Agenda Item 6.1.2 — Further Implementation of the Agreement

Species Action Plans

Conservation Plan for the Harbour Porpoise Population in the Western Baltic, the Belt Sea and the Kattegat (WBBK Plan)

Information Document 6.1.2

Progress Report on the Conservation Plan for the Harbour Porpoise Population in the Western Baltic, the Belt Sea and the Kattegat 2020

Action Requested

Take note

Submitted by

Harbour Porpoise Coordinator

Note:
Delegates are kindly reminded to bring their own document copies to the meeting, if needed.

PROGRESS REPORT

on

THE CONSERVATION PLAN

FOR THE HARBOUR PORPOISE POPULATION

IN THE WESTERN BALTIC, THE BELT SEA AND THE KATTEGAT

2020

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Coalition Clean Baltic & Sea Watch Foundation, UK

CONTENTS

The views and recommendations expressed in this report are the author's own

Background & History

Following the establishment of a Recovery Plan for Baltic Harbour Porpoises (the Jastarnia Plan) and a Conservation Plan for Harbour porpoises in the North Sea, it was decided at the 18th Meeting of the ASCOBANS Advisory Committee (AC 18 Bonn, Germany) in 2011 that there should also be a Conservation Plan for porpoises inhabiting the waters between these two regions, i.e. the Western Baltic, the Belt Sea and the Kattegat. Concern had been expressed over potential declines in harbour porpoise abundance in this region from the two wide-scale surveys of SCANS in 1994 and SCANS II in 2005.

A draft paper containing background information and proposed objectives and measures for the ’gap area’ not covered by the Jastarnia Plan was commissioned following a recommendation by the 7th meeting of the Jastarnia Group (Copenhagen, Denmark, February 2011). This paper was reviewed and refined by the 8th meeting of the Jastarnia Group (Bonn, Germany, 31 January – 2 February 2012), and again, following the 19th Meeting of the Advisory Committee (AC19), Galway, Ireland (20-22 March 2012). It was formally adopted by the 7th Meeting of the Parties in Brighton, UK, in September 2012.

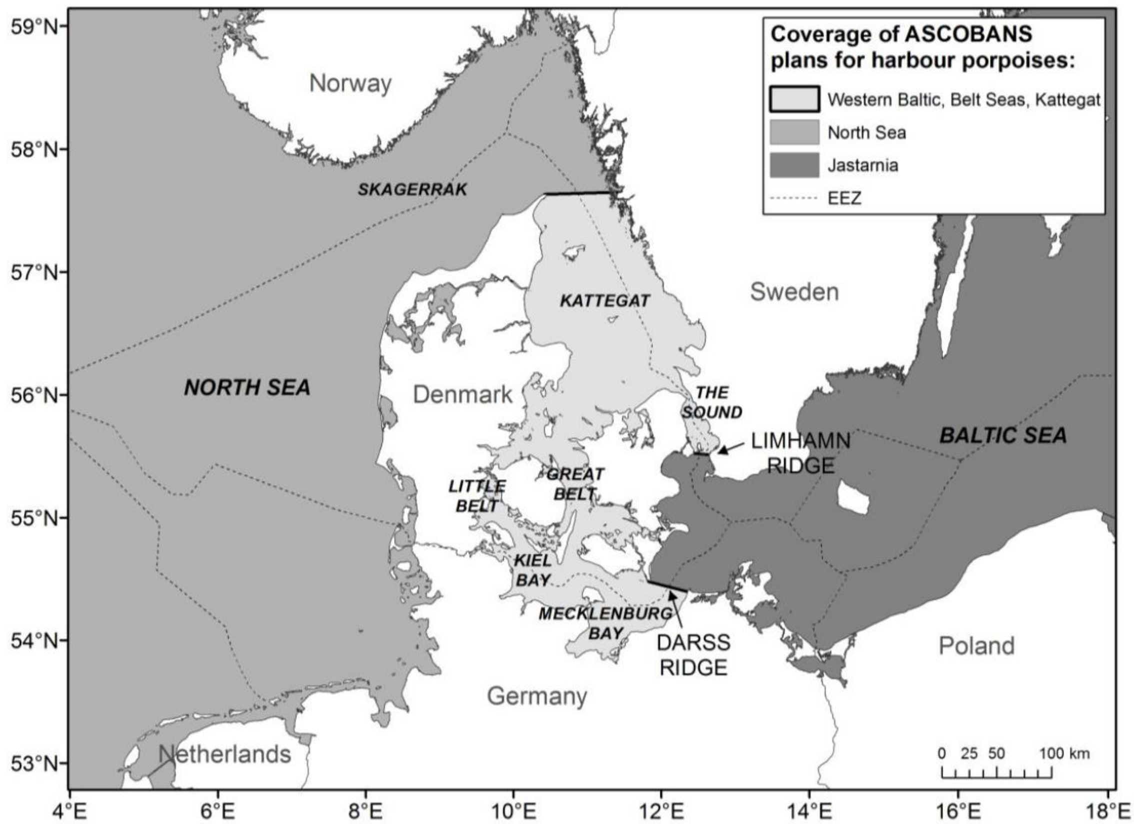

Figure 1. Map of the North Sea and the Baltic indicating where the geographical area covered by the Plan for the population in the Western Baltic, the Belt Sea and the Kattegat adjoins that of the ASCOBANS North Sea Plan and the ASCOBANS Jastarnia Plan. The dashed line indicates the national borders of the Exclusive Economic Zone (EEZ) (Source: ASCOBANS, 2012)

The draft plan (ASCOBANS, 2012) covered the ‘gap area’, and included the waters north and west of the Darss and Limhamn ridges up to the north-western border of the Baltic Sea as defined by HELCOM (i.e. a line from the northern point of Denmark to the coast of Sweden at 57°44.43’N) (see Figure 1). This area is now referred to as the Western Baltic, the Belt Sea and the Kattegat (shortened to

WBBK). It could be considered, possibly after more data has been collected through the SAMBAH II project, if the delimitation between the WBBK plan and the Jastarnia plan should be changed to better reflect the ranges of the two populations.

A series of actions have been proposed in the WBBK Conservation Plan (ASCOBANS, 2012). Progress on each of these is reviewed below.

Actions

1. Actively seek to involve fishermen in the implementation of the plan and in mitigation measures to ensure a reduction in bycatch

Germany

Germany has been investigating alternative management approaches and the use of alternative fishing gear. The "Stella" Project (November 2016 – December 2019) had a number of strands: building data, modifying gillnets, investigating the feasibility of alternative gear, creating incentives for data collection, synthesizing the results, and promoting social responsibility within the German Baltic EEZ. This inter-disciplinary project was funded by the Federal Agency for Nature Conservation (BfN), and conducted by the Thünen Institute of Baltic Sea Fisheries. It has engaged fishermen of the Baltic Sea, and amongst other tasks, will synthesise the results of the various disciplines - fisheries biology, fishing technology and social sciences, and derive policy advice for decision makers, considering also the interest of nature conservation. Within the Stella project, Thünen Institute of Baltic Sea Fisheries have been carrying out trials on developing acoustically reflective gillnets. The first step was to find the optimal size and material of a small sphere that would resonate at 130kHz. Acrylic glass spheres were found to be the best available option, of 9.6 or 6.4 mm diameter, and echograms of pearl nets show significantly increased reflectivity at 120 kHz. In the last step, field trials with pearl nets were carried out in the Black Sea turbot fishery, where harbour porpoise bycatch rates are higher than in the Baltic Sea. Over a total of ten hauls, 5 porpoises were bycaught in standard gillnets, and 2 in pearl gillnets. These results are not statistically significant, and the mechanisms behind bycatch in modified nets have to be looked more closely into. Next steps should include behavioural experiments to look at porpoise behaviour around standard and modified nets, further trials in commercial fisheries and development of an automated process to put pearls on nets. The final report from the Stella project is expected during 2020, but hopefully trials with modified gillnets will continue.

There has been a voluntary agreement with fishers since 2013 in Schleswig-Holstein, for the conservation of harbour porpoises and sea ducks in the German Baltic. This has involved the Fishery Association and Fishery Protection Union of Schleswig-Holstein, the Baltic Sea Information Centre (OIC), and the Ministry of Energy Transition, Agriculture, Environment and Rural Areas Schleswig-Holstein (MELUR). The result has been a reduction in the total length of gillnets in the months of July and August to 4km for boats >8m, to 3km for boats between 6 and 8m, and to 1.5km for boats <6m. In addition, almost 1,700 alternative acoustic deterrence devices, Porpoise Alerting Devices or PALs, has been handed out to fishers through the OIC in Eckernförde since 2017. PALs operate by replicating the sounds of porpoises (synthesising supposedly aggressive click trains at 133 kHz) and were designed to serve as an alerting device rather than as a deterrent, by increasing their rate of echolocation (B. Culik et al., 2015). Trials in a Danish fishery in the Western Baltic and the sound using REM to monitor bycatch rates had indicated a 70% reduction when PALs were deployed (Culik et al., 2017), although the size of the effect was much smaller than with pingers. The device has also been tested in a Danish North Sea fishery but was found to have no effect there (B. M. Culik et al., 2015). Reasons for the different results are unclear but it is possible the two different porpoise populations are responding differently to the signals. To date, there is no clear evidence that PAL operates as an alerting device.

Denmark

Denmark was the first country in Europe to trial the use of Remote Electronic Monitoring (REM) to assess bycatch, in 2008, operating on pelagic trawl fisheries (Ulrich et al., 2015, 2013). Since 2010, they have been used routinely in Danish fisheries (Kindt-Larsen et al., 2012). It has proved to be a cost-effective and accurate method of monitoring. Part of its success has been due to the relationship built up between fisheries authorities and fishers themselves, through a mixture of trust and incentives. Collaborations with the fishing industry have also taken place in exploring mitigation measures such as pingers, and the use of alternative fishing methods. The developing and testing of pingers continues, directly involving fishermen, as well as testing the use of lights and low nets to reduce bycatch. In developing and testing alternative gear, studies are taking place to improve the catch efficiency of cod traps, using push-up traps for cod as well as developing and testing small-scale Danish seine for cod. These actions are being undertaken in collaboration with SLU, Sweden. These programmes of research are scheduled to be completed by 2020.

Sweden

The Swedish authorities are holding dialogue meetings with fishermen concerning the regulation of fisheries in protected areas, both for specific areas and more generally, the latter in conjunction with the Swedish Agency for Marine & Water Management (SwAM).

A project on remote electronic monitoring (REM) is ongoing at SLU Aqua and at present has about 8 fishermen engaged. SLU Aqua is looking for more fishermen to participate and there is funding available for the project from 2020. The biggest problem has been to find good cameras, and own equipment has been built for trials. Soon a new system from New Zealand will be tested.

The implementation of pingers as previously laid down in Reg. 812/2004 and now in the Technical Conservation Measures regulation 2019/1241, is most likely not being implemented in regulated fisheries in Sweden. In 2015, SLU Aqua started a project in ICES SubDivisions 21 and 23 with the purpose of implementing pingers in the lumpfish and cod fishery on a voluntary basis. After discussions with fishermen, Banana pingers were chosen for the project. The fishers consider the Banana pinger to be practical to use and that it decreases bycatch of harbour porpoises. They report their catch, effort and bycatch. This project ends and a report will be available at the end of 2020. There is no funding to buy more pingers, but the fishermen who participated are still using the pingers they were given and are still reporting data to SLU Aqua.

In the area where pingers have been used in the commercial lumpfish fisheries in southern Sweden, a study looking at the distribution of harbour porpoises in relation to commercial fisheries with pingers has recently ended. Results show that harbour porpoise detections in the area are low when fisheries with pingers are carried out. However, when the pingers were switched off, the harbour porpoise detections increase and are at the same levels as areas where no fishing with pingers has been carried out. A paper on this study is in prep. and is expected to be submitted at the end of 2020.

In the Swedish small-scale coastal fisheries, alternative fishing gear has been, and is still being, developed. Pontoon traps for fishing salmon, white fish, trout and vendace are now used in commercial fisheries in the northern Baltic. During recent years, there has been a development of a pontoon trap to be used for cod in the southern Baltic. The results show that during certain times catches of cod can be high. However, gear needs further development with regards to resistance to rough seas and open archipelagos as well as practical handling (Nilsson, 2018). The main reason behind the development of the fishing gear is the seal inflicted damages to fishing gear and catch, which threatens an economically viable gillnet fishery.

Between 2014-2020 there have been funding opportunities for fishers to put forward their ideas for selective fishing gear to the "Secretariat for selective fishing gear" funded by the Swedish Agency for Water Management. The purpose of the Secretariat was to enable the fishing industry to develop selective fishing gear to help the transition to the new landing obligation. Projects were carried out by SLU Aqua in cooperation with the involved fishers. From 2020 and onwards funding is uncertain.

SLU Aqua together with DTU Aqua and the Thünen Institute have been engaged in a programme to improve the design of cod pots to reduce bycatch. However, due to the ban on cod fisheries in the Baltic Sea, this study and others focusing on alternative gear for cod fisheries have been postponed or cancelled.

Several studies have been undertaken to evaluate the catch efficiency of different cod and lobster pots and what factors affect it (Hedgärde et al., 2016; Ljungberg et al., 2016; Nilsson, 2018). This is done partly by studying the behaviour of cod in relation to cod pot models and other fisheries related factors such as soak-time. The entry rate of cod entering pots gives an indication on the catch efficiency of the pots and by studying the entry rate in relation to factors such as cod pot model, number of fish inside the pot, and current strength, one gains information on what factors are affecting catchability. The results are show that the number of entrances on the pot and the number of cod already inside the pot affect the entry rate of the cod entering the pot (Hedgärde et al., 2016). Another study has shown that using a funnel on the entrance opening to the fish holding chamber also affects the behaviour of cod while entering the pots. However, it increases the catch efficiency (cpue) due to the decreasing number of cod exiting the pots (Ljungberg et al., 2016).

An alternative to both trawl and gillnet fisheries is bottom seine netting, such as Danish Bottom Seine. Bottom seines are generally considered less damaging than bottom trawls, and well-managed seine fisheries generally have minor ecosystem impacts (Morgan and Chuenpagdee, 2003). In 2016, the Swedish University of Agriculture Science has continued to develop a seine net modified for small open boats and tried it for pelagic and demersal species as a possible alternative to gillnet fisheries. The development is still under progress and the upcoming years there will be a focus on evaluating the seines environmental impact on the benthic habitat.

Key Conclusions and Recommendations *All three Range States are actively engaged in collaborative projects with fishermen but there is always scope to do more. Denmark has had a long history of working with fishermen on pinger deployment and over the last ten years, with remote electronic monitoring. Such measures could be applied more widely with good effect through the region.*

2. *Cooperate and inform other relevant bodies about the conservation plan*

Explicit information about the Conservation Plan specifically has not been disseminated to the public in any of the three countries. However, several of the actions recommended within the Plan have been promoted within each country. The raising of public awareness of harbour porpoises generally has been implemented, particularly within Germany.

In **Germany**, sightings and strandings programmes involving the public are well developed. For Schleswig-Holstein, they are coordinated by the Terrestrial and Aquatic Wildlife Research (ITAW) in Büsum, and for Mecklenburg – Vorpommern they are administered by the German Oceanographic Museum in Stralsund, who have also produced an app "OstSeeTiere" (Baltic Sea Animals) (https://www.deutsches-meeresmuseum.de/wissenschaft/ infothek/sichtungskarte/).

Public engagement activities include an exhibition "Die letzten 300" in collaboration with NGOs NABU and OceanCare as well as with ASCOBANS. The exhibition displayed the many works received as part of the creative competition, and was on display in the German Oceanographic Museum from January – April 2015, and visited by an estimated 30,000 people. Every year, the museum also participates in the International Day of the Baltic Harbour Porpoise coordinated by ASCOBANS, with specific activities and information for the public. The museum has implemented a marine mammal science education project (https://marine-mammals.com/) together with other organisations in the Baltic Sea Region, which focuses mainly on school activities and educating teachers, providing tools for using marine mammals in education. In 2017, the German Oceanographic museum produced an app ("Be the Whale") depicting a humpback whale, and in 2018 is doing the same using the beluga. Although not focused upon the harbour porpoise, these are designed to make children aware of dangers to cetaceans in general. Noise, pollution and bycatch are all included as threats as well as shipping in general (ship strikes) and prey depletion. Although located in the Baltic Proper, the museum serves the public over a much wider region and their conservation education activities are clearly relevant to the Western Baltic region to which this Conservation Plan applies.

Public awareness activities, public sightings and strandings schemes are much less developed in Denmark and Sweden, although in **Sweden**, between 2016-2018 a total of 220 stranded animals were reported. Records of strandings are collected opportunistically by the Swedish Natural History Museum (NRM) in collaboration with the Gothenburg Museum of Natural History. The Swedish Museum of Natural history also collects reports of opportunistic sightings at www.nrm.se/tumlare.

In **Denmark**, there is no comprehensive coordinated stranding scheme although reporting is encouraged to the Maritime Museum in Esbjerg (https://fimus.dk/en/about-the-museum/emergency-management-for-marine-mammals/). There is also no active public sighting reporting scheme. On the other hand, porpoise research in Denmark has focused upon fisheries interactions, the effects of noise, and developing management strategies within SACs. Carcasses that are in good enough condition to be autopsied and/or used for a blubber thickness indicator study for the HELCOM indicator for nutritional state are collected by Aarhus university. A review of Danish strandings (see Table 3) was published recently by Kinze et al. (2018).

Key Conclusions and Recommendations *Germany has a long history of working with stakeholders and the general public on conservation issues. There have been similar schemes in Denmark and Sweden mainly at a local level, but the NGO movement is less developed, although things are have started moving in recent years. Efforts should be made to address this in those countries, particularly with respect to citizen science projects.*

3. Protect harbour porpoises in their key habitats by minimizing bycatch as far as possible

In recent years, there has been a concerted effort to identify and establish Natura 2000 sites as Special Areas of Conservation (SACs) under the EU Habitats Directive. Figure 2 shows the Natura 2000 sites established for harbour porpoises in the WBBK and the surrounding area, as of 2 Sept 2020.

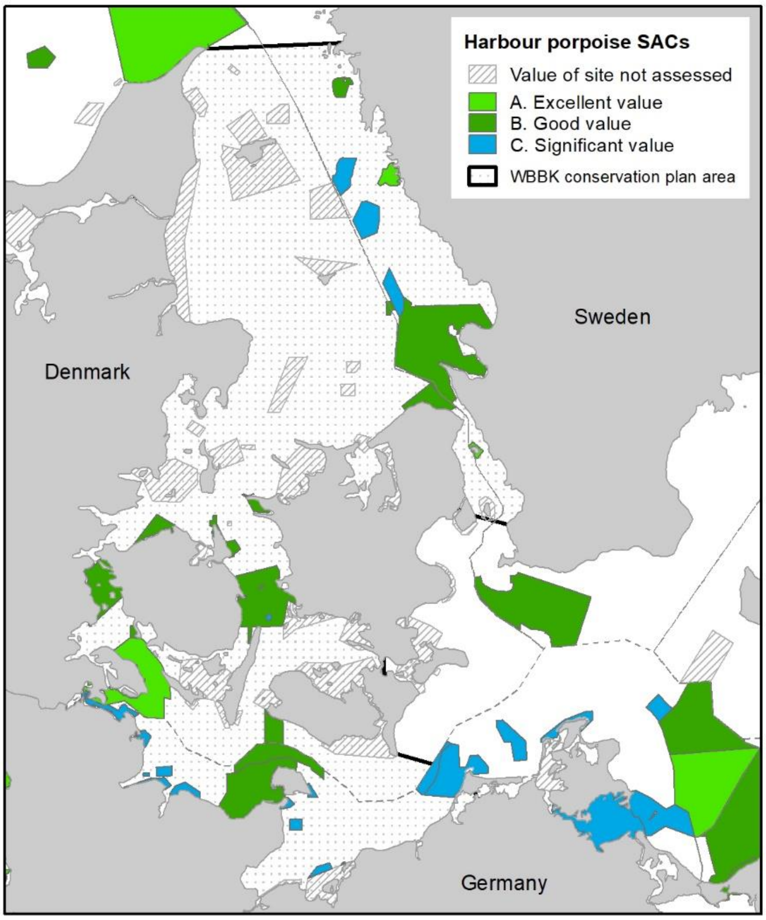

Figure 2. Special Areas of Conservation (SACs) where the harbour porpoise is on the list of species. Green and blue colours refer to sites designated according to the EU Habitats Directive for harbour porpoises (i.e. where harbour porpoises are part of the selection criteria and listed as Population Status A, B, or C), and green and blue colours refer to the global assessment of each of those sites to harbour porpoises. Grey areas have the harbour porpoise listed as Population Status D, and hence the value of those sites have not been assessed (source: https://www.eea.europa.eu/data-and-maps/data/natura-11)

The next step is to develop management plans for the SACs that are still missing them, and to implement conservation measures including fisheries regulations. To date, none of these areas have any concrete conservation measures in place.

In **Denmark**, the Nature Agency contracted Aarhus University to produce a report to assess the importance and status of all the Natura 2000 sites in Danish waters (Sveegaard et al., 2018). In 2010, 16 sites of Community importance (SCIs) were designated in Danish waters for harbour porpoises in accordance with the EU Habitats Directive, whereof 12 are in the WBBK area. The designation was based on a review of existing knowledge at the time. Since 2011, harbour porpoises have been monitored as part of the Danish monitoring programme, NOVANA, both within the SCIs and in their entire range. The report presents an update of knowledge since 2010 and describes the distribution and hotspots of harbour porpoise in Danish waters, including changes over time. The significance for harbour porpoises of each of the 84 Danish marine SCIs is evaluated by comparing the site with the updated knowledge presented in the report. Of the 84 SCIs, 21 are assessed as being of major importance, 16 as medium importance, 25 as low importance, and 22 as no importance. The 16 SCIs designated for harbour porpoises are evaluated separately in relation to changes in density and importance since 2010: In 14 SCIs, data indicate no or minor changes and in two sites, ”Flensborg Fjord, Bredgrund og farvandet omkring Als” and ”Maden på Helnæs og havet vest for”, data indicate a decrease.

None of the 16 areas have any conservation or fisheries measures implemented, and the only statement about porpoise conservation is the same in all the management plans, namely that the Danish Nature Agency are developing a strategy for protection of harbour porpoise in Danish waters. This strategy is now planned for 2021. The fishing pressure, also with static nets, is quite high in some of the protected areas (https://mst.dk/media/194110/n1-basisanalyse-2022-27-skagens-gren-og-skagerrak.pdf).

In **Germany** there are general national ordinances set for the marine protected areas (mainly Natura 2000 areas) designated for porpoises, which include prohibition of some constructions and aquaculture as well as obligations for compatibility studies for windfarm construction, pipe laying and material extraction. Recreational fisheries are also prohibited in some parts of areas. During summer 2020 draft management plans have been sent out for public consultation, but at this point they do not include fisheries measures. It is said that this will be done once the Stella project final report has been finalized. There are 12 German SACs designated for harbour porpoise within the WBBK area.

In **Sweden**, there are 9 SACs within the WBBK area designated for harbour porpoise. Some have management plans but there are no concrete conservation measures or fisheries regulations in place. Since May 2019 the Swedish national monitoring programme includes 14 stations within these SACs. A dialogue is ongoing within Sweden on fisheries in protected areas, and the Swedish Agency for Marine and Water Management are due to initiate the process for joint recommendations on fisheries regulations for Natura 2000 areas during 2020. Internal Swedish public consultations on these regulations are expected to be circulated shortly.

On 2 July 2020, the European Commission sent a letter of formal notice to Sweden for not living up to articles 6.2 and 12.4 of the Habitats Directive (1992/43/EEC) in regards to taking the necessary measures to protect harbour porpoise within SACs designated for the species, and to establishing a system to monitor incidental bycatch of harbour porpoise. The Commission also raises the issue of not correctly transposing the indicated articles from the habitats directive to Swedish law. Sweden has until 2 October September 2020 to respond to the inquiry, and if there is no or an unsatisfactory response, the Commission will take the next step which would be to send a so called reasoned opinion. The third and final step, if Sweden does not fulfil the requirements, is a case in the European Court of Justice.

Key Conclusions and Recommendations *Several Natura 2000 sites now exist in the Western Baltic, Belt Sea and Kattegat. The next step is to develop management plans for each site and more importantly to ensure there is mitigation measures in place to minimise adverse effects of human activities such as fisheries and noise disturbance. There should also be adequate regular monitoring of porpoises in and around those areas.*

4. *Implement pinger use in fisheries causing bycatch*

Regulation 812/2004 was repealed and replaced by regulation 2019/1241 in 2019. Figure 3 shows the areas where pinger use is mandatory according to both of these regulations. Unfortunately, these areas are clearly not based on data on harbour porpoise distribution. Also, the fact that the new regulation still only includes vessels with a length of over 12 m means that most static net fisheries in the region are excluded, and the regulation hence has very little actual impact on harbour porpoise conservation. Monitoring effort of pinger use is very low, and compliance is very likely low in all three countries.

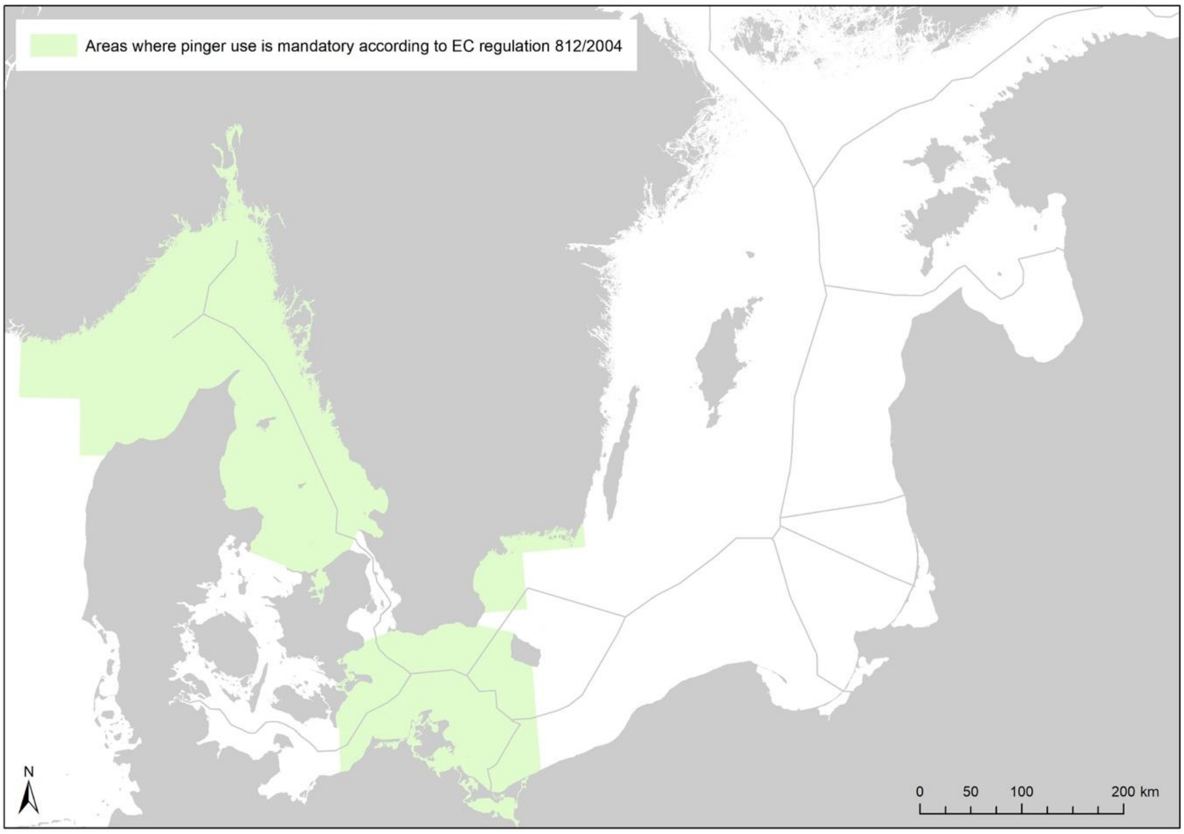

Figure 3. Areas where pinger use were mandatory under EC Regulation 812/2004, and now are mandatory under Regulation 2019/1241, on bottom set gillnets and entangling nets from vessels ≥ 12 m.

In **Germany**, fishing vessels use analog and digital pingers commercially available. In order to carry out compliance monitoring, the personnel of the competent federal and state authorities were equipped with Pinger Detector Amplifiers (Etec model PD1102) and trained accordingly. The detectors determine whether a pinger in the water actually emits its ultrasonic signals. The use of such detectors proves difficult in practice, since pinger signals can be masked by engine noise from control vessels. The relevant legal norm (Article 2, paragraph 2, Reg. 812/2004) requires that the pingers only have to function at the time of deployment. It is therefore irrelevant to check nets already set, as possible violations could not be punished. The legal framework for the detection and prosecution of violations should therefore be further optimised.

In 2016, a total of 4 vessels ≥12m were registered as gillnetters in Mecklenburg-Vorpommern. During 2016 inspections, none of these vessels were encountered in ICES Division 3.24 during the setting of gillnets in the course of sea inspections. Coastal waters of Schleswig-Holstein in the Baltic Sea do not fall within the scope of Annex I of Reg 812/2004 (see Figure 3).

In Schleswig-Holstein, almost 1,700 alternative acoustic deterrence devices, Porpoise Alerting Devices or PALs, has been handed out to fishers through the OIC in Eckernförde since 2017. PALs operate by replicating the sounds of porpoises (synthesising supposedly aggressive click trains at 133 kHz) and were designed to serve as an alerting device rather than as a deterrent, by increasing their rate of echolocation (B. Culik et al., 2015). Trials in a Danish fishery in the Western Baltic and the sound using REM to monitor bycatch rates had indicated a 70% reduction when PALs were deployed (Culik et al., 2017), although the size of the effect was much smaller than with pingers. The device has also been tested in a Danish North Sea fishery but was found to have no effect there (B. M. Culik et al., 2015). Reasons for the different results are unclear but it is possible the two different porpoise populations are responding differently to the signals. To date, there is no clear evidence that PAL operates as an alerting device.

In **Denmark**, a total of 22 vessels were obliged to use pingers in 2017. Monitoring of pinger use is part of the inspection of gillnet fisheries in Denmark, however in 2017 no inspections were carried out due to re-organisation and transfer of responsibility from one ministry to another.

Sweden reported that the implementation of pingers as was laid down in Reg. 812/2004 now 2019/1241 (see Figure 3), most likely are not being implemented in regulated fisheries in Sweden. However, very few gillnet vessels in Sweden are over 12 m and hence required by the Regulation to use pingers. In 2015 a project started with the purpose of implementing pingers on a voluntary basis on boats below 12 m (and hence not obliged to use pingers according to the regulations) in the Sound, ICES divisions 3.21 and 3.23. After discussions with fishermen Banana pingers were chosen for the project. The fishermen consider the Banana pinger to be practical to use and that the bycatch of harbor porpoises decreased. The fishermen report their catch, effort and bycatch. The voluntary pinger use has continued in 2016-2020 and the project report will be available in the end of 2020.

In the area where pingers have been used in the commercial lumpfish fisheries in southern Sweden, a study looking at the distribution and displacement of harbour porpoises in relation to commercial fisheries with pingers is currently taking place. Preliminary results show that harbour porpoise detections in the area are low when fisheries with pingers are carried out. However, when fisheries have stopped, the harbour porpoise detections do increase and are at the same levels as areas where no fishing with pingers has been carried out. No habituation to the pingers have been detected. A paper on this study is in prep. and is expected to be submitted at the end of 2020.

Currently, a large pinger project is carried out in cooperation between DTU Aqua and fjord & Bælt in Denmark and SLU Aqua in Sweden. This project will examine distance effects, test different types of pingers in active fisheries, and carry out a drone study on reactions of harbour porpoise to pingers. The project runs until the end of 2020.

Key Conclusions and Recommendations *Pingers are deployed in parts of the static gillnet fisheries by the fleets of all three Range States. However, compliance with regulations is not fully checked or enforced throughout the region, and is very likely not fully implemented.*

Given the arbitrary delimitation of areas where pingers should be used under Regulation 2019/1241, and the 12 m vessel size limit which clearly has nothing to do with bycatch risk, countries should carry out bycatch risk modelling and implement pinger use, or when possible introduction of alternative fishing gear, in areas and fisheries with high risk of bycatch.

The German PAL system needs further investigation to determine to what extent it functions as an alerting rather than deterrent device, and to establish its potential in different situations. A scientific monitoring scheme should be implemented as soon as possible.

5. Where possible, replace gillnet fisheries known to be associated with high porpoise bycatch with alternative fishing gear known to be less harmful

In **Germany**, a voluntary agreement has been in place with fishermen since 2013 in Schleswig-Holstein, resulting in a reduced length of gillnets deployed in the months of July and August.

Germany has also been investigating alternative management approaches and the use of alternative fishing gear. The "Stella" Project (November 2016 – December 2019) had a number of strands: building data, modifying gillnets, investigating the feasibility of alternative gear, creating incentives for data collection, synthesizing the results, and promoting social responsibility within the German Baltic EEZ. This inter-disciplinary project was funded by the Federal Agency for Nature Conservation (BfN), and conducted by the Thünen Institute of Baltic Sea Fisheries. It has engaged fishermen of the Baltic Sea, and amongst other tasks, will synthesise the results of the various disciplines - fisheries biology, fishing technology and social sciences, and derive policy advice for decision makers, considering also the interest of nature conservation. Within the Stella project, Thünen Institute of Baltic Sea Fisheries have been carrying out trials on developing acoustically reflective gillnets. The first step was to find the optimal size and material of a small sphere that would resonate at 130kHz. Acrylic glass spheres were found to be the best available option, of 9.6 or 6.4 mm diameter, and echograms of pearl nets show significantly increased reflectivity at 120 kHz. In the last step, field trials with pearl nets were carried out in the Black Sea turbot fishery, where harbour porpoise bycatch rates are higher than in the Baltic Sea. Over a total of ten hauls, 5 porpoises were bycaught in standard gillnets, and 2 in pearl gillnets. These results are not statistically significant, and the mechanisms behind bycatch in modified nets have to be looked more closely into. Next steps should include behavioural experiments to look at porpoise behaviour around standard and modified nets, further trials in commercial fisheries and development of an automated process to put pearls on nets. The final report from the Stella project is expected during 2020, but hopefully trials with modified gillnets will continue.

With regard to bycatch mitigation, in **Denmark** "pingers" are being developed and tested, and trials are also conducted using lights and setting nets lower to examine whether such measures can decrease bycatch. In developing and testing alternative gear, studies are taking place to improve the catch efficiency of cod traps, using push-up traps for cod as well as developing and testing small-scale Danish seine for cod. These actions are being undertaken in collaboration with SLU, Sweden. These programmes of research are scheduled to be completed by 2020.

In the small-scale coastal fisheries in **Sweden** alternative fishing gear has been, and is still being, developed. Pontoon traps for fishing salmon, white fish, trout and vendace are now used in commercial fisheries in the northern Baltic. During recent years, there has been a development of a pontoon trap to be used for cod in the southern Baltic. The results show that during certain times catches of cod can be high. However, gear needs further development with regards to resistance to rough seas and open archipelagos as well as practical handling (Nilsson, 2018). The main reason behind the development of the fishing gear is the seal inflicted damages to fishing gear and catch, which threatens an economically viable gillnet fishery.

Between 2014-2020 there have been funding opportunities for fishers to put forward their ideas for selective fishing gear to the "Secretariat for selective fishing gear" funded by the Swedish Agency for Water Management. The purpose of the Secretariat was to enable the fishing industry to develop selective fishing gear to help the transition to the new landing obligation. Projects were carried out by SLU Aqua in cooperation with the involved fishers. From 2020 and onwards funding is uncertain. SLU Aqua together with DTU Aqua and the Thünen Institute have been engaged in a programme to improve the design of cod pots to reduce bycatch. However, due to the ban on cod fisheries in the Baltic Sea, this study and others focusing on alternative gear for cod fisheries have been postponed or cancelled.

Several studies have been undertaken to evaluate the catch efficiency of different cod and lobster pots and what factors affect it (Hedgärde et al., 2016; Ljungberg et al., 2016; Nilsson, 2018). This is done partly by studying the behaviour of cod in relation to cod pot models and other fisheries related factors such as soak-time. The entry rate of cod entering pots gives an indication on the catch efficiency of the pots and by studying the entry rate in relation to factors such as cod pot model, number of fish inside the pot, and current strength, one gains information on what factors are affecting catchability. The results are show that the number of entrances on the pot and the number of cod already inside the pot affect the entry rate of the cod entering the pot (Hedgärde et al., 2016). Another study has shown that using a funnel on the entrance opening to the fish holding chamber also affects the behaviour of cod while entering the pots. However, it increases the catch efficiency (cpue) due to the decreasing number of cod exiting the pots (Ljungberg et al., 2016).

An alternative to both trawl and gillnet fisheries is bottom seine netting, such as Danish Bottom Seine. Bottom seines are generally considered less damaging than bottom trawls, and well-managed seine fisheries generally have minor ecosystem impacts (Morgan and Chuenpagdee, 2003). In 2016, the Swedish University of Agriculture Science has continued to develop a seine net modified for small open boats and tried it for pelagic and demersal species as a possible alternative to gillnet fisheries. The development is still under progress and the upcoming years there will be a focus on evaluating the seines environmental impact on the benthic habitat.

Key Conclusions and Recommendations *Studies are ongoing in all three countries to find alternative fishing methods that are less harmful to marine wildlife including porpoises. These should be strongly encouraged, and knowledge gained should be shared widely across the fishing industry and other marine stakeholders*.

6. Estimate total annual bycatch

The **German** commercial fleet in the Baltic Sea consists of about 60 trawlers and larger (>10 m total length) polyvalent vessels, and about 650 vessels using exclusively passive gear (< 12 m total length). There is no specific monitoring of bycatch, instead bycatch monitoring is included as part of the Data Collection Regulation scheme. In 2017, no harbour porpoise bycatch was registered under this monitoring.

In **Denmark**, no specific monitoring programmes for incidental bycatch of cetaceans have been undertaken in recent years. Instead, observer data on incidental catches of marine mammals are collected under the Data Collection Regulation scheme (DCR). In the latest year of reporting (2017) one harbour porpoise was reported bycaught in area 27.3.b.23.

Sweden has no dedicated at-sea observer scheme focusing on the bycatch of marine mammals. The monitoring effort conducted and provided by Sweden is part of the EU Data Collection Framework where on-board observer data are mainly from trawl fisheries but also pot fisheries for crayfish. In Swedish waters, harbour porpoises are bycaught mainly in gillnets and not in pelagic trawls, and therefore observing 5% of Swedish pelagic trawl effort is insufficient to provide an estimate of total cetacean bycatch with acceptable confidence limits.

In 2017, no bycatch of cetaceans was observed under the DCF monitoring programme. However, in a pilot project carried out by the Department of Aquatic Resources at the Swedish University of Agricultural Sciences (SLU Aqua) during 2017, where observers were onboard on a total of 36 Days at Sea, two porpoises were recorded bycaught in large mesh gillnets in ICES SubDivision 23 (the Sound).

A project on remote electronic monitoring (REM) is ongoing at SLU Aqua and at present has about 8 fishermen engaged. SLU Aqua is looking for more fishermen to participate and there is funding available for the project from 2020. The biggest problem has been to find good cameras, and own equipment has been built for trials. Soon a new system from New Zealand will be tested.

Key Conclusions and Recommendations *Dedicated monitoring of marine mammal bycatch in is not undertaken in any of the Range States, covering a sufficient part of the fleet of higher risk fisheries to arrive at reliable estimates. Reliance upon the EU Data Collection Framework risks seriously under-recording porpoise bycatch. Remote electronic monitoring appears to be much more effective but has not yet been developed sufficiently to be applied widely to the extent needed. Until all these issues are addressed, an assessment of the true level of bycatch of harbour porpoise in the region will not be realised.*

7. *Estimate trends in abundance of harbour porpoises in the Western Baltic, the Belt Sea and the Kattegat*

The abundance of harbour porpoises in northern European waters has been estimated three times from internationally coordinated large-scale dedicated surveys; SCANS (Small Cetacean Abundance in the North Sea and Adjacent waters) in July 1994 (Hammond et al., 2002), SCANS-II in July 2005 (Hammond et al., 2013), and SCANS-III in July 2016. Previously, the abundance for the population inhabiting the Kattegat, Belt Sea, the Sound and Western Baltic was estimated to be 27,767 (CV = 0.45, 95% confidence interval (CI) = 11,946-64,549) in 1994, and 10,865 (CV=0.32, 95% CI = 5,840-20,214) in 2005 (Teilmann et al., 2011). Although this represents a 60% decline in the point estimates, the wide confidence limits result in no significant trend.

Following the abundance survey in July 2016, a trend was determined from the three SCANS surveys for harbour porpoises in the Skagerrak, Kattegat and Belt Seas (see Figure 4). This indicated a slight but non-significant (p=0.81) increase of 1.24% (CV-0.30; 95% Cis of -39% to +67%), for the three abundance estimates (ICES, 2017a). The results of a power analysis showed that the data used have 80% power to detect an annual rate of change of 3.7%.

In addition to the three SCANS surveys, the Kattegat / Belt Sea Management Unit was surveyed in the first MiniSCANS survey in July 2012 (Viquerat et al., 2014). That estimate is compared with one for the equivalent area from the July 2016 SCANS survey (see red dots in Figure 4). They also show no significant change between surveys. The 2012 survey gave an abundance estimate of 40,475 ((CV=0.24; 95% CI: 25,614-65,041), whereas the 2016 survey gave an abundance estimate of 42,324 (CV=0.30; 95% CI: 23,368-76,658).

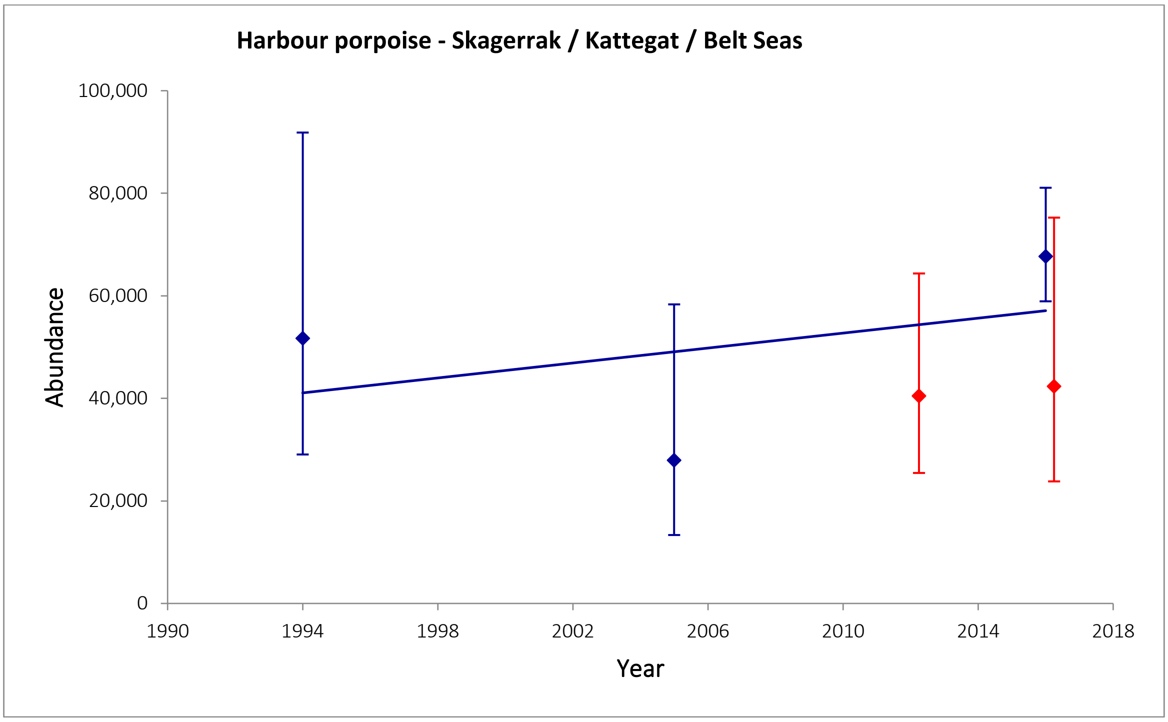

Figure 4. Estimates of abundance (error bars are log-normal 95% confidence intervals) for harbour porpoise in the Skagerrak / Kattegat / Belt Seas area (blue dots and line) and Kattegat / Belt Seas ICES Management Unit (MU) (red dots). All estimates are from SCANS surveys, except Kattegat/Belt Seas in 2012 (Viquerat *et al*., 2014) (Source: ICES, 2017)

Table 1 summarises porpoise abundance estimates from each survey, with the SCANS estimates subdivided into the original blocks (Skagerrak, Kattegat and Belt Seas) and then within the management unit area of the Belt Sea harbour porpoise population in the Kattegat and Belt Seas.

Table 1. Abundance estimates for harbour porpoise in the Skagerrak, Kattegat and Belt Seas and for the management unit area of the Kattegat and Belt Seas. 1994 & 2005 estimates are revised from Hammond et al. (2002) and Hammond et al. (2013) respectively, 2012 estimate from Viquerat et al. (2014), and 2016 estimate from (Hammond et al., 2017), see also the ICES WGMME report from 2017 (ICES, 2017b). Note that the areas of coverage for each survey are not strictly comparable.

Year	Area	Estimate	CV (95% CI)
1994	Skagerrak, Kattegat, Belt Seas	51,660	0.30 (29,058-91,841)
2005	Skagerrak, Kattegat, Belt Seas	27,901	0.39 (13,345-58,333)
2016	Skagerrak, Kattegat, Belt Seas	67,691	0.22 (16,607-38,748)
1994	Kattegat, Belt Seas	27,767	0.45 (11,946-65,549)
2005	Kattegat, Belt Seas	10,865	0.32 (5,840-20,214)
2012	Kattegat, Belt Seas	40,475	0.24 (25,454-64,361)
2016	Kattegat, Belt Seas	42,324	0.30 (23,807-75,244)

The 1994 & 2005 Kattegat & Belt Seas estimates from Teilmann et al. (2011) are not strictly comparable to more recent ones because although taken from the SCANS (1994) & SCANS II (2005) surveys, these violate the formal assumption of equal coverage probability because the survey was designed to achieve that over the whole block (which is a larger area).

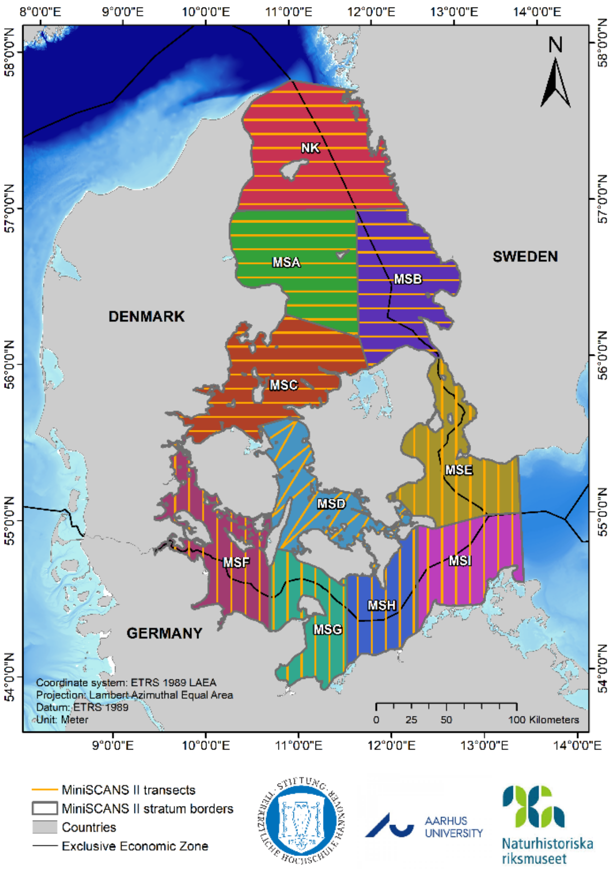

Figure 5. Transect design for international survey carried out in July 2020

A mini-SCANS survey was conducted in July 2020, co-funded by Denmark, Germany and Sweden. The transect design for the survey is illustrated in Figure 5.

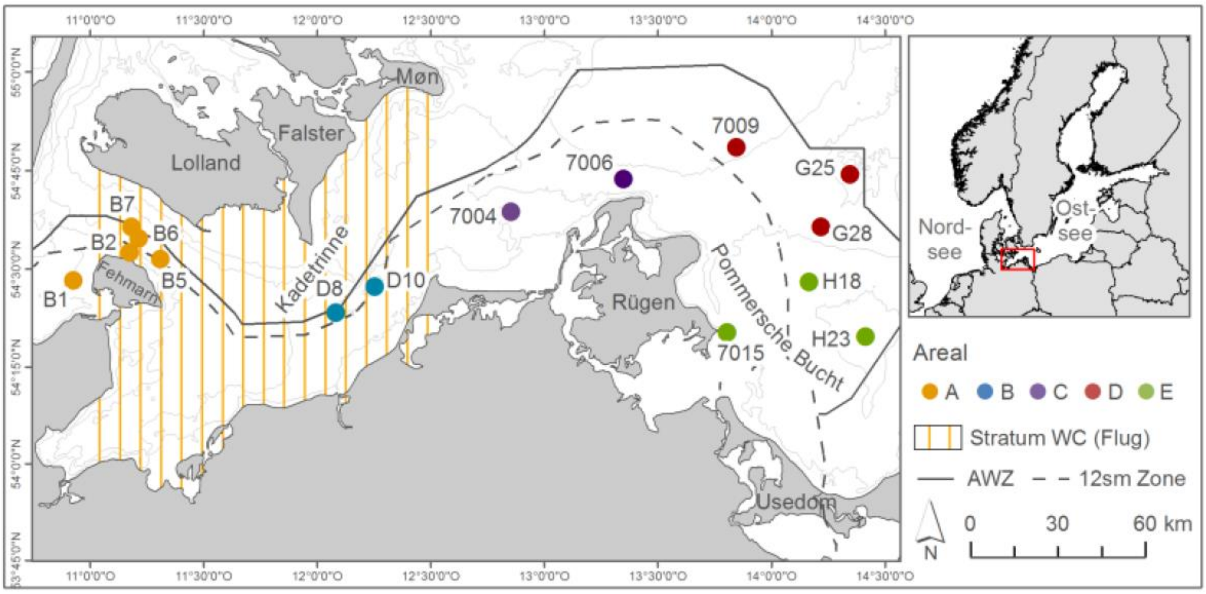

Figure 6. Locations of C-PODs deployed as part of the German Acoustic Monitoring Programme

In **Denmark**, monitoring involving passive acoustic monitoring was conducted from 2011-2016, but then ceased. However, a new period of acoustic monitoring began in 2017 and is due to continue until 2021. In this programme, C-PODs are circulated between in harbour porpoise SACs.

Acoustic monitoring in **German** waters of the WBBK area continues to use C-PODs (see Figure 6). Germany also has an established monitoring programme of their waters using visual and digital aerial surveys within the WBBK region (west of 13.5° E around the island of Rügen). This is funded by BfN, with surveys in summer every two years. Around Fehmarn, however, the surveys are undertaken annually. There are also winter surveys (in association with seabird monitoring) around the "Pommersche Bucht".

Figure 7. Locations of C-PODs deployed as part of the Swedish Acoustic Monitoring Programme. In total 14 stations are located within the WBBK area.

In **Sweden**, 14 acoustic monitoring stations in Natura 2000 sites in the WBBK area were added into the national monitoring programme in May 2019, see Figure 7.

Key Conclusions and Recommendations *The SCANS III survey in July 2016 has provided a recent abundance estimate of approximately 42,000 porpoises for the area of the WBBK management unit. There is a proposal to carry out a MiniSCANS survey of the area in summer 2020. This should make it possible to better establish a trend for this population. No attempt has been made as yet to visually monitor seasonal variation in abundance. Acoustic monitoring provides some measure of this but so far has been patchy in space and time. It is recommended that monitoring, both visually and acoustically, is extended, ideally to fill those gaps. For the region as a whole, coverage could usefully be raised to the level currently undertaken by countries in the southern North Sea, with both summer and winter covered on an annual basis.*

8. *Monitoring population health status, contaminant load and causes of mortality*

Within the WBBK area, only **Germany** has a dedicated stranding scheme, which operates in both Schleswig-Holstein and Mecklenburg-Vorpommern. The scheme is administered in the former region by the Terrestrial and Aquatic Research Institute (ITAW) in Büsum, and in the latter region by the German Oceanographic Museum in Stralsund.

Since German waters span the transition zone, it is difficult to know how many animals come from the Baltic Proper and the Belt Sea population, respectively. In 2019, 135 animals were reported stranding in Schleswig-Holstein and 64 in Mecklenburg-Vorpommern. Necropsies are undertaken on fresh specimens to determine cause of death and collect life history information. Kesselring et al. (2017) investigated the first signs of sexual maturity for a period of almost two decades (1990-2016). Ovaries from 111 female harbour porpoises stranded or bycaught from the German North Sea and Baltic Sea were examined for the presence and morphological structure of follicles, corpora lutea and corpora albicantia. They found that whereas there were no significant differences in the demographic structure of females between the two regions, the average age at death differed significantly with 5.70 (± 0.27) years for North Sea animals and 3.67 (± 0.30) years for those in the Baltic Sea. By comparing the age structure with the average age at sexual maturity, it has been estimated that around 28% of the female harbour porpoises found dead along the German Baltic coast of Schleswig-Holstein had lived long enough to reach sexual maturity. In comparison, about 45% of the dead females from the North Sea had reached sexual maturity. They concluded that growing evidence existed to suggest that the shortened lifespan of Baltic Sea harbour porpoises is linked to an anthropogenically influenced environment with rising bycatch mortalities probably due to local gillnet fisheries since about 30% of the animals sampled were thought to be by-caught.

In Denmark, the Danish Nature Agency funds the dissection and necropsy of 25 stranded or bycaught porpoises per year in order to examine health and cause of death. However, since there is no stranding scheme in place to collect these animals, the actual numbers of examined specimens are much lower, e.g., from 2008-2016, 0-5 porpoises were dissected per year. A review of Danish strandings (see Table 2) was published recently by Kinze et al. (2018). Between 2008 and 2017 34 porpoises have been autopsied (see https://fimus.dk/wp-content/uploads/2018/10/Beredskabsrapport-2017-1.pdf).

Table 2. Summary of harbour porpoise strandings for the period 2008-2017 divided by zoo-geographical region Outer Danish Waters (ODW), Inner Danish Waters (IDW) and the Waters Around Bornholm (WAB)

	Zoo-geographical region			
Year	**ODW**	**IDW**	**WAB**	**Total**
2008	149	75	0	**224**
2009	49	84	1	**134**
2010	73	46	0	**119**
2011	97	50	1	**148**
2012	66	52	3	**121**
2013	102	34	0	**136**
2014	78	43	0	**121**
2015	9	13	1	**23**
2016	57	19	1	**77**
2017	51	18	0	**69**
Total	**731**	**434**	**7**	**1172**

In **Sweden**, records of strandings are collected opportunistically by the Swedish Museum of Natural History (SMNH) in collaboration with the Gothenburg Museum of Natural History, and carcasses are collected for necropsy. From the Baltic Sea coast all carcasses are collected even if they are too decomposed for necropsy, and full skeletons are prepared and added to the collections of SMNH. Some form of genetic samples are also always taken. From the Swedish west coast carcasses are collected if they are fresh enough for necropsy. The aim for this programme is to continue to undertake necropsies at the level of 30 animals/year, which is a slight increase since 2019.

In 2020 a report was published by the Swedish National Veterinary Institute and the Swedish Museum of Natural History on health and causes of death in 109 harbour porpoises dead between 2006-2019 (Neimane et al., 2020). Most of the animals necropsied and included in this study were from the Swedish west-coast, so most probably belong to the Belt Sea population.

Sweden is now starting up a health and disease monitoring program for harbour porpoise, although at a small scale to begin with. This is very good news and we hope that this effort will be continued and expanded.

In all three countries, the protocols used for examining strandings, and for undertaking necropsies, have been the ones recommended from the pathology workshops held by the European Cetacean Society (Garcia Hartmann, 2001; Kuiken, 1996; Kuiken and Garcia Hartmann, 1992).

Key Conclusions and Recommendations *For studies of health status, contaminant loads and causes of death, there needs to be a well-developed stranding reporting scheme with regular necropsies undertaken of a reasonable sample size. Germany has such a scheme and performs necropsies on a routine basis. However, neither Sweden nor Denmark have well-established stranding schemes, although Sweden does perform necropsies on a sample of stranded animals. There is a need to establish a more comprehensive stranding reporting scheme in those countries, and in particular in Denmark, to have routine necropsies undertaken.*

9. *Ensure a non-detrimental use of pingers by examining habitat exclusion and long-term effects of pingers*

A number of studies have examined possible long-term effects of pingers through habitat exclusion (Carlström et al., 2009, 2002; Hardy et al., 2012; Kyhn et al., 2015; Teilmann et al., 2015). Kyhn et al (2015) examined the effects of 2 types of pingers (Airmar: 10 kHz tone; Save-Wave Black Saver: 30−160 kHz sweep) on the presence of wild harbour porpoises, at two sites in Jammerland Bay in the Great Belt, Denmark and concluded that if pingers are used as deterrent devices, the impact of habitat exclusion needs to be considered concurrently with mitigation of bycatch, especially when regulating fisheries in Marine Protected Areas.

Another study took into account not only the direct effects but also the sub-lethal population level effects of pinger use resulting from e.g. reduced foraging efficiency, and showed through the use of an individual-based model that a combination of time-area fishing closures and the use of pingers was likely the most beneficial way of mitigating bycatch (van Beest et al., 2017).

Since this study, further studies in Denmark have tried to better understand behavioural responses of porpoises in the presence of pingers, for example using drones, so as to improve their effectiveness without deleterious side effects. This research continues during 2020.

Sweden has in 2015-2020 carried out an extensive long term study on the distribution and displacement of harbour porpoises in relation to commercial gillnet fisheries with pingers. Results show that harbour porpoise detections in the area are low when fisheries with pingers are carried out. However, when the pingers were switched off, the harbour porpoise detections increase and are at the same levels as areas where no fishing with pingers has

Germany is currently not undertaking studies of possible habitat exclusion or habituation in the presence of pingers. Although the Thünen Institute's development of PAL devices was to tackle the acoustic deterrent issue, there remains uncertainty whether those devices serve only an alerting function or also deter animals in the same way as pingers do. The scientific community has called for monitoring of the effects of the massive deployment of PALs in German waters.

Key Conclusions and Recommendations *Scientists from the Range States have led much of the research that has been undertaken to date on the interactions between porpoises and pingers. The main objective is to ensure that with pinger deployment, porpoises are alerted to the presence of a net in a manner that avoids entanglement whilst not being deterred enough that it excludes them from important habitat for significant periods of time resulting in a population impact. Studies continue to investigate the efficacy of this potential mitigation measure. These should be encouraged.*

We strongly recommend close monitoring of the large-scale deployment of PALs in German Baltic waters. The ability of these devices to decrease bycatch, as well as their effects on harbour porpoise distribution and behaviour, needs to be investigated.

10. Include monitoring and management of important prey species in national harbour porpoise management plans

In general, studies are largely lacking on the effects of prey depletion on porpoise energetics and its impact upon population dynamics. A major gap exists in understanding prey preferences and how diet varies in time and space. In the North Sea, the availability of sandeel has been found to correlate with the number of harbour porpoise starved to death (MacLeod et al., 2007), indicating that the availability of a specific prey species can have significant effects on harbour porpoise survival. In the Baltic, a recent study found that weight of herring affected the blubber thickness of Baltic grey seals (Kauhala et al., 2017), which raises the question of prey quality and its effects on harbour porpoise.

In the WBBK region, important work has been undertaken. (Sveegaard et al., 2012) examined the stomach contents of 53 harbour porpoises collected between 1987 and 2010 in the Öresund Sound (ICES SubDivision 23) that links the western Baltic with the Kattegat (high season, April-Oct, n=34 porpoises; low season, Nov-Mar, n=19 porpoises). A total of 1,442 individual specimens from thirteen fish species were identified. The distribution in terms of occurrence and number of fish species differed between seasons, indicating a seasonal shift in prey intake. During the high-density season, the mean and total prey weight per stomach as well as the prey species diversity was higher, and results were interpreted as indicating a higher quality of prey in the high-density season. Atlantic cod was found to be the main prey species in terms of weight in the high-density season while Atlantic herring and Atlantic cod were equally important during the low-density season. They considered that prey availability and predictability were likely to be the main drivers for harbour porpoise distribution in this region.

More recently, (Andreasen et al., 2017) analysed a much larger sample, a data set including 339 stomachs collected over a 32-year period (1980–2011) from the western Baltic Sea (ICES SubDivisions 22-24) with a few additional samples from the Kattegat (ICES SubDivision 21). As is usually the case, the stomach contents were mainly hard parts of fish prey and in particular otoliths. In this study, the bias originating from the differential residence time of otoliths in the stomachs was addressed by use of a recently developed approach. Atlantic cod and herring were the main prey of adult porpoises, constituting on average 70% of the diet by mass. Juvenile porpoises also frequently consumed gobies, the mass contribution by gobies averaging 25%, which was as much as cod. In this region, other species such as whiting, sprat, eelpout, and sandeels were of minor importance for both juveniles and adults. The diet composition differed between years, quarters, and porpoise acquisition method. Yearly consumption rates for porpoises in the western Baltic Sea were obtained in three scenarios on the daily energy requirements of a porpoise in combination with an estimate including the 95%CLs of the porpoise population size. Cod of age groups 1 and 2 and intermediate-sized herring were estimated to suffer the highest predation from porpoises in this region.

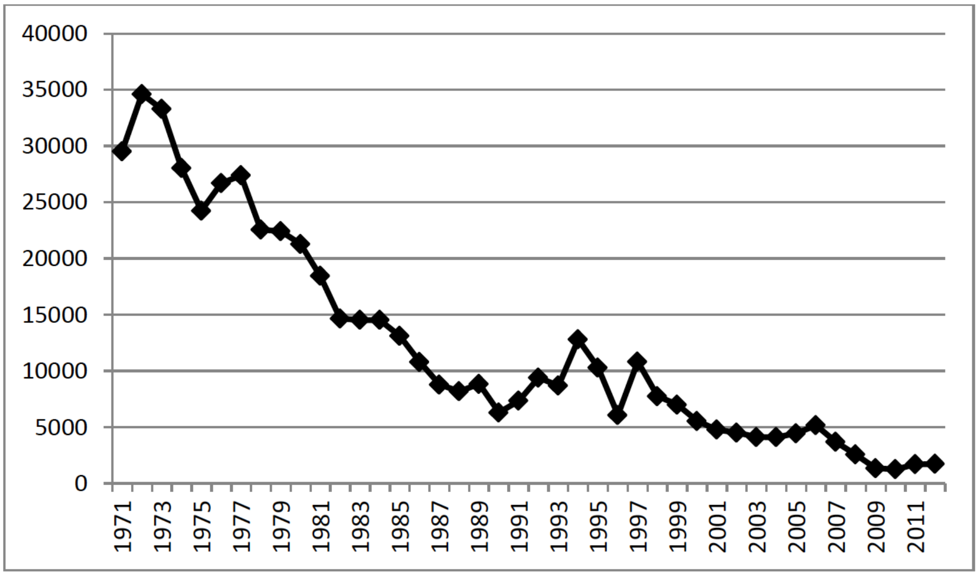

Figure 8. Spawning stock biomass (SSB) trend for the Kattegat cod stock (Source: HELCOM 2013)

The stocks of cod and herring in the region have changed markedly over the last fifty years. The spawning stock biomass of cod in the Kattegat (ICES SubDivision 21) has declined from around 35,000 tonnes in the early 1970s to around 2,000 tonnes by the early 2010s (Figure 8). Cod spawning aggregations have been observed in the central and southern part of the Kattegat (HELCOM, 2013).

The Western Baltic stock of cod (ICES SubDivisions 22-24) has fluctuated over the same time period, declining markedly between the early 1970s and early 1990s, but recovering somewhat in the early 2010's (Figure 9). However, there is no sign of a full recovery in stock size from the historical levels (ICES, 2012), with it suffering from a fishing mortality above sustainable levels, and reduced recruitment (Oceana, 2016) and the Commission proposal in 2020 recommends further decrease in catch quotas. Spawning takes place in the Sound, in the Belt Sea, and at various locations in the Arkona basin (HELCOM, 2013).

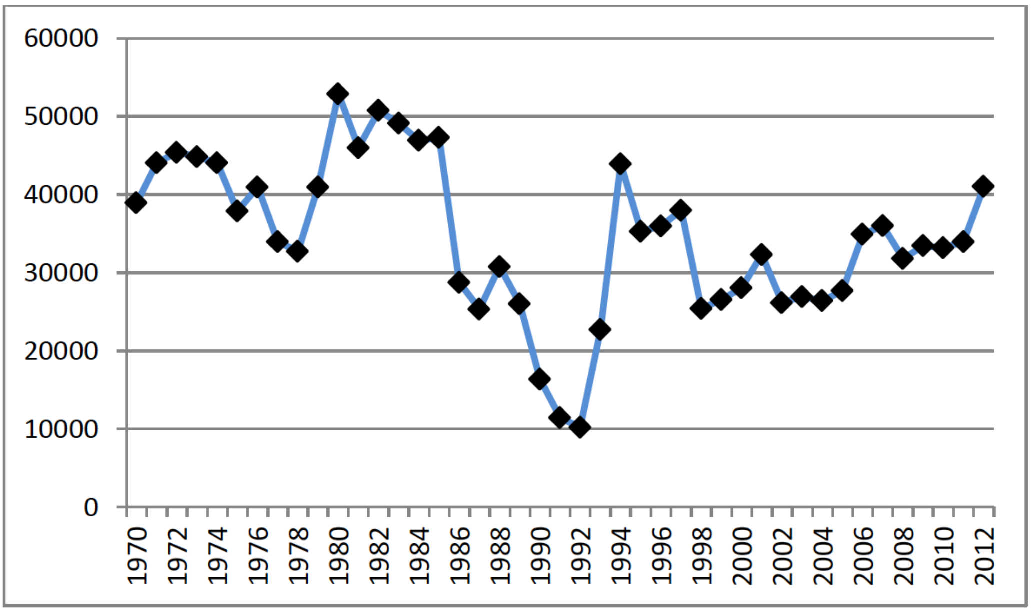

Figure 9. Spawning stock biomass (SSB) trend for the Western Baltic cod stock (Source: HELCOM, 2013)

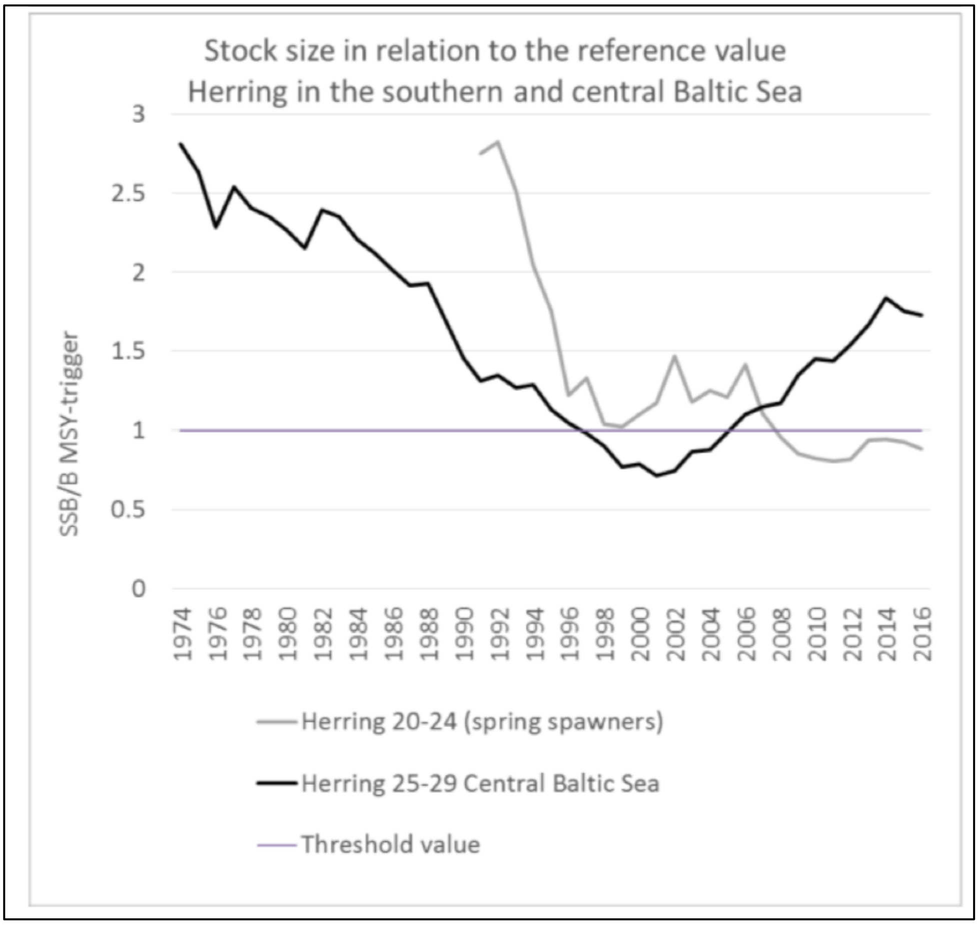

Figure 10. Trend in ratio of spawning stock biomass (SSB) to maximum sustainable yield (MSY) for spring spawning herring in ICES SubDivisions 20-29 (Source: HELCOM, 2017a)

Important stocks of spring spawning herring exist in the Skagerrak (ICES SubDivision 20), Kattegat (ICES SubDivision 21) and Belt Seas (ICES SubDivisions 22-24). A comparison of the spawning stock biomass and assessment of maximum sustainable yield shows a marked decline for the stock in ICES SubDivisions 20-24 during the 1990s, steadying thereafter but at a much lower level (Figure 10; HELCOM, 2017). The SSB of this stock is just above one third of what it was in the 1990s when the time series began, and has been decreasing since 2006, with the lowest ever level observed in 2011. Since then, it has increased somewhat, just above the precautionary level, and ICES now classifies the stock to be at full reproductive capacity. Fishing mortality was at an historical low (below FMSY) in 2014. The ICES advice in order to achieve MSY means that catches in the whole distribution area should be no more than 52,547 tonnes, for subdivisions 22-24 this means a TAC of 26,274 tonnes (Oceana, 2016).

Figure 11 shows the distribution of fishing effort leading to extraction of fish of three target species, and harbour porpoise prey species (cod, herring and sprat) for the Kattegat, Belt Seas, Western Baltic and Baltic Proper.

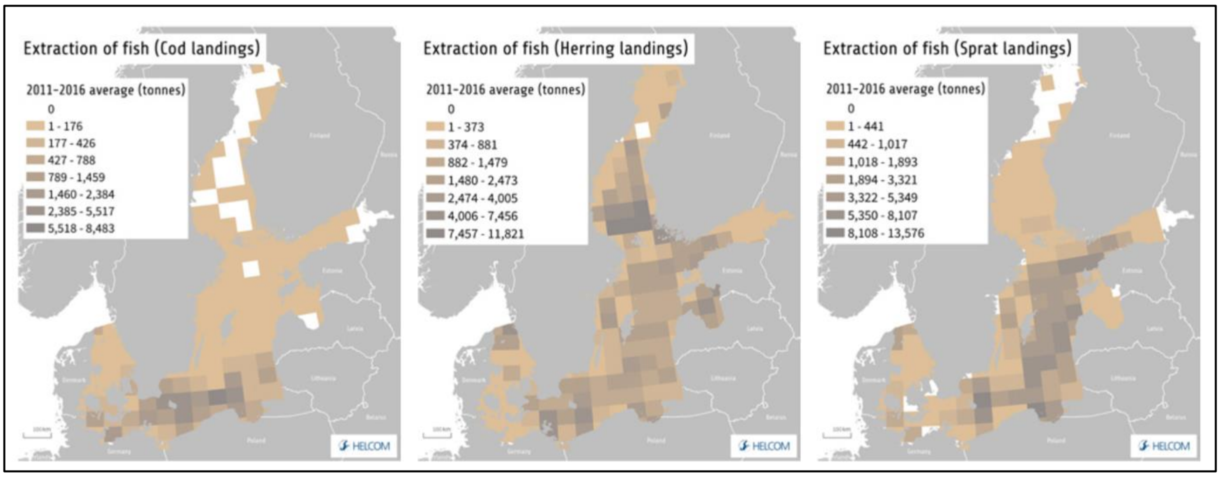

Figure 11. Spatial distribution of commercial landings of cod, herring and sprat in the Baltic Sea (Source: HELCOM, 2018a)

Herring biomass is dependent on the size of the cod stock, which is its main predator, and on the size of the sprat stock, with which it competes for food. For herring, there are also large differences in growth rates between regions: individuals are small in the northern areas and larger in the south. This has been shown to influence grey seal blubber thickness (Kauhala et al., 2017) and could have implications for other top predators like harbour porpoise.

The state of cod and herring stocks may impact harbour porpoises in various ways: by triggering shifts in their main areas of concentration, switching to other prey, and/or reduced body condition which could lead to lower reproductive rates. These relationships need to be investigated further. The same applies to porpoises in the Baltic Proper where high fishing mortality has led to long-term changes in the stock sizes of various fish species (cod, herring and sprat in particular)(HELCOM, 2018a).

Key Conclusions and recommendations *Recent studies have provided insight into the diet of porpoises in the region, illustrating the importance of cod and herring for adult porpoises whilst juveniles also consumed a significant quantity of gobies. Both cod and herring stocks have declined in the Skagerrak, Kattegat and Belt Seas and the western Baltic cod needs to see further decreases in catch quotas. Trends in the stocks of these important prey species could potentially affect porpoise reproductive rates and possibly also survival rates. It is recommended that studies investigate in more detail predator-prey interactions at an ecosystem level.*

11. Restore or maintain habitat quality

One of the main human pressures that can affect the environment in which harbour porpoises live is the production of underwater noise. It may cause behavioural changes to both porpoises and their prey, mask communication, and even have physiological impacts. Underwater noise can be divided into continuous sounds largely derived from shipping, and impulsive sounds derived from sources such as seismic survey airguns, pile driving, detonations and active sonar. For this reason, under the EU Marine Strategy Framework Directive, two indicators were developed for Descriptor 11 on the introduction of energy/noise:

- 11.1. Distribution in time and place of loud, low and mid frequency impulsive sounds
- 11.2. Continuous low frequency sound

Impulsive noise

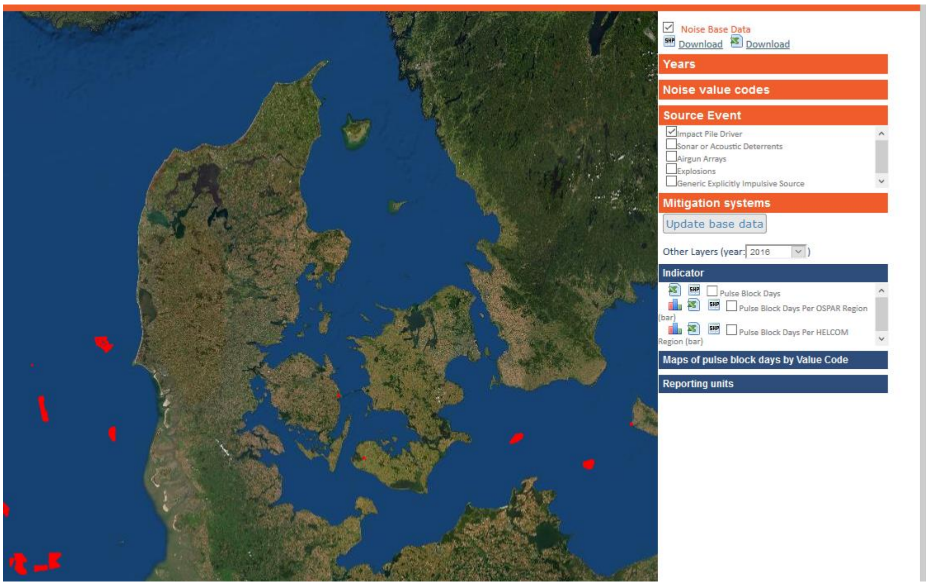

Figure 12. Noise Map of Impulsive sound produced from pile driving between 2010 and 2019 (Source: ICES database)

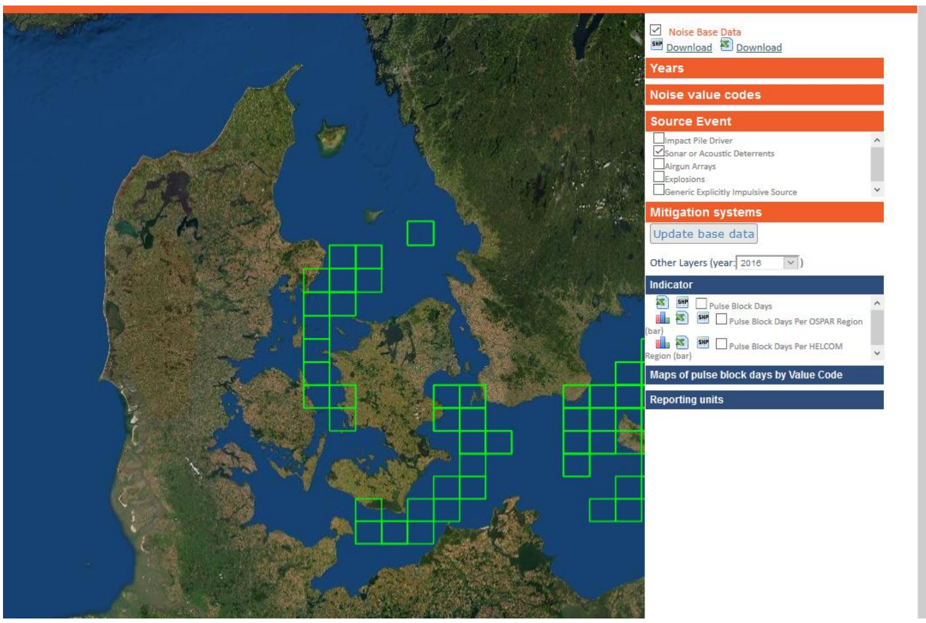

Figure 13. Noise Map of Impulsive sound produced from sonar or ADDs between 2010 and 2019 (Source: ICES database)

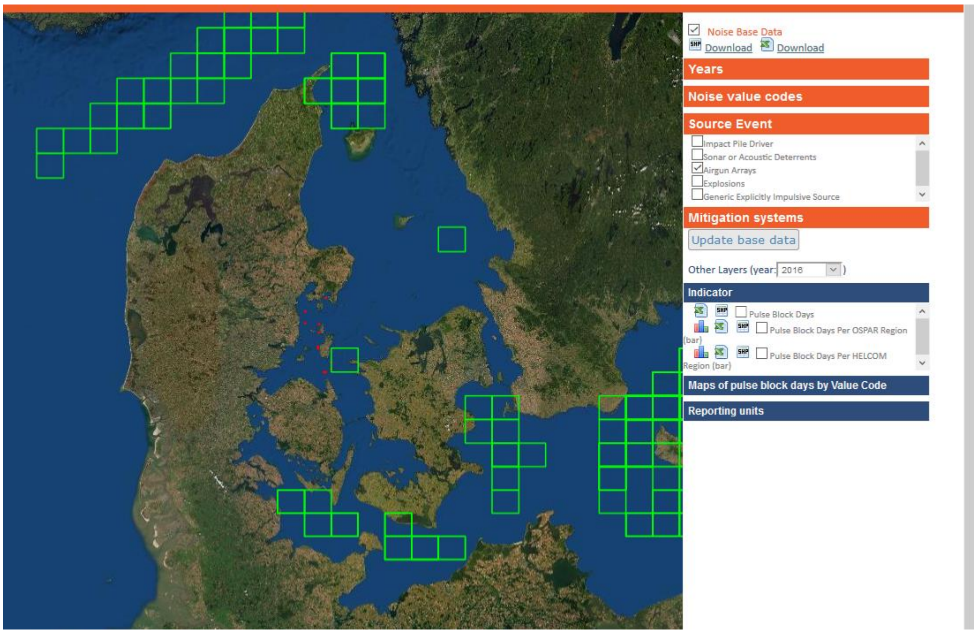

Figure 14. Noise Map of Impulsive sound produced from airgun arrays between 2010 and 2019 (Source: ICES database)

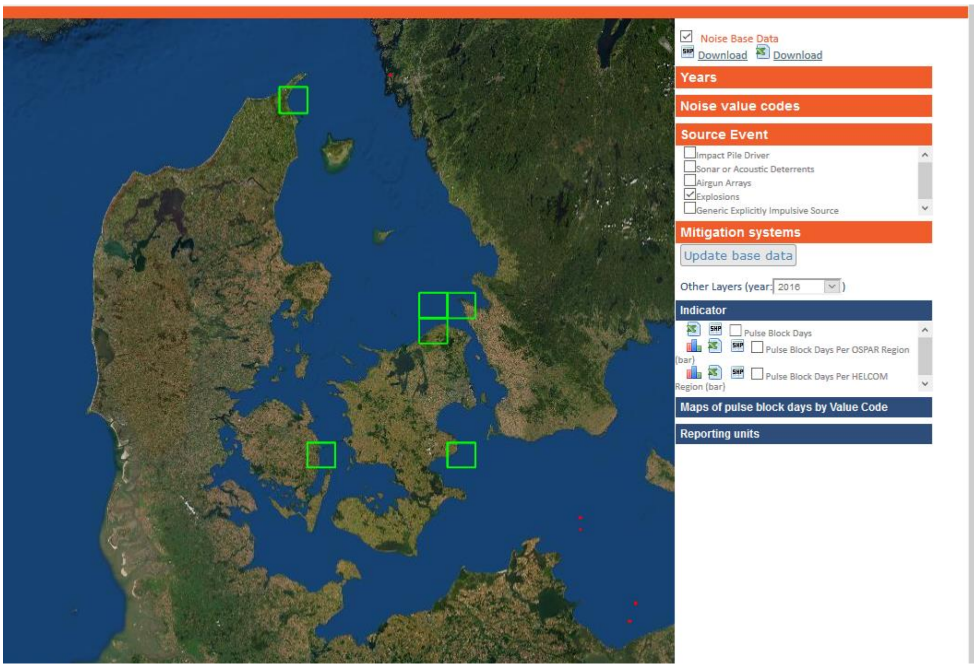

Figure 15. Noise Map of Impulsive sound produced from explosions between 2010 and 2019 (Source: ICES database)

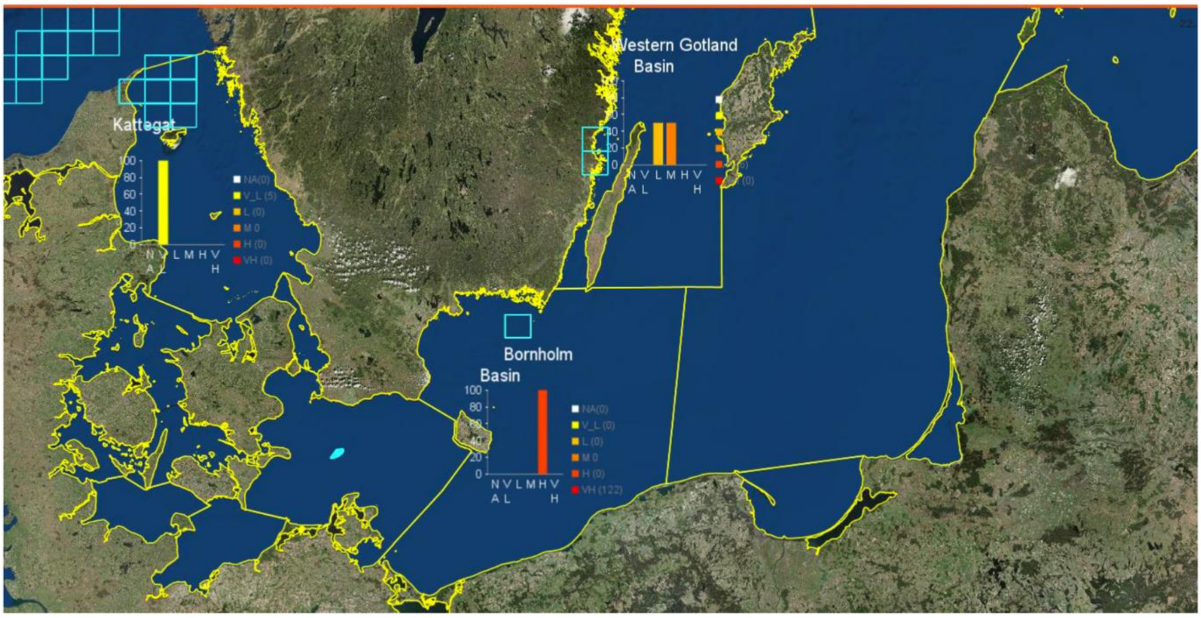

Figure 16. First draft of the graphs of pulse block days per HELCOM sub-basin based on data from the regional registry (Source: HELCOM, 2017b)

For Indicator 11.1, ICES have set up a registry in support of HELCOM and OSPAR. This registry provides an overview of the spatial and temporal distribution