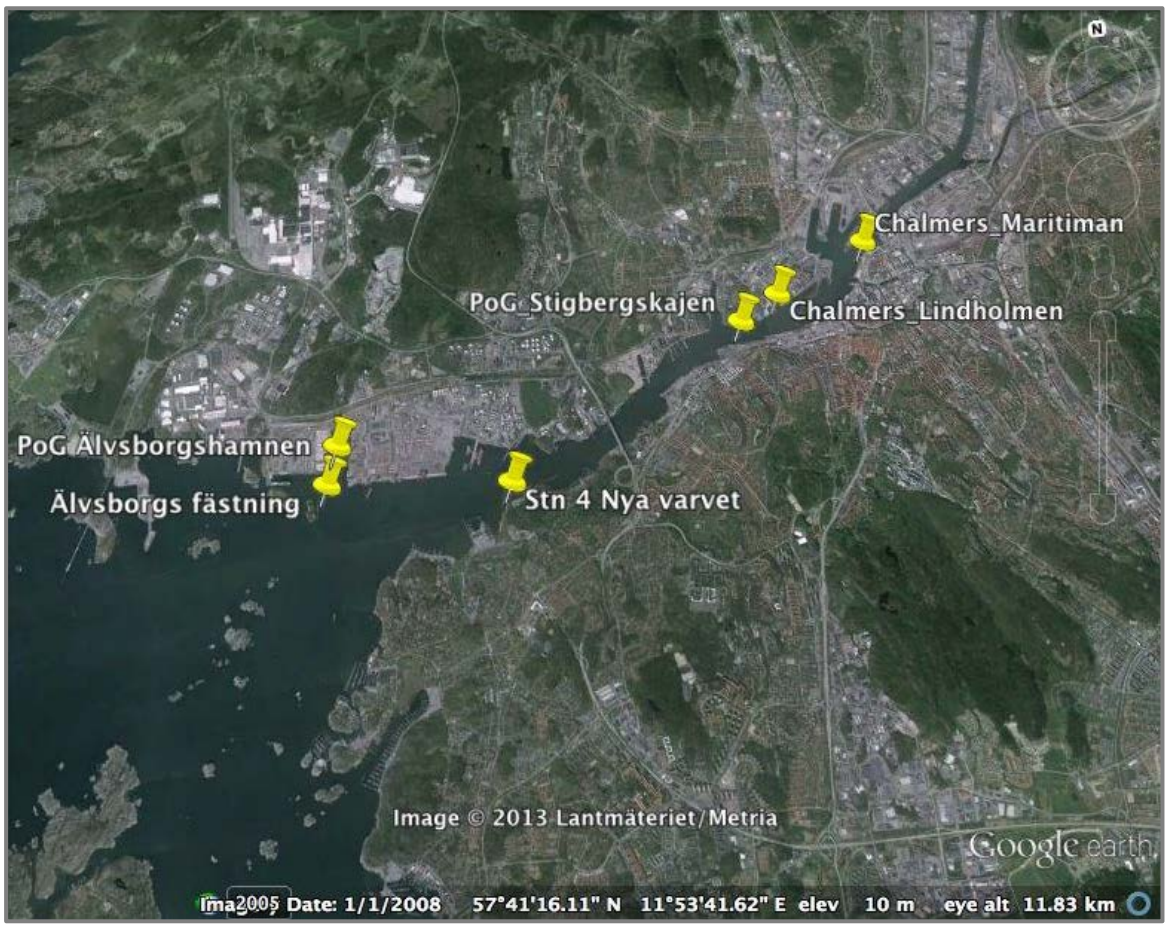

Figure 8 – Sites samples in the Port of Gothenburg.

Methods

To take the samples, a handheld Ponar grab operated from dock or boat was used (see **Figure 9**). Improvements for the benthic infauna sampling were discussed and the use of drop video to locate spots suitable for sampling was considered to avoid inefficient sampling (i.a. grab running into concrete fundaments) as well as the use of a boat with winch to achieve the best operation of the grab. One of the advantages of using ethanol to fix all samples is that samples can be subsequently used for barcoding.

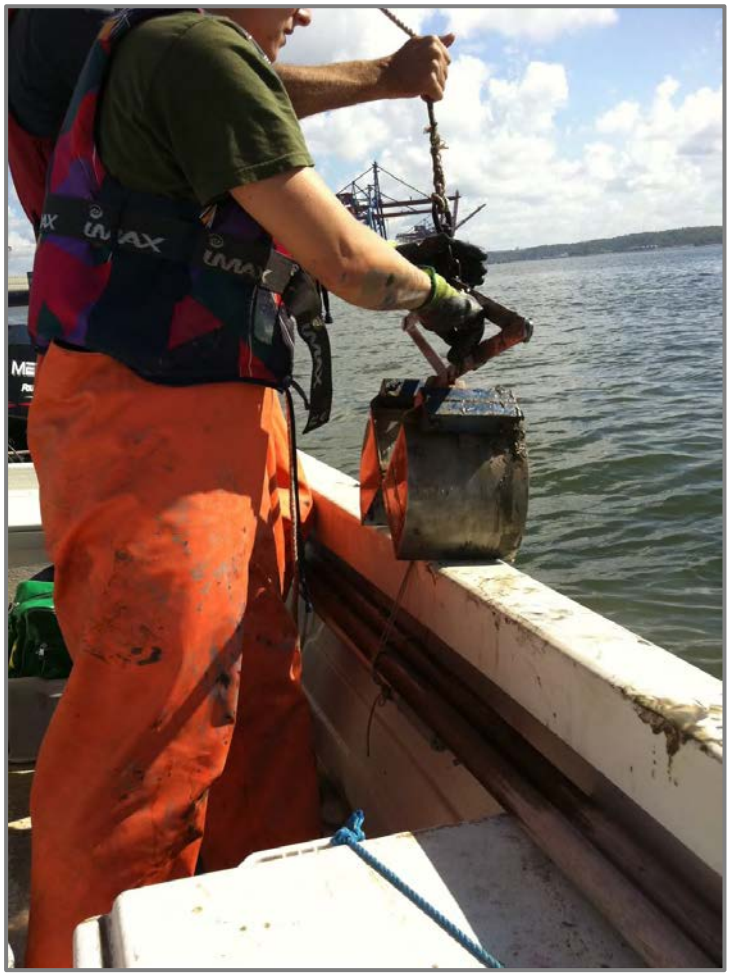

Figure 9 - Handheld Ponar used for benthos sampling.

Regarding mobile epifauna sampling, crab larval traps were used in addition to Chinese crab traps (mesh size 12 mm) and crayfish traps (mesh size 10 mm).

Results

The dominating species in the traps for mobile epifauna was the crab *Carcinus maenas* and no other crab species were found during either the 2x24 h fishing periods at the tree sites or during the extended period of fishing during 9 days at the station Nya Varvet (with readings and new bait added after 24h, 72h, 144h and 216h) (Appendix III).

On the fouling plates the hydrozoa *Cordylophora caspia* (Brackish water hydroid) dominated on the plates in the inner harbour together with the barnacle *Amphibalanus improvisus.*

Species recordings of interest are: the fish *Neogobius melanostomus* found at station Nya Varvet in the outer harbour caught with crab and crayfish traps. *Neogobius melanostomus* in Gothenburg harbour is earlier only documented on few occasions by recreational fishermen.

The polycheate worm *Marenzelleria viridis* found in the benthic infauna samples at Lindholmen station (inner harbour) and Älvsborgs fästning station (outer harbour) and the tunicate *Molgula manhattensis* from the plates at Älvsborgshamnen/Kaj 702 station (outer harbour) have earlier only few recordings from the Swedish west coast.

Results from the plankton samples are currently pending and will be analysed shortly.

5. Developing the online A-4 decision support tool

HELCOM ALIENS 2 project developed a prototype decision support tool referred to in Chapter 6 of the "Joint HELCOM/OSPAR Guidelines on the granting of exemptions under the International Convention for the Control and Management of Ships' Ballast Water and Sediments, Regulation A-4" adopted by HELCOM and OSPAR in 2013.

Based on HELCOM ALIENS 3 project an updated and improved decision support tool, named "Risk Assessment Tool under the HELCOM/OSPAR Harmonized Procedure on Exemptions under the Ballast Water Management Convention" is now available through the domain http://jointbwmexemptions.org/ballast_water_RA.

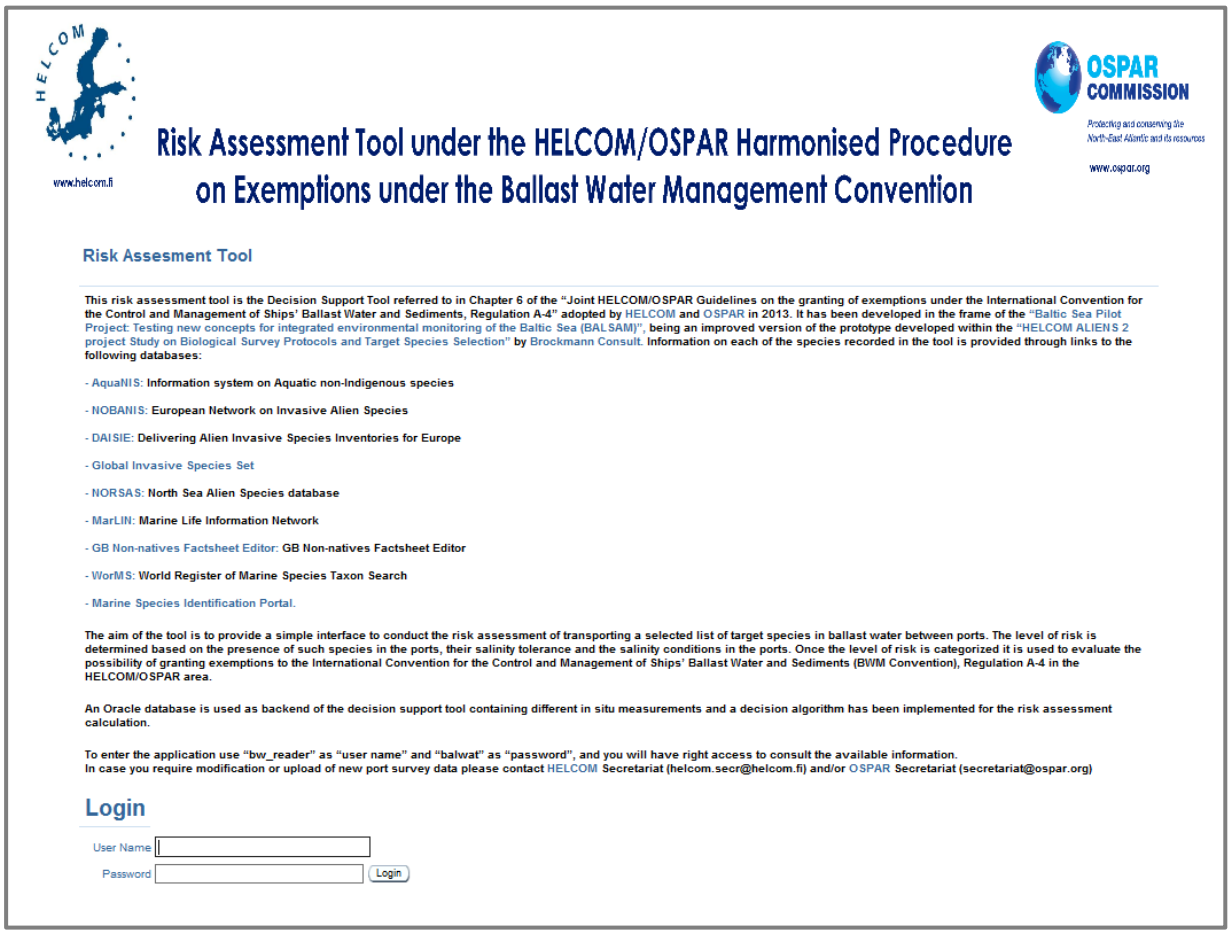

Figure 10 – Logging page to the Risk Assessment Tool under the HELCOM/OSPAR Harmonized Procedure on Exemptions under the Ballast Water Management Convention.

To enter the application use "bw_reader" as "user name" and "balwat" as "password", and right access is given to consult the available information.

The main webpage provides background information on the tool and gives access to eight tabs where information is structured as follows:

- **Home**: introduction on the tool as well as the administrative process to proceed with when asking for an exemption under the Joint HELCOM/OSPAR Guidelines;
- **Risk Assessment Algorithm:** used by the risk assessment tool to determine if there is a high, medium or low risk scenario of spreading of alien species by ships on voyages within ports in the Baltic and OSPAR area, based on the salinity in the port of departure and arrival, the

salinity tolerance of target species and the occurrence of different target species in the start and destination ports;

- **All Species in the HELCOM/OSPAR area:** all species whose presence has been recorded in the combined HELCOM and OSPAR areas;
- **Target Species in the HELCOM/OSPAR area:** target non-native species selected and agreed by Parties to HELCOM and OSPAR;
- **Risk Assessment:** access to running A-4 risk assessment on spreading of alien species when travelling from port A to port B;
- **Quality Check:** quality of the samples with regard to number of species observed (species-area curves);
- **View Data:** additionally to the list of the species found in the different samples taken, information on the port characteristics, sampling environmental conditions and sampling methodology can also be viewed;
- **Additional Information & Help:** containing a user guide to help understand the tool, the data model behind the tool, and two documents: the BWM Convention and the Joint HELCOM/OSPAR Guidelines.

Detailed information on each of the species recorded in the tool is provided through links to the following databases:

- AquaNIS: Information system on Aquatic non-Indigenous species;
- NOBANIS: European Network on Invasive Alien Species;
- DAISIE: Delivering Alien Invasive Species Inventories for Europe;
- Global Invasive Species Set;
- NORSAS: North Sea Alien Species database;
- MarLIN: Marine Life Information Network;
- GB Non-natives Factsheet Editor: GB Non-natives Factsheet Editor;
- WorMS: World Register of Marine Species Taxon Search;
- Marine Species Identification Portal.

The main changes by HELCOM ALIENS 3 to the original prototype developed by the HELCOM ALIENS 2 project could be summarized as follows:

- removal of dummy/test data;
- updating with real data from the port surveys described in chapter 3;
- inclusion of live links to the more than 600 species contained in the tool;
- reorganization of the tabs of the tool as well as the information contained in each of them to make the contents more friendly and understandable for users;

- the scheme of the administrative procedure and the risk assessment algorithm have been updated according to the contents of the Joint HELCOM/OSPAR Guidelines adopted in 2013;
- the information displayed in the quality check tab has been reorganized so that only results from the sampling carried out in one port are shown at a time. Information of the results obtained is organized by groups of organisms (e.g. mobile epifauna, phytoplankton, fouling, benthos, zooplankton, pathogens);
- information on the port characteristics, environmental conditions and sampling methodology used during the port survey appears in the same tab as the list of species found in each sample. Thus, the user is to decide whether to visualize this additional information or not when displaying the information on the species found;
- elaboration of a user guide on the tool explaining it and detailing the options it enables with regard to data arrangement;
- inclusion of the BWM Convention and the Joint HELCOM/OSPAR Guidelines as additional information.

The transferral of the on-line decision support tool and database to HELCOM servers in April 2014 and part of the technical implementation of the above changes was done by Brockmann Consult in the frame of the EU-financed "Baltic Sea Pilot Project: Testing new concepts for integrated environmental monitoring of the Baltic Sea (HELCOM BALSAM)".

6. Supporting the HELCOM-OSPAR TG BALLAST

The first task of the project in early 2013 was to, on behalf of the HELCOM Secretariat, lead the drafting the joint harmonized procedure document on A-4 exemptions for the combined HELCOM and OSPAR marine area subsequently adopted by HELCOM and OSPAR Heads of Delegation in 2013.

Another overall aim of the HELCOM ALIENS 3 project was to support the joint HELCOM-OSPAR TG BALLAST by preparing meetings, as well as presenting the advances of the activities of the project. The 2nd and 3rd meetings of the HELCOM-OSPAR TG BALLAST took place on 28 February – 1 March 2013; and 4-5 December 2013, respectively.

7. Drafting HELCOM Guide on Alien Species and Ballast Water Management in the Baltic Sea

In order to raise public awareness as well as inform end users on the regulations in force regarding ballast water management in the Baltic Sea, the "HELCOM Guide to Alien Species and Ballast Water Management in the Baltic Sea" was drafted by the HELCOM ALIENS 3 project, with input from the experts from HELCOM member states (HELCOM 2014).

The document provides an overview of the regional Baltic Sea measures related to shipping, developed by the Coastal countries and the European Union within HELCOM MARITIME in order to prevent the entrance and settlement of non-native species present in ships' ballast water in the Baltic Sea area.

The Guide was approved by HELCOM MARITIME 13/2013 (26-28 November 2013, Szczecin, Poland) and published on 15 April 2014 on the HELCOM website.

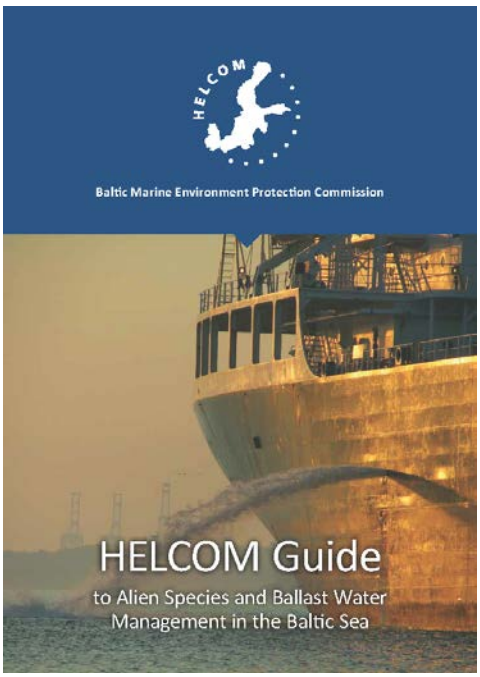

Figure – Cover page of the HELCOM Guide to Alien Species and Ballast Water Management in the Baltic Sea.

8. Workshops

Two workshops were organized by the HELCOM ALIENS 3 project to help interested organizations, e.g. members of the environmental monitoring institutions around the Baltic Sea, to carry out port sampling and to collect feedback from such sampling. An introductory workshop, describing and displaying the port sampling methods, was organized on 31 May 2013 and a workshop summarising port sampling experiences was organized on 17 October 2013 both at HELCOM Secretariat premises in Helsinki. Outcomes are available via the HELCOM document meeting portal.

Based on these experiences the project submitted a document on proposed improvements to the joint Guidelines for the joint HELCOM-OSPAR protocol (HELCOM-OSPAR TG BALLAST 3/2013, doc. 4/3) to the HELCOM-OSPAR TG BALLAST meeting that took place on 4-5 December 2013 in The Hague (Netherlands).

9. References

Buschbaum, C.; Karez, R.; Lackschewitz, D.; Reise, K. 2010. Rapid assessment of neobiota in German coastal waters. HELCOM Indicator Fact Sheets and development of the HELCOM core set of indicators. St. Petersburg, Russia.

EUSBSR Seed Money Facility. 2013. (http://seed.eusbsr.eu/).

Gollasch, S.; David, M.; Leppäkoski, E. 2011. Pilot risk assessments of alien species transfer on intra-Baltic ship voyages. HELCOM Project No. 11.36.

Hayek, L.- A.C. & Buzas, M.A. 2010. Surveying natural populations - Quantitative tools for assessing biodiversity. 2nd edition Columbia University Press. NY- USA. 590 pp.

HELCOM. 2010. HELCOM Ministerial Declaration on the implementation of the HELCOM Baltic Sea Action Plan - Guidance to distinguish between unacceptable high risk scenarios and acceptable low risk scenarios – a risk of spreading of alien species by ships on Intra-Baltic voyages, to be followed when applying for, or granting, exemptions to requirements of ballast water management of the Ballast Water Management Convention to ships operating within the Baltic Sea. (http://www.helcom.fi/helcom-at-work/ministerial-declarations/)

HELCOM. 2013a. 2013 HELCOM Ministerial Declaration - Joint HELCOM/OSPAR Guidelines on the granting of exemptions under the International Convention for the Control and Management of Ships' Ballast Water and Sediments, Regulation A-4. (http://www.helcom.fi/Documents/Ministerial2013/Ministerial%20declaration/Adopted_endorsed%20documents/Joint%20HELCOM_OSPAR%20Guidelines.pdf).

HELCOM. 2013b. HELCOM ALIENS 2- Non-native species port survey protocols, target species selection and risk assessment tools for the Baltic Sea. 34 pp.

HELCOM. 2014. HELCOM Guide to Alien Species and Ballast Water Management in the Baltic Sea. (http://helcom.fi/Lists/Publications/BallastGuide2014_FINAL_web.pdf).

HELCOM MARITIME. 2011. Minutes of the Tenth Meeting of the Maritime Group (HELCOM MARITIME 10/2011). (http://www.helcom.fi/)

HELCOM MARITIME. 2013. Minutes of the Thirteenth Meeting of the Maritime Group (HELCOM MARITIME 13/2013). (http://www.helcom.fi/)

IMO. 2007. Guidelines for risk assessment under regulation A-4 of the BWM Convention (G7). Resolution MEPC.162(56). (http://www.imo.org/blast/blastDataHelper.asp?data_id=19689&filename=162(56).pdf)

Lindeyer, F.; Gittenberger, L. 2011. Ascidians in the succession of marine fouling communities. *Aquatic Invasions*, 6 (4): 421–434.

Paavola, M., A. O. Laine, M. Helavuori, and P. Kraufvelin. 2008. Profiling four brackish-water harbours: zoobenthic composition and invasion status. *Boreal Environment Research* 13:159–175.

Walk, M., H. Modrzejewska, and G. Szydłowska-Herbut. 2011. Alien Species Introduction Risk Assessment on the Basis of Quality of Ballast Water Discharged at the Port of Gdynia. Page 45.

Appendix I Suggestions and comments on the protocol

In ALIENS 3 Port Survey Workshop in May 2013 attendees discussed about further developments for the protocol. Attendees were also asked to provide further feedback after the port sampling had been conducted. This document is a review of the comments received from the project partners at the post-sampling seminar in October 2013.

1. **Following the demonstration in the workshop, port sampling protocol was commented and the following suggestions arose for its improvement:**

   - Flexibility of the timing of sampling, so it is adapted to local conditions (point 2.15 of the Guidelines).
   - If it is possible, pH of the water should be recorded within environmental data together with salinity and temperature (p. 20).
   - Inclusion of ~500µm net for zooplankton sampling may be required depending on the biota present at each location (p. 21).
   - There is a need to standardize fouling sampling: best color of the plates to receive fouling (grey); appropriate type of rope; disposal of a tube between the rope and the plate to avoid loosing of the plates; how to scratch the plates; analyze of fresh samples is preferred (or freeze them if an immediate analyze is not possible) (p. 23)
   - Recommendation of Petersen compared to Ekman grab for soft substrate sampling (p. 28).
   - Importance of a common data reporting platform.
   - Recommendation of using a boat to perform the sampling when it is available, rather than doing it from the pier, due to its simplicity.
   - Importance of the collaboration of the Port Authorities on the sampling process.
   - The need of certain flexibility when performing the also the importance of that deviation to be recorded.
   - The order of the sampling performance is to be detailed in the Protocol, starting with plankton sampling to avoid being affected by sediments suspension after sediment sampling.
   - Specification on the storage of the samples collected is required.
   - Clarification on the gathering (number of samples to be taken) of phytoplankton and zooplankton samples is needed to avoid uncertainties.
   - Suggestion to photograph the species encountered and identified in the samples should be included in the protocol.

2. **General comments received following the conducted port surveys:**

   - Local environmental authorities should also be contacted about the port surveys. They could have background info of interest about the sample area and since the results could be of value to them as well (at the very least in disseminating info and increasing public awareness in the prevention of invasive species) they might be interested in participating which could benefit both.
   - Use of boat in the sampling should be considered especially to allow horizontal zooplankton tows and more comprehensive sampling of benthos.

3. **Comments about benthos sampling**

   - Ekman grab is too light weight to be able to get a decent sample. Heavier samples would be better.
   - Handheld Ponar appeared too heavy to be operated from the dock. Instead a winch, which requires a vessel, was used.

4. **Comments about phytoplankton samples**

   - Brown bottles would be better for storing the samples.

5. **Comments about zooplankton samples**

   - Hard to find a suitable net that can be operable from the dock that could still have flow meter installed.
   - Inclusion of horizontal zooplankton samples is suggested.
   - For the large Plankton-net the cod-end was modified (large transparent bag) to be able to capture and identify fragile gelatinous organisms.

6. **Comments about traps**

   - Very few organisms got trapped due to large mesh size. Amy's box traps (habitat traps, figure attached) should also be considered.
   - For traps a longer than 48hrs period was used at one station in Gothenburg (2 weeks with readings each 48h)
   - Also in addition to the two trap-types above "larval-traps" for smaller crabs and crab-larvae (10 -20 mm carapax length) were used in Gothenburg
   - The Chinese crab trap and "Mjärde" both captured crabs with carapax length 23mm-75mm

7. **Comments about fouling plates**

   - Fouling plates should be deployed already in April/May which was not possible this year (Gdynia)
   - Alternative preservation methods (freezing?) need to be discussed.
   - Analysis could follow the methods described in Lindeyer and Gittenberger 2011 and Ruiz et al. 2006 and Hines and Ruiz 2000.

8. **Comments about scrape samples**

   - Impossible to take in most locations
   - Hard to analyse for example barnacle samples (damaged and impossible to count). Suitable for bivalves and macroalga as well as for associated fauna.

9. **Number of sampling sites**

   - Three is too few even in a small port such as Gdynia.
   - In Finland experiments with adding more sites in Sköldvik.

10. **Additions to/Removals from the protocol**

- Sampling of meiobenthos and diatoms should be added
- Inclusion of horizontal zooplankton and pelagic sampling
- Required use of small research vessel with a winch should be considered
- Ability to sieve and preserve on board would secure the quality of the samples.
- A Smith MacIntyre grab to be able to compare and use similar data from other marine monitoring programs running close by (Sweden).

Appendix II Identified taxa from the ports surveyed within HELCOM ALIENS-projects

Port of Gothernburg			
Native species	**N**	**Non-indigenous species**	**N**
Fouling plates	**13**	**Fouling plates**	**3**
Carcinus maenas		*Amphibalanus improvisus*	
Chlorophyta		*Cordylophora caspia*	
Ciona intestinalis		*Molgula manhattensis*	
Cyanobacteria		**Benthic infauna**	**2**
Electra pilosa		*Amphibalanus improvisus*	
Filamentous phaeophyceae		*Marenzelleria viridis*	
Gammarus sp.		**Mobile epifauna**	**1**
Mytilus edulis		*Neogobius melanostomus*	
Neanthes succinea			
Phaeophyta/Rhodophyta			
Polysiphona sp.			
Rhodophyta/ Phaeophyta			
Ulva linza			
Benthic infauna	**44**		
Abra alba			
Abra prismatica			
Anthozoa			
Aphelochaeta marioni			
Aphelochaeta sp.			
Balanus crenatus			
Baltidrilus costatus			
Cerastoderma edule			
Corbula gibba			
Corophium sp.			
Corophium volutator			
Crangon crangon			
Cyanophthalma obscura			
Erichtonius rubricornis			
Harmothoe imbricata			
Hediste diversicolor			
Heteromastus filiformis			
Jaera albifrons			
Liocarcinus navigator			
Macoma balthica			
Microdeutopus gryllotalpa/propinquus			
Modiolus modiolus			
Mya arenaria			
Neanthes succinea			
Neoamphitrite figulus			

Nephtys hombergii	
Nephtys incisa	
Nereis sp.	
Parvicardium scabrum	
Pectinaria koreni	
Peringia ulvae	
Phaxas pellucidus	
Phoronis muelleri	
Polydora caulleryi	
Polydora ciliata	
Polydora ligni	
Polydora sp.	
Rissoa membranacea	
Spio filicornis	
Spisula subtruncata	
Streblospio benedicti	
Terebellides stroemi	
Tubifex pseudogaster	
Tubificoides benedii	
Mobile epifauna	4
Anguilla anguilla	
Carcinus maenas	
Gobius niger	
Myoxocephalus scorpius	

Port of Turku			
Native species	**N**	**Non-native species**	**N**
Fouling plates	**15**	**Fouling plates**	**6**
Acarina spp.		*Amphibalanus improvisus*	
Apocorophium lacustre		*Boccardiella ligerica*	
Cerastoderma glaucum		*Cordylophora caspia*	
Chironomidae spp.		*Gammarus tigrinus*	
Corophium sp.		*Mytilopsis leucophaeata*	
Electra crustulenta		*Rhithropanopeus harrisii*	
Gammarus sp.		**Benthos**	**6**
Harpacticoida sp.		*Amphibalanus improvisus*	
Leptocheirus pilosus		*Boccardiella ligerica*	
Macoma balthica		*Marenzelleria spp.*	
Mytilus trossulus		*Mytilopsis leucophaeata*	
Nematoda spp.		*Rhithropanopeus harrisii*	
Oligochaeta sp.		*Victorella pavida*	
Trichoptera sp.		**Fouling (Scrape)**	**10**
Turbellaria sp.		*Amphibalanus improvisus*	
Benthos	**14**	*Boccardiella ligerica*	
Acarina spp.		*Cercopagis pengoi*	
Chironomidae spp.		*Cordylophora caspia*	
Corophium volutator		*Gammarus tigrinus*	
Electra crustulenta		*Mytilopsis leucophaeata*	
Gammarus sp.		*Palaemon elegans*	
Harmothoe sarsi		*Rhithropanopeus harrisii*	
Harpacticoida sp.		*Tenellia adspersa*	
Hediste diversicolor		*Victorella pavida*	
Hydrozoa sp.		**Mobile epifauna**	**2**
Macoma balthica		*Palaemon elegans*	
Mytilus trossulus		*Rhithropanopeus harrisii*	
Neomysis integer		**Zooplankton**	**4**
Oligochaeta sp.		*Acartia tonsa*	
Tenellia adspersa		*Amphibalanus improvisus*	
Fouling (Scrape)	**20**	*Cercopagis pengoi*	
Acarina spp.		*Rhithropanopeus harrisii*	
Acartia sp.			
Apocorophium lacustre			
Chironomidae spp.			
Corophium sp.			
Electra crustulenta			
Enteromorpha sp.			
Eurytemora affinis			
Harpacticoida sp.			
Hydrobia sp.			
Hydrozoa sp.			
Leptocheirus pilosus			
Macoma balthica			
Mytilus trossulus			
Oligochaeta sp.			
Palaemon sp.			
Polychaeta sp.			
Tardigrada sp.			

Trichoptera sp.	
Unknown	
Mobile epifauna	3
Blicca bjoerkna	
Gobius niger	
Gymnocephalus cernuus	
Phytoplankton	48
Anabaena inaequalis	
Anabaena lemmermannii	
Aphanizomenon flos-aquae	
Aphanizomenon gracile	
Aulacoseira islandica helvetica	
Aulacoseira italica	
Centrales spp.	
Ceratoneis closterium	
Chrysochromulina spp.	
Cyclotella choctawhatcheeana	
Desmodesmus spinosus	
Diatoma spp.	
Diatoma tenuis	
Ebria tripartita	
Eutreptiella spp.	
Flagellates spp.	
Glenodinium spp.	
Gymnodiniales spp.	
Heterocapsa rotundata	
Koliella longiseta f. longiseta	
Leucocryptos marina	
Melosira lineata	
Monoraphidium contortum	
Monoraphidium griffithii	
Monoraphidium komarkovae	
Monoraphidium minutum	
Navicula spp.	
Nitzschia spp.	
Nodularia spumigena	
Oocystis spp.	
Plagioselmis prolonga	
Plagioselmis spp.	
Planktolyngbya spp.	
Planktothrix agardhii	
Pseudanabaena acicularis	
Pseudanabaena limnetica	
Pseudanabaena spp.	
Pseudopedinella elastica	
Pseudopedinella thomsenii	
Romeria spp.	
Skeletonema costatum	
Snowella atomus	
Snowella septentrionalis	
Sphaerocystis schroeteri	
Teleaulax spp.	

Telonema spp.	
Thalassiosira hyperborea v. lacunosa	
Thalassiosira pseudonana	
Zooplankton	24
Acartia sp.	
Bivalvia sp.	
Bosmina sp.	
Brachionus sp.	
Chironomidae spp.	
Cladocera sp.	
Copepoda sp.	
Cyclopidae sp.	
Daphnia cucullata	
Daphnia sp.	
Eurytemora affinis	
Gastropoda sp.	
Harpacticoida sp.	
Keratella cochlearis	
Keratella quadrata	
Leptodora kindtii	
Limnocalanus macurus macurus	
Mysidae sp.	
Nematoda spp.	
Oligochaeta sp.	
Polychaeta sp.	
Sida sp.	
Synchaeta monopus	
Synchaeta sp.	

Port of Naantali			
Native species	**N**	**Non-native species**	**N**
Fouling plates	**15**	**Fouling plates**	**7**
Acarina spp.		*Amphibalanus improvisus*	
Apocorophium lacustre		*Boccardiella ligerica*	
Cerastoderma glaucum		*Cordylophora caspia*	
Chironomidae spp.		*Gammarus tigrinus*	
Electra crustulenta		*Mytilopsis leucophaeata*	
Gammarus sp.		*Palaemon elegans*	
Harpacticoida sp.		*Rhithropanopeus harrisii*	
Hydrobia sp.		**Benthos**	**4**
Jaera sp.		*Amphibalanus improvisus*	
Leptocheirus pilosus		*Boccardiella ligerica*	
Macoma balthica		*Marenzelleria spp.*	
Mytilus trossulus		*Mytilopsis leucophaeata*	
Nematoda spp.		**Fouling (Scrape)**	**7**
Oligochaeta sp.		*Amphibalanus improvisus*	
Ulva intestinalis		*Boccardiella ligerica*	
Benthos	**10**	*Cercopagis pengoi*	
Acarina spp.		*Gammarus tigrinus*	
Chironomidae spp.		*Mytilopsis leucophaeata*	
Corophium volutator		*Palaemon elegans*	
Electra crustulenta		*Rhithropanopeus harrisii*	
Harmothoe sarsi		**Mobile epifauna**	**3**
Hediste diversicolor		*Neogobius melanostomus*	
Macoma balthica		*Palaemon elegans*	
Mytilus trossulus		*Rhithropanopeus harrisii*	
Oligochaeta sp.		**Zooplankton**	**6**
Tenellia adspersa		*Acartia tonsa*	
Fouling (Scrape)	**16**	*Amphibalanus improvisus*	
Acarina spp.		*Cercopagis pengoi*	
Apocorophium lacustre		*Mytilopsis leucophaeata*	
Cerastoderma glaucum		*Palaemon elegans*	
Chironomidae spp.		*Rhithropanopeus harrisii*	
Cladophora sp.			
Electra crustulenta			
Enteromorpha sp.			
Gammarus sp.			
Gammarus zaddachi			
Jaera sp.			
Leptocheirus pilosus			
Mytilus trossulus			
Oligochaeta sp.			
Palaemon sp.			
Polychaeta sp.			
Ulva intestinalis			
Mobile epifauna	**3**		
Gymnocephalus cernuus			
Perca fluviatilis			
Syngnathus typhle			
Phytoplankton	**36**		
Actinocyclus octonarius v. octonarius			

Anabaena inaequalis	
Anabaena lemmermannii	
Anabaena spp.	
Aphanizomenon flos-aquae	
Aphanizomenon gracile	
Centrales spp.	
Chaetoceros wighamii	
Chrysochromulina spp.	
Cyclotella choctawhatcheeana	
Desmodesmus armatus v. armatus	
Eutreptiella spp.	
Glenodinium spp.	
Gymnodinium sp.	
Hemiselmis virescens	
Heterocapsa rotundata	
Katablepharis remigera	
Leucocryptos marina	
Monoraphidium contortum	
Monoraphidium griffithii	
Monoraphidium minutum	
Oocystis spp.	
Plagioselmis prolonga	
Plagioselmis spp.	
Pseudanabaena limnetica	
Pseudanabaena spp.	
Pseudopedinella elastica	
Pyramimonas spp.	
Pyramimonas virginica	
Snowella atomus	
Snowella septentrionalis	
Teleaulax spp.	
Telonema spp.	
Thalassiosira hyperborea v. lacunosa	
Thalassiosira pseudonana	
Uroglena spp.	
Zooplankton	13
Acartia sp.	
Alona sp.	
Bivalvia sp.	
Bosmina sp.	
Daphnia cucullata	
Eurytemora affinis	
Gastropoda sp.	
Harpacticoida sp.	
Keratella quadrata	
Limnocalanus macurus macurus	
Polychaeta sp.	
Sida sp.	
Synchaeta monopus	

Port of Kokkola			
Native species	**N**	**Non-native species**	**N**
Fouling plates	**11**	**Fouling plates**	**2**
Acarina spp.		*Amphibalanus improvisus*	
Alona sp.		*Cordylophora caspia*	
Bithynia tentaculata		**Benthos**	**2**
Bryozoa sp.		*Cordylophora caspia*	
Chironomidae spp.		*Marenzelleria spp.*	
Gammarus sp.		**Fouling (Scrape)**	**1**
Gastropoda sp.		*Gammarus tigrinus*	
Harpacticoida sp.		**Zooplankton**	**1**
Hydrozoa sp.		*Evadne anonyx*	
Laomedea sp.			
Sida sp.			
Benthos	**6**		
Chironomidae spp.			
Cyanophthalma obscura			
Diptera sp.			
Oligochaeta sp.			
Saduria entomon			
Ulva intestinalis			
Fouling (Scrape)	**17**		
Acarina spp.			
Bosmina sp.			
Ceratopogonidae			
Chironomidae spp.			
Chydorus spp.			
Cladocera sp.			
Cottidae			
Cyclopidae sp.			
Diptera sp.			
Eurytemora affinis			
Gammarus sp.			
Gammarus zaddachi			
Gasterosteus aculeatus			
Oligochaeta sp.			
Pisces			
Podon sp.			
Sida sp.			
Mobile epifauna	**2**		
Gasterosteus aculeatus			
Perca fluviatilis			
Phytoplankton net	**124**		
Achnanthes taeniata			
Actinocyclus octonarius v. crassus			
Actinocyclus octonarius v. octonarius			
Amphiprora paludosa v. paludosa			
Amphora spp.			
Anabaena solitaria			
Anabaena spp.			
Anabaenopsis			
Aphanizomenon			

Aphanizomenon flos-aquae
Aphanizomenon issatschenkoi
Asterionella formosa
Aulacoseira islandica helvetica
Aulacoseira islandica islandica
Botryococcus braunii
Centrales spp.
Chaetoceros ceratosporus v. ceratosporus
Chaetoceros gracilis
Chaetoceros holsaticus
Chaetoceros similis
Chaetoceros spp.
Chaetoceros subtilis v. subtilis
Chaetoceros tenuissimus
Chaetoceros wighamii
Chlamydomonas
Chlorococcales spp.
Chroococcales spp.
Chrysochromulina spp.
Cocconeis placentula v. placentula
Cocconeis spp.
Coelastrum microporum
Coscinodiscus granii
Cryptomonadales
Cyclotella spp.
Cylindrotheca closterium
Desmodesmus armatus v. armatus
Desmodesmus communis
Desmodesmus intermedius
Desmodesmus opoliensis v. opoliensis
Diatoma tenuis
Diatoma vulgaris
Dinobryon divergens
Dinobryon faculiferum
Ebria tripartita
Epithemia spp.
Eutreptiella spp.
Flagellates spp.
Fragilaria crotonensis
Fragilaria spp.
Fragilariopsis cylindrus
Gymnodiniales spp.
Gymnodinium sp.
Gyrosigma spp.
Heterocapsa arctica frigida
Heterocapsa rotundata
Heterocapsa triquetra
Katablepharis spp.
Koliella longiseta f. longiseta
Lagerheimia longiseta
Lagerheimia longiseta v. longiseta
Lyngbya majuscula

Melosira arctica
Melosira lineata
Melosira moniliformis
Melosira nummuloides
Merismopedia glauca
Merismopedia tenuissima
Mesodinium rubrum
Microcystis wesenbergii
Monoraphidium arcuatum
Monoraphidium contortum
Mougeotia spp.
Navicula spp.
Navicula vanhoeffenii
Nitzschia acicularis v. acicularis
Nitzschia frigida
Nitzschia paleacea
Nitzschia spp.
Oblea rotunda
Oocystis borgei
Oocystis lacustris
Oocystis spp.
Oocystis submarina
Oscillatoriales
Pediastrum boryanum v. boryanum
Pediastrum duplex v. duplex
Pennales
Peridiniales
Peridiniella catenata
Plagioselmis prolonga
Planktolyngbya spp.
Planktothrix agardhii
Prorocentrum lima
Protoceratium reticulatum
Protoperidinium brevipes
Protoperidinium granii
Protoperidinium pellucidum
Prymnesiales spp.
Prymnesium sp.
Pseudanabaena spp.
Pseudo-nitzschia spp.
Pseudopediniella sp.
Pyramimonas spp.
Quadrigula spp.
Rhoicosphenia abbreviata
Romeria spp.
Scenedesmus acuminatus
Scenedesmus obtusus
Scrippsiella
Snowella
Spirogyra spp.
Surirella
Synedra acus v. acus

Synedra ulna v. ulna
Tabellaria flocculosa
Tabularia fasciculata
Teleaulax spp.
Telonema subtile
Tetraedron minimum
Thalassionema nitzschioides
Thalassiosira baltica
Woronichinia
Woronichinia compacta
Woronichinia naegeliana
Phytoplankton water 70
Achnanthes taeniata
Amphidinium crassum
Amphiprora paludosa v. paludosa
Anabaena spp.
Anabaenopsis
Aphanizomenon flos-aquae
Aphanocapsa
Aphanothece
Centrales spp.
Chaetoceros ceratosporus v. ceratosporus
Chaetoceros gracilis
Chaetoceros holsaticus
Chaetoceros spp.
Chaetoceros tenuissimus
Chaetoceros wighamii
Chlamydomonas
Chlorococcales spp.
Chroococcales spp.
Chrysochromulina spp.
Crucigenia quadrata
Cryptomonadales
Cryptomonas
Cyclotella choctawhatcheeana
Cylindrotheca closterium
Desmodesmus bicellularis
Desmodesmus opoliensis v. opoliensis
Diatoma tenuis
Dinobryon faculiferum
Ebria tripartita
Eutreptiella spp.
Flagellates spp.
Gymnodiniales spp.
Gymnodinium sp.
Hemiselmis virescens
Heterocapsa arctica frigida
Heterocapsa rotundata
Katablepharis spp.
Lagerheimia longiseta v. longiseta
Leucocryptos marina
Licmophora gracilis v. gracilis

Melosira arctica	
Melosira lineata	
Melosira nummuloides	
Mesodinium rubrum	
Monoraphidium contortum	
Monoraphidium komarkovae	
Monoraphidium minutum	
Navicula spp.	
Nitzschia spp.	
Oblea rotunda	
Oocystis submarina	
Oscillatoriales	
Pennales	
Peridiniales	
Peridiniella catenata	
Plagioselmis prolonga	
Planktolyngbya spp.	
Prymnesiales spp.	
Pseudanabaena spp.	
Pseudopediniella sp.	
Pyramimonas spp.	
Rhoicosphenia abbreviata	
Scrippsiella	
Tabularia fasciculata	
Teleaulax spp.	
Telonema subtile	
Thalassiosira baltica	
Thalassiosira levanderi	
Woronichinia	
Woronichinia naegeliana	
Zooplankton	21
Acartia bifilosa	
Alona sp.	
Asplanchna	
Ceriodaphnia sp.	
Chydorus sphaericus	
Cyclopoida sp.	
Daphnia sp.	
Diaphanosoma sp.	
Eubosmina maritima	
Eurytemora affinis	
Evadne nordmanni	
Harpacticoida sp.	
Kellicottia longiseta	
Keratella quadrata	
Leptodora kindtii	
Nauplii	
Polyphemus sp.	
Simocephalus sp.	
Synchaeta baltica	

Port of HaminaKotka, Kotka	
Native Species	**N**
Fouling plates	**12**
Acarina spp.	
Alona sp.	
Annelida sp.	
Bryozoa sp.	
Chironomidae spp.	
Einhornia crustulenta	
Ephemeroptera	
Gammarus sp.	
Harpacticoida sp.	
Hydrozoa sp.	
Oligochaeta sp.	
Sida sp.	
Benthos	**8**
Chironomidae spp.	
Cladophora glomerata	
Corophium volutator	
Cyanophthalma obscura	
Macoma balthica	
Oligochaeta sp.	
Saduria entomon	
Ulva intestinalis	
Fouling (Scrape)	**24**
Acarina spp.	
Agraylea	
Alona sp.	
Bosmina sp.	
Chironomidae spp.	
Cladocera sp.	
Cyclopidae sp.	
Daphnia cucullata	
Daphnia sp.	
Diptera sp.	
Dytiscidae	
Ephemeroptera	
Eurytemora affinis	
Gammarus sp.	
Gammarus zaddachi	
Harpacticoida sp.	
Hydrozoa sp.	
Lymnaea peregra	
Oligochaeta sp.	
Ostracoda	
Pisces	
Cyanopthalma obscura	
Sida sp.	
Trichoptera sp.	
Mobile epifauna	**1**
Perca fluviatilis	
Phytoplankton net	**116**

Non-Indigenous species	**N**
Fouling plates	**4**
Amphibalanus improvisus	
Cercopagis pengoi	
Cordylophora caspia	
Gammarus tigrinus	
Benthos	**2**
Cordylophora caspia	
Marenzelleria spp.	
Fouling (Scrape)	**5**
Acartia tonsa	
Amphibalanus improvisus	
Cercopagis pengoi	
Gammarus tigrinus	
Palaemon elegans	
Mobile epifauna	**1**
Palaemon elegans	
Zooplankton	**3**
Amphibalanus improvisus	
Cercopagis pengoi	
Evadne anonyx	

Acanthoceras zachariasii
Achnanthes taeniata
Actinocyclus octonarius v. octonarius
Amphiprora paludosa v. paludosa
Amphora ovalis
Anabaena baltica
Anabaena lemmermannii
Anabaena solitaria
Anabaena spp.
Aphanizomenon spp.
Aphanizomenon flos-aquae
Aphanocapsa
Aphanothece
Asterionella formosa
Aulacoseira spp.
Aulacoseira granulata v. granulata
Aulacoseira islandica helvetica
Aulacoseira islandica islandica
Bacillaria paxillifera
Botryococcus braunii
Centrales spp.
Ceratium hirundinella
Chaetoceros minimus
Chaetoceros similis
Chaetoceros subtilis v. subtilis
Chaetoceros tenuissimus
Chaetoceros wighamii
Chlamydomonas
Chlorococcales spp.
Chroococcales spp.
Chroococcus turgidus
Chrysochromulina spp.
Cocconeis placentula v. placentula
Cocconeis spp.
Coelastrum astroideum
Coelastrum microporum
Cosmarium spp.
Crucigenia quadrata
Crucigeniella rectangularis
Cryptomonadales
Cyanodictyon spp.
Cylindrotheca closterium
Cymbella lanceolata
Desmodesmus armatus v. armatus
Desmodesmus communis
Desmodesmus intermedius
Desmodesmus maximus
Desmodesmus opoliensis v. opoliensis
Dictyosphaerium pulchellum
Dinobryon cylindricum
Dinobryon divergens
Dinophysis acuminata

Dinophysis norvegica
Dinophysis rotundata
Ebria tripartita
Eutreptiella spp.
Flagellates spp.
Fragilaria crotonensis
Fragilaria spp.
Gymnodiniales spp.
Heterocapsa rotundata
Heterocapsa triquetra
Katablepharis spp.
Leptocylindrus danicus
Licmophora spp.
Melosira lineata
Melosira moniliformis
Melosira spp.
Merismopedia warmingiana
Mesodinium rubrum
Microcystis aeruginosa
Microcystis viridis
Microcystis wesenbergii
Monoraphidium contortum
Monoraphidium minutum
Mougeotia spp.
Navicula spp.
Nitzschia spp.
Nodularia spumigena
Oblea rotunda
Oocystis borgei
Oocystis lacustris
Oocystis spp.
Oocystis submarina
Oscillatoriales
Pediastrum boryanum v. boryanum
Pediastrum duplex v. duplex
Pediastrum simplex
Pennales
Peridiniales
Plagioselmis prolonga
Planctococcus sphaerocystiformis
Planctonema lauterbornii
Planktolyngbya spp.
Planktothrix agardhii
Protoperidinium bipes
Protoperidinium brevipes
Pseudanabaena spp.
Pseudopediniella sp.
Pyramimonas spp.
Quadrigula spp.
Scenedesmus obtusus
Selenastrum gracile
Skeletonema marinoi

Snowella spp.	
Staurastrum spp.	
Staurastrum pingue	
Staurodesmus spp.	
Synedra ulna v. ulna	
Tabellaria flocculosa	
Tabellaria flocculosa v. asterionel	
Teleaulax spp.	
Thalassionema nitzschioides	
Woronichinia spp.	
Woronichinia compacta	
Woronichinia naegeliana	
Phytoplankton water	65
Anabaena spp.	
Aphanizomenon	
Aphanizomenon flos-aquae	
Aphanocapsa	
Aphanothece spp.	
Aphanothece clathrata	
Aulacoseira islandica helvetica	
Centrales spp.	
Chlamydomonas	
Chlorococcales spp.	
Chroococcales spp.	
Chrysochromulina spp.	
Crucigenia fenestrata	
Crucigenia tetrapedia	
Cryptomonas	
Cyanodictyon	
Cyclotella choctawhatcheeana	
Cylindrotheca closterium	
Cyst	
Desmodesmus armatus v. armatus	
Diatoma tenuis	
Dictyosphaerium pulchellum	
Dinobryon balticum	
Dinobryon spp.	
Dinophysis acuminata	
Ebria tripartita	
Eutreptiella spp.	
Flagellates spp.	
Gymnodiniales spp.	
Gymnodinium sp.	
Hemiselmis virescens	
Heterocapsa rotundata	
Heterocapsa triquetra	
Katablepharis spp.	
Koliella longiseta f. longiseta	
Leucocryptos marina	
Lyngbya aestuarii	
Merismopedia tenuissima	
Merismopedia warmingiana	

Mesodinium rubrum
Monoraphidium contortum
Monoraphidium minutum
Oblea rotunda
Oocystis spp.
Oocystis submarina
Pediastrum boryanum v. boryanum
Pediastrum duplex v. duplex
Pediastrum tetras
Pennales
Peridiniales
Plagioselmis prolonga
Planctonema lauterbornii
Planktothrix agardhii
Pseudanabaena spp.
Pseudopediniella sp.
Pyramimonas spp.
Rhoicosphenia abbreviata
Romeria spp.
Skeletonema costatum
Snowella spp.
Staurastrum
Teleaulax spp.
Tetraedron minimum
Woronichinia spp.
Woronichinia naegeliana
Zooplankton 25
Acartia bifilosa
Alona sp.
Asplanchna
Ceriodaphnia sp.
Cyclopoida sp.
Daphnia sp.
Diaphanosoma sp.
Eubosmina maritima
Eudiaptomus gracilioides
Eurytemora affinis
Evadne nordmanni
Harpacticoida sp.
Kellicottia longiseta
Keratella cochlearis
Keratella quadrata
Leptodora kindtii
Limnocalanus macrurus
Nauplii
Neomysis integer
Pleopsis polyphemoides
Podon intermedius
Polyarthra sp.
Polychaeta sp.
Synchaeta baltica
Temora longicornis

Port of HaminaKotka, Hamina			
Native species	**N**	**Non-indigenous species**	**N**
Fouling plates	**28**	**Fouling plates**	**5**
Acarina spp.		*Acartia tonsa*	
Agraylea		*Amphibalanus improvisus*	
Alona sp.		*Cercopagis pengoi*	
Bivalvia sp.		*Cordylophora caspia*	
Bosmina sp.		*Gammarus tigrinus*	
Bryozoa sp.		**Benthos**	**4**
Chironomidae spp.		*Amphibalanus improvisus*	
Chydorus spp.		*Cordylophora caspia*	
Cladocera sp.		*Marenzelleria spp.*	
Cyclopidae sp.		*Potamopyrgus antipodarum*	
Eurytemora affinis		**Fouling (Scrape)**	**2**
Gammarus sp.		*Cercopagis pengoi*	
Gammarus zaddachi		*Cordylophora caspia*	
Harpacticoida sp.		**Phytoplankton net**	**2**
Hydra sp.		*Dreissena polymorpha*	
Hydrozoa sp.		*Prorocentrum minimum*	
Jaera albifrons		**Zooplankton**	**3**
Jaera ischiosetosa		*Amphibalanus improvisus*	
Jaera sp.		*Cercopagis pengoi*	
Leptocheirus pilosus		*Evadne anonyx*	
Lumbriculidae			
Naididae			
Nematoda spp.			
Oligochaeta sp.			
Pisces			
Sida sp.			
Stylaria lacustris			
Trichoptera sp.			
Benthos	**6**		
Chironomidae spp.			
Cladophora glomerata			
Cyanophthalma obscura			
Macoma balthica			
Oligochaeta sp.			
Ulva intestinalis			
Fouling (Scrape)	**18**		
Acarina spp.			
Agraylea			
Asellus aquaticus			
Bithynia tentaculata			
Chironomidae spp.			
Chydorus spp.			
Cladocera sp.			
Cyclopidae sp.			
Gammarus sp.			
Gammarus zaddachi			
Gastropoda sp.			
Hydra sp.			
Lumbriculidae			

Lymnaea peregra	
Oligochaeta sp.	
Ostracoda	
Physa fontinalis	
Stylaria lacustris	
Mobile epifauna	2
Gymnocephalus cernuus	
Perca fluviatilis	
Phytoplankton net	67
Actinocyclus octonarius v. octonarius	
Akashiwo sanguinea	
Amphiprora paludosa v. paludosa	
Anabaena lemmermannii	
Anabaena solitaria	
Anabaena spp.	
Anabaenopsis	
Aphanizomenon flos-aquae	
Aphanizomenon issatschenkoi	
Aphanocapsa	
Asterionella formosa	
Bacillaria paxillifera	
Centrales spp.	
Chaetoceros gracilis	
Chaetoceros minimus	
Chaetoceros subtilis v. subtilis	
Chaetoceros tenuissimus	
Chaetoceros wighamii	
Chlorococcales spp.	
Chroococcales spp.	
Chrysochromulina spp.	
Closterium	
Cryptomonas	
Cyclotella choctawhatcheeana	
Cylindrotheca closterium	
Desmodesmus armatus v. armatus	
Desmodesmus communis	
Desmodesmus maximus	
Diatoma tenuis	
Dinophysis acuminata	
Ebria tripartita	
Eutreptiella spp.	
Flagellates spp.	
Fragilaria crotonensis	
Gonyaulax verior	
Gymnodinium sp.	
Gyrosigma spp.	
Heterocapsa triquetra	
Melosira lineata	
Melosira moniliformis	
Mesodinium rubrum	
Monoraphidium contortum	
Monoraphidium minutum	

Mougeotia spp.
Nitzschia spp.
Nodularia spumigena
Oblea rotunda
Oocystis borgei
Oocystis spp.
Oocystis submarina
Pennales
Peridiniales
Plagioselmis prolonga
Planctonema lauterbornii
Planktolyngbya spp.
Planktothrix agardhii
Protoceratium reticulatum
Prymnesiales spp.
Pseudanabaena spp.
Pseudopediniella sp.
Pyramimonas spp.
Rhoicosphenia abbreviata
Skeletonema costatum
Snowella
Tabularia fasciculata
Teleaulax spp.
Woronichinia
Phytoplankton water 48
Anabaena spp.
Anabaenopsis
Aphanizomenon
Aphanizomenon flos-aquae
Aphanizomenon issatschenkoi
Aphanocapsa
Aphanothece
Chaetoceros minimus
Chaetoceros spp.
Chaetoceros subtilis v. subtilis
Chaetoceros tenuissimus
Chaetoceros throndsenii v. throndseinii
Chaetoceros wighamii
Chrysochromulina spp.
Cryptomonas
Cyclotella choctawhatcheeana
Cylindrotheca closterium
Desmodesmus armatus v. armatus
Diatoma tenuis
Ebria tripartita
Eutreptiella spp.
Flagellates spp.
Fragilaria spp.
Gymnodiniales spp.
Gymnodinium sp.
Hemiselmis virescens
Heterocapsa rotundata

Katablepharis spp.	
Koliella longiseta f. longiseta	
Merismopedia warmingiana	
Mesodinium rubrum	
Monoraphidium contortum	
Nitzschia spp.	
Oocystis spp.	
Oocystis submarina	
Oscillatoriales	
Pennales	
Peridiniales	
Plagioselmis prolonga	
Planktolyngbya spp.	
Pseudanabaena spp.	
Pseudopediniella sp.	
Pyramimonas spp.	
Rhoicosphenia abbreviata	
Skeletonema costatum	
Teleaulax spp.	
Telonema subtile	
Woronichinia	
Zooplankton	18
Acartia bifilosa	
Alona sp.	
Bivalvia sp.	
Ceriodaphnia sp.	
Chydorus sphaericus	
Cyclopidae sp.	
Daphnia sp.	
Diaphanosoma sp.	
Eubosmina maritima	
Eurytemora affinis	
Harpacticoida sp.	
Keratella quadrata	
Leptodora kindtii	
Limnocalanus macrurus	
Nauplii	
Polychaeta sp.	
Polyphemus sp.	
Temora longicornis	

Neste Oyj, Sköldvik			
Native species	**N**	**Non-native species**	**N**
Fouling plates	**28**	**Fouling plates**	**5**
Alona sp.		*Amphibalanus improvisus*	
Amphipoda sp.		*Cercopagis pengoi*	
Bivalvia sp.		*Cordylophora caspia*	
Bosmina sp.		*Mytilopsis leucophaeata*	
Cerastoderma glaucum		**Benthos**	**4**
Chironomidae spp.		*Amphibalanus improvisus*	
Corophium lacustre		*Cordylophora caspia*	
Corophium volutator		*Marenzelleria neglecta*	
Cyclopidae sp.		*Potamopyrgus antipodarum*	
Daphnia sp.		***Fouling (Scrape)***	**1**
Einhornia crustulenta		*Cercopagis pengoi*	
Eurytemora affinis		**Mobile epifauna**	**1**
Gammarus sp.		*Neogobius melanostomus*	
Gammarus zaddachi		**Zooplankton**	**3**
Gastropoda sp.		*Amphibalanus improvisus*	
Harpacticoida sp.		*Cercopagis pengoi*	
Hydrobia sp.		*Evadne anonyx*	
Hydrozoa sp.			
Jaera albifrons			
Jaera sp.			
Leptocheirus pilosus			
Macoma balthica			
Mytilus trossulus			
Nematoda spp.			
Oligochaeta sp.			
Sida sp.			
Tenellia adspersa			
Benthos	**16**		
Battersia arctica			
Cerastoderma glaucum			
Chironomidae spp.			
Corophium volutator			
Cyanophthalma obscura			
Gammarus salinus			
Gammarus sp.			
Gammarus zaddachi			
Hediste diversicolor			
Hydrobia sp.			
Jaera albifrons			
Leptocheirus pilosus			
Macoma balthica			
Oligochaeta sp.			
Saduria entomon			
Ulva intestinalis			
Fouling (Scrape)	**1**		
Oligochaeta sp.			
Mobile epifauna	**1**		
Blicca bjoerkna			
Phytoplankton net	**144**		

Achnanthes taeniata
Actinocyclus octonarius v. octonarius
Akashiwo sanguinea
Amphidinium crassum
Amphidinium sphenoides
Amphiprora paludosa v. paludosa
Amphora spp.
Amylax triacantha
Anabaena baltica
Anabaena lemmermannii
Anabaena solitaria
Anabaena spp.
Apedinella radians
Aphanizomenon
Aphanizomenon flos-aquae
Aphanocapsa
Aulacoseira islandica helvetica
Aulacoseira islandica islandica
Bacillaria paxillifera
Botryococcus braunii
Centrales spp.
Chaetoceros ceratosporus v. ceratosporus
Chaetoceros danicus
Chaetoceros gracilis
Chaetoceros holsaticus
Chaetoceros minimus
Chaetoceros subtilis v. subtilis
Chaetoceros tenuissimus
Chaetoceros throndsenii v. throndseinii
Chaetoceros wighamii
Chlamydomonas
Chlorococcales spp.
Chroococcales spp.
Chrysochromulina spp.
Closterium acutum v. variabile
Cocconeis spp.
Coelastrum microporum
Coscinodiscus granii
Crucigenia quadrata
Cryptomonadales
Cryptomonas
Cyclotella choctawhatcheeana
Cyclotella meneghiniana
Cylindrotheca closterium
Desmodesmus armatus v. armatus
Desmodesmus maximus
Diatoma tenuis
Dinophysis acuminata
Dinophysis norvegica
Dinophysis rotundata
Ebria tripartita
Euglena spp.

Eutreptiella spp.
Flagellates spp.
Fragilaria crotonensis
Fragilaria spp.
Fragilariopsis
Fragilariopsis cylindrus
Gymnodiniales spp.
Gymnodinium sanguineum
Gymnodinium spp.
Gyrosigma spp.
Hemiselmis virescens
Heterocapsa arctica frigida
Heterocapsa rotundata
Heterocapsa triquetra
Katablepharis spp.
Katodinium glaucum
Licmophora spp.
Lyngbya aestuarii
Lyngbya spp.
Melosira arctica
Melosira lineata
Melosira moniliformis
Melosira nummuloides
Merismopedia punctata
Merismopedia tenuissima
Merismopedia warmingiana
Mesodinium rubrum
Monoraphidium arcuatum
Monoraphidium contortum
Monoraphidium komarkovae
Monoraphidium minutum
Navicula spp.
Navicula vanhoeffenii
Nitzschia frigida
Nitzschia longissima
Nitzschia paleacea
Nitzschia spp.
Nodularia spumigena
Oblea rotunda
Oocystis borgei
Oocystis lacustris
Oocystis spp.
Oocystis submarina
Oscillatoriales
Pandorina morum
Pediastrum boryanum v. boryanum
Pediastrum duplex v. duplex
Pennales
Peridiniales
Peridiniella catenata
Peridinium inconspicuum
Pinnularia spp.

Plagioselmis prolonga
Planctonema lauterbornii
Planktolyngbya contorta
Planktolyngbya spp.
Prorocentrum micans
Protoceratium reticulatum
Protoperidinium bipes
Protoperidinium brevipes
Protoperidinium granii
Protoperidinium pellucidum
Prymnesiales spp.
Pseudanabaena spp.
Pseudo-nitzschia spp.
Pseudopedinella
Pyramimonas spp.
Pyramimonas virginica
Pyrophacus horologicum
Quadrigula spp.
Rhoicosphenia abbreviata
Romeria spp.
Scenedesmus acuminatus
Scenedesmus bicaudatus
Scrippsiella
Skeletonema costatum
Skeletonema marinoi
Snowella
Staurastrum
Synedra acus v. acus
Synedra ulna v. ulna
Tabularia fasciculata
Tabularia tabulata
Teleaulax spp.
Telonema spp.
Telonema subtile
Thalassiosira baltica
Treubaria triappendiculata
Woronichinia
Woronichinia compacta
Woronichinia naegeliana
Phytoplankton water 88
Achnanthes taeniata
Akashiwo sanguinea
Amphidinium
Amphora spp.
Anabaena spp.
Aphanizomenon
Aphanizomenon flos-aquae
Aphanocapsa
Aphanothece
Centrales spp.
Chaetoceros ceratosporus v. ceratosporus
Chaetoceros holsaticus

Chaetoceros minimus
Chaetoceros spp.
Chaetoceros tenuissimus
Chaetoceros throndsenii v. throndseinii
Chaetoceros wighamii
Chroococcales spp.
Chrysochromulina spp.
Cryptomonadales
Cryptomonas
Cyclotella choctawhatcheeana
Cylindrotheca closterium
Desmodesmus armatus v. armatus
Desmodesmus bicellularis
Diatoma tenuis
Dinobryon faculiferum
Dinophysis acuminata
Ebria tripartita
Euglena spp.
Eutreptiella spp.
Flagellates spp.
Gymnodiniales spp.
Gymnodinium sp.
Gymnodinium vestificii
Hemiselmis virescens
Heterocapsa
Heterocapsa arctica frigida
Heterocapsa rotundata
Heterocapsa triquetra
Katablepharis spp.
Koliella longiseta f. longiseta
Kryptoperidinium foliaceum
Lemmermanniella
Leucocryptos marina
Licmophora spp.
Limnothrix spp.
Melosira arctica
Merismopedia warmingiana
Mesodinium rubrum
Monoraphidium arcuatum
Monoraphidium contortum
Monoraphidium komarkovae
Monoraphidium minutum
Navicula spp.
Nitzschia paleacea
Nitzschia spp.
Oocystis lacustris
Oocystis spp.
Oocystis submarina
Pennales
Peridiniales
Peridiniella catenata
Plagioselmis prolonga

Planktolyngbya spp.	
Protoceratium reticulatum	
Protoperidinium granii	
Prymnesiales spp.	
Prymnesium sp.	
Pseudanabaena spp.	
Pseudopedinella	
Pyramimonas spp.	
Pyramimonas virginica	
Rhoicosphenia abbreviata	
Romeria spp.	
Scenedesmus acuminatus	
Scrippsiella	
Skeletonema costatum	
Tabularia fasciculata	
Tabularia tabulata	
Teleaulax spp.	
Telonema spp.	
Telonema subtile	
Tetraedron minimum	
Thalassiosira baltica	
Thalassiosira levanderi	
Unicell spp.	
Woronichinia	
Zooplankton	22
Acartia bifilosa	
Asplanchna	
Centropages hamatus	
Cyclopidae sp.	
Daphnia sp.	
Eubosmina maritima	
Eudiaptomus gracilioides	
Eurytemora affinis	
Evadne nordmanni	
Gastropoda sp.	
Harpacticoida sp.	
Keratella cochlearis	
Keratella quadrata	
Leptodora kindtii	
Limnocalanus macrurus	
Nauplii	
Neomysis integer	
Pleopsis polyphemoides	
Podon intermedius	
Polychaeta sp.	
Synchaeta monopus	
Temora longicornis	

Appendix III Further background information

1. International framework

The International Convention for the Control and Management of Ship's Ballast Water and Sediments, 2004 (IMO, 2004)[2] is the first international regulation that aims to translate into measures all previous concerns on the introduction of alien species already raised in 1982 by the United Nations Convention on the Law of the Sea (UNCLOS, 1982; Article 196(1))[3], followed by the 1992 Convention on Biological Diversity (CBD, 1992)[4]. The importance of the issue has continued to grow. One evidence is the ongoing drafting of a proposal for a EU regulation on the prevention and management of the introduction and spread of invasive alien species (European Commission, 2013)[5].

The BWM 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 book 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 will enter into force 12 months after being ratified by 30 Member States, representing 35% of the world merchant shipping tonnage. Considering its current state of ratification (38 Member States representing 30.38% of the world merchant shipping tonnage in April 2014[6]) it is expected that the Convention enters into force in 2015[7] or 2016 (Lloyd's Register Marine, 2014[8]), depending on the source consulted. With this regard, an IMO Assembly Resolution was adopted at the 28th Meeting of the Assembly (Resolution A.1088(28))[9] recommending[10] that ships constructed before the entry into force of the Convention will not be required to comply with regulation D-2 (ballast water performance standard), until their first renewal survey following the date of entry into force of the Convention. The revised schedule for when existing ships and ships under construction at the time of the Convention enters into force, will have to treat ballast water (see **Table A**).

[2] IMO. 2004. The International Convention for the Control and Management of Ships' Ballast Water Ballast Water and Sediments, 2004. BWM/CONF/36.

[3] United Nations Convention on the Law of the Sea, UNCLOS. 1982. (http://www.un.org/depts/los/convention_agreements/convention_overview_convention.htm).

[4] Convention on Biological Diversity, CBD. 1992. (http://www.cbd.int/convention/text/).

[5] European Commission. 2013. Proposal for a Regulation of the European Parliament and of the Council on the prevention and management of the introduction and spread of invasive alien species COM (2013) 620 final (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52013PC0620:EN:NOT).

[6] Available at: http://www.imo.org/About/Conventions/StatusOfConventions/Pages/Default.aspx

[7] In the last MECP meeting (MEPC 65, May 2013) it was assumed that the Convention would enter into force on 1 January 2015 (MEC 65/2/11).

[8] Lloyd's Register Marine. 2014. Future IMO legislation – January 2014. (http://www.lr.org/Images/Future%20IMO%20Legislation%20-%20January%202014_tcm155-203196.pdf).

[9] Resolution A.1088(28) Application of the International Convention for the Control and Management of Ship's Ballast Water and Sediments, 2004. (HTTP://WWW.IMO.ORG/MEDIACENTRE/PRESSBRIEFINGS/PAGES/A-28-ENDS-.ASPX#.UVDV_VMSX8E).

[10] Since the Convention has not yet entered into force, it cannot be amended, so therefore actions to be taken can only be recommended to the Administrations.

Ballast water capacity	Constructed before 2009	Constructed in or after 2009 but before 2012	Constructed in or after 2012
<1 500 m^3	EIF before 2016: by 1st IOPP* renewal survey after the anniversary of the delivery of the ship in 2016 EIF after 2016: by 1st IOPP renewal survey	By 1st IOPP renewal survey after EIF	
Between 1,500 and 5,000 m^3	By 1st IOPP renewal survey after EIF		
Greater than 5,000 m^3	EIF before 2016: by 1st IOPP renewal survey after the anniversary of the delivery of the ship in 2016 EIF after 2016: by 1st IOPP renewal survey		

Table A – Reschedule for ships constructed (keel laid) before entry into force (EIF) of the Convention (Source: Lloyd's Register Marine, 2014).

Recently and with the aim of supporting the entering into force of several IMO Conventions, IMO Secretary-General Koji Sekimizu launched the 2014's World Maritime Day theme, "IMO conventions: effective implementation", expressing the hope that the year would see genuine progress towards effective and global implementation of all IMO conventions, making specific reference to the BWM Convention[11].

2. Exemptions to ballast water management

According to the BWM Convention, ships will be required to implement ballast water management unless an exemption, following a risk assessment based on IMO Guidelines, has been granted (Regulation A-4 of the BWM Convention). These IMO G7 Guidelines (IMO, 2007)[12] do not propose any specific aspects of how to assess risks within, instead of between, biogeographic regions according to the BWM Convention definition, such as the Baltic Sea[13]. Hence specific guidance was developed (within the frame of HELCOM HOLAS project) bearing in mind Baltic Sea regional specifics. This "Guidance to distinguish between unacceptable high risk scenarios and acceptable low risk scenarios – a risk of spreading of alien species by ships on Intra-Baltic voyages, to be followed when applying for, or granting, exemptions to requirements of ballast water management of the Ballast Water Management Convention to ships operating within the Baltic Sea", adopted by 2010 HELCOM Ministerial Meeting, took the form of recommendations (HELCOM, 2010[14]). The eight recommendations developed dealt with:

(i) robustness criteria to be fulfilled by the risk assessment;

(ii) application of the species-specific risk assessment type;

(iii) employment individual ports and their surrounding area with similar environmental conditions as the primary units of the risk assessments;

(iv) species to be included in the risk assessments (harmful non-indigenous and cryptogenic species);

[11] http://docs.imo.org/Common/NewsItem.aspx?id=4cd975f7-ff27-4890-8b27-a3b24703e92e

[12] IMO. 2007. Guidelines for risk assessment under regulation A-4 of the BWM Convention (G7). Resolution MEPC.162(56). (http://www.imo.org/blast/blastDataHelper.asp?data_id=19689&filename=162(56).pdf).

[13] Large Marine Ecosystems (LME) scheme, used in the IMO BWM Convention Guideline G7: "a large natural region defined by physiographic and biologic characteristics within which the animal and plant species show a high degree of similarity. There are no sharp and absolute boundaries but rather more or less clearly expressed transition zones".

[14] HELCOM. 2010. HELCOM Ministerial Declaration on the implementation of the HELCOM Baltic Sea Action Plan - Guidance to distinguish between unacceptable high risk scenarios and acceptable low risk scenarios – a risk of spreading of alien species by ships on Intra-Baltic voyages, to be followed when applying for, or granting, exemptions to requirements of ballast water management of the Ballast Water Management Convention to ships operating within the Baltic Sea. (http://www.helcom.fi/helcom-at-work/ministerial-declarations/).

(v) salinity and temperature to be used as environmental parameters to compare species' success to disperse from donor to the recipient port and to become established in the recipient environment and spread;

(vi) species specific data to be included in the risk assessment;

(vii) background information on shipping activities;

(viii) species' ability to disperse 'naturally' by means of active swimming or passively with water currents between ports, e.g. without human introduced vector.

The consideration of all these recommendations led to conclude if a voyage was of low or high risk. At that point, the common HELCOM understanding on the level of acceptable and unacceptable risk was not established. The guidance was recommended to be followed by all HELCOM Contracting Parties whilst allowing flexibility or stricter actions on national level.

Subsequently, the viability of such Guidance was tested during 2010-2011 within the HELCOM project ALIENS "Pilot risk assessments of alien species transfer on intra-Baltic ship voyages" (HELCOM, 2011)[15]. The project showed that in order to be able to apply the species-specific and target species risk assessment to the Baltic Sea there was a need of data on already introduced species in the area[16]. So, as starting point it was decided to carry out a target species selection process based upon a harmonized selection criteria. However, there was still a need to undertake port baseline surveys in order to know the occurrence on the target species in ballast water donor areas, subsequently enabling to conduct the risk assessment. Regarding the recommendation of using temperature and salinity as environmental parameters to compare species' success to disperse from donor to the recipient port, the study concluded that water salinity should be the only environmental feature to consider since the more environmental parameters are being included the lesser robust and reliable becomes the assessment being in conflict with the precautionary principle. The use of temperature as key environmental factor was dismissed due to its lower reliability compared to salinity to identify low risk scenarios. This assumption was based on the greater temperature difference, compared to salinity difference, which species need to tolerate over the seasons in the Baltic region. Therefore, the risk assessment proposed was the combination of the target species approach together with an environmental match. Thus, should the selected target species occur in the ballast water donor area and both the ballast water donor and recipient ports show matching salinities[17], a high risk is assessed. However, if a high mismatch of salinity[18] is identified between donor and recipient ports, the ballast water may be identified as low risk.

From the outcomes of the project, it was evidenced that there was a need of obtaining port survey data and of selecting target species for the purpose of the risk assessments. With the aim of sorting out this lack of information the HELCOM ALIENS 2 project "Non-native species survey protocols, target species selection and risk assessment tools for the Baltic Sea" was carried out from December 2011 to December 2012 (HELCOM, 2013)[19]. Within the project a protocol to be used in collecting information from ports in order to conduct reliable risk assessments was proposed, criteria for selection of target species to be used in the risk assessment were defined and a harmonized decision support tool to run the risk assessments using the available data (collected by using the protocol) and target species (selected using the criteria) was developed.

[15] HELCOM. 2011. Pilot risk assessments of alien species transfer on intra-Baltic ship voyages by Stephan Gollasch, Matej David, Erkki Leppäkoski for Helsinki Commission – Baltic Marine Environment Protection Commission HELCOM.

[16] IMO Guideline 7 states that specific risk assessment may be best suited to situations where the assessment can be conducted in a limited number of harmful species within a biogeographic region.

[17] E.g., marine to marine, marine to brackish or freshwater to brackish environments.

[18] E.g., freshwater (< 0.5 PSU) to marine (> 30 PSU).

[19] HELCOM. 2013. HELCOM ALIENS 2- Non-native species port survey protocols, target species selection and risk assessment tools for the Baltic Sea. 34 pp.

The proposed protocol was based on the CRIMP sampling protocol (Hewitt & Martin, 2001[20]), rapid assessment protocols (Pederson et al. 2003[21], Cohen et al. 2005[22], Buschbaum et al. 2010[23]) and aligned with HELCOM monitoring protocols (HELCOM, 2014[24]) where applicable. Sampling methods were tested over late summer and fall 2012 and the survey protocol was modified based on experiences from the field testing. The protocol requires information on port characteristics, sampling site and environmental data, as well as sampling of human pathogens (intestinal Enterococci, *Escherichia coli* and *Vibrio cholerae*), phytoplankton, zooplankton, zoobenthos, fouling organisms and (mobile) epifauna following a detailed methodology specified in the protocol (see **Table B**).

Port characteristics	– General info about the port (size, area, what kind of transport cargo or people etc.) – Description of any recent construction activities – Summary of Last port of Call and Next Port of Call – Main shipping routes – Catchment area: surface, salinity, temperature, tidal range – Origin and amounts of ballast water released and taken – Habitat description – Existing monitoring – Adjacent waters
Sampling site and environmental data	– Minimum of 3 sites per port, representing different port areas within the port – Specifications regarding prioritizing of sampling locations – GPS location – Atmospheric conditions: air temperature, cloud cover, wind speed and direction – Water characteristics: sea state (wave height), temperature, salinity, dissolved oxygen, turbidity, chlorophyll-a, pH – Sediment sample: method, sediment quality, fractions and grain size, organic content
Human pathogens (intestinal Enterococci, *Escherichia coli* and *Vibrio cholerae*)	– Sampling in spring bloom and summer maximum – One water sample (500 mL from 30 cm depth) per site from each sampling site should be taken. Register sample depth and water depth at the site
Phytoplankton sampling	– Sampling in spring bloom and summer maximum – Two samples per site, one pooled water sample (from at 1 and 5 m depth samples) of at least 250 mL and one concentrated sample taken with a 20µm net
Zooplankton sampling	– Two vertical samples per site taken with different mesh size nets (100 and 500 µm). For that purpose, three tows should be conducted, and samples pooled afterwards

[20] Hewitt, C.L.; Martin, R.B. 2001. Revised protocols for baseline port surveys for introduced marine species: survey design, sampling protocols and specimen handling. Centre for Research on Introduced Marine Pests. Technical Report No. 22. CSIRO Marine Research, Hobart. 46 pp.

[21] Pederson, J.; Bullock, R.; Carlton, J.; Dijkstra, J.; Dobroski, N.; Dyrynda, P.; Fisher, R.; Harris, L.; Hobbs, N.; Lambert, G.; Lazo-Wasem, E.; Mathieson, A.; Miglietta, M.-P.; Smith, J.; Smith, J.I.; Tyrrell, M. 2003. Marine Invaders in the Northeast - Rapid Assessment Survey of Non-native and Native Marine Species of Floating Dock Communities. Page 29.

[22] Cohen, A.N.; Harris, L.H.; Bingham, B.L.; Carlton, J.T.; Chapman, J.W.; Lambert, C.C.; Lambert, G.; Ljubenkov, J.C.; Murray, S.N.; Rao, L.C.; Reardon, K.; Schwindt, E. 2005. Rapid Assessment Survey for Exotic Organisms in Southern California Bays and Harbors, and Abundance in Port and Non-port Areas. Biological Invasions 7: 995–1002. doi: 10.1007/s10530-004-3121-1.

[23] Buschbaum, C.; Karez, R.; Lackschewitz, D.; Reise, K. 2010. Rapid assessment of neobiota in German coastal waters. HELCOM Indicator Fact Sheets and development of the HELCOM core set of indicators. St. Petersburg, Russia.

[24] Last updated version of the Manual for Marine Monitoring in the COMBINE program of HELCOM. HELCOM. 2014. Manual for Marine Monitoring in the COMBINE Programme of HELCOM. (http://helcom.fi/Documents/Action%20areas/Monitoring%20and%20assessment/Manuals%20and%20Guidelines/Manual%20for%20Marine%20Monitoring%20in%20the%20COMBINE%20Programme%20of%20HELCOM.pdf).

Zoobenthos	– Minimum of three grab samples per site using a Petersen or Ekman grab, subsequently 1 mm sieved
Fouling organisms	– Sampling by scraping in summer maximum: identify the species attached to ropes, chains, pilings and hard surfaces using hand held scraping tools and estimate the species coverage. Minimum sampling: three structures – Settlement plates should be deployed during the first sampling and retrieved during the second one (three months soak time at minimum). One rope with three plates at different depths
(Mobile) epifauna	– Sampling in summer maximum – Sampling at each site using light weight traps: three Chinese crab traps and three minnow traps. Soaking time: 48 h minimum

Table B – Summary of the port surveys according to the HELCOM-OSPAR Guidelines (HELCOM, 2013c).

2.1. Exemptions to ballast water management in the HELCOM/OSPAR area

HELCOM and OSPAR Commissions started working together on the application of ballast water exemptions at an interregional level in August-September 2012. At that time the Joint HELCOM/OSPAR Task Group (HELCOM-OSPAR TG BALLAST) on Ballast Water Management Convention Exemptions was established involving Contracting Parties of both Conventions. The Terms of Reference of the HELCOM-OSPAR TG BALLAST included the development of the "Joint HELCOM/OSPAR Guidelines for the Contracting Parties of OSPAR and HELCOM on the granting of exemptions under the International Convention for the Control and Management of Ships' Ballast Water and Sediments, Regulation A-4". Based on the HELCOM experience on ballast water exemptions previously mentioned in this chapter, and with the work developed within the HELCOM-OSPAR TG BALLAST, the Joint HELCOM/OSPAR Guidelines were prepared enabling a harmonized implementation of the BWM Convection Regulation A-4 on granting exemptions from Regulation B-3 (Ballast Water Management for Ships) and Regulation C-1 (Additional Measures) within the Baltic Sea and the North Sea and also between both seas once it is required by the entering into force of the BWM Convention.

The Guidelines were adopted by the HELCOM Ministerial Meeting in 2013 (HELCOM, 2013)[25], and the OSPAR Commission meeting (24-28 June 2013). Based on the Guidelines for risk assessment under regulation A-4 of the BWM Convention (G7) (resolution MEPC.162(56)), they are not Guidelines in the sense of Regulation A-4 or any other section of the Convention, but a set of concrete tools related to harmonizing the granting of A-4 exemptions:

- a detailed description of the port survey protocol that Parts to the HELSINKI and OSPAR Conventions are to carry out in order to evaluate the possibility of granting exemptions to the BWM Convention according to Regulation A-4 (see Table B);

- a selection of 114 target species to be assessed for their risk (permanently updated by OSPAR and HELCOM Commissions on a yearly basis);

- a data model to feed the risk assessment tool;

- a risk assessment tool (available through internet to authorized users) which, based on the responses of a set of binary "yes/no" questions on the difference in water salinity between ports, the presence of target species, and their salinity tolerance, categorizes the risk of distribution of target species through ballast water in high, medium and low risk. Decisions on granting or not exemptions are subsequently made depending on the level of this risk (**see Figure A);** and

[25] HELCOM. 2013. 2013 HELCOM Ministerial Declaration - Joint HELCOM/OSPAR Guidelines on the granting of exemptions under the International Convention for the Control and Management of Ships' Ballast Water and Sediments, Regulation A-4.

– an administrative procedure to guide applicants through the exemption application process (see **Figure B**).

In addition, the Guidelines acknowledge the HELCOM-OSPAR TG BALLAST as the expert level group carrying out work to keep the Guidelines up-to date and in general as the forum to discuss technical ballast water management issues in the Baltic and North East Atlantic regions. This compromise also applies to the target species list contained in the Guidelines which will be under continuous revision by the appropriate HELCOM and OSPAR groups.

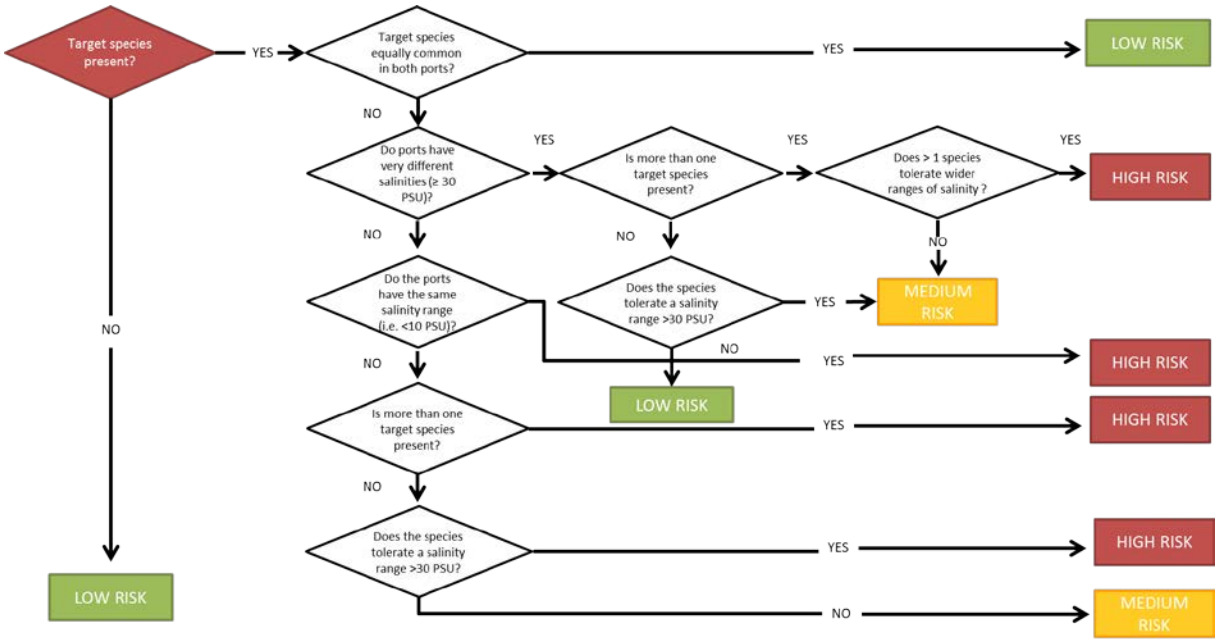

Figure A – Risk assessment procedure followed by the risk assessment tool (HELCOM, 2013).

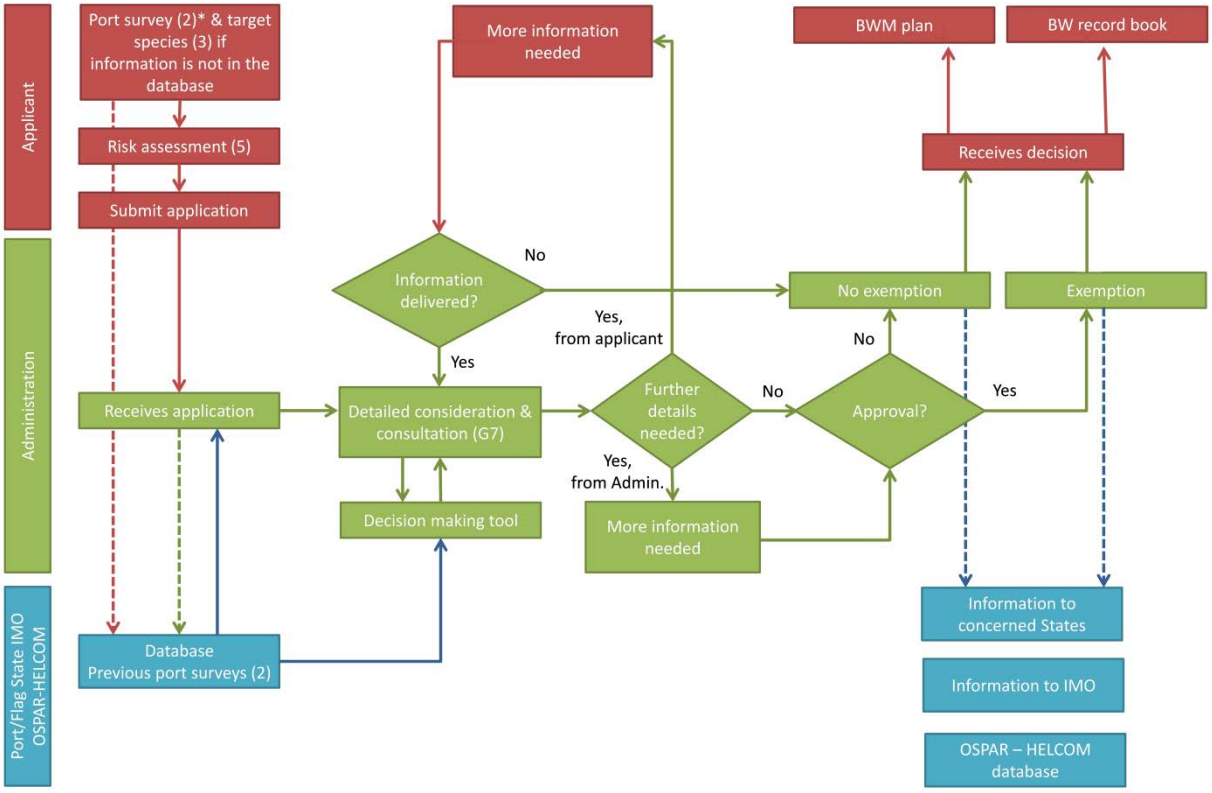

Figure B – Risk assessment procedure followed by the risk assessment tool (HELCOM, 2013c).

Baltic Marine Environment Protection Commission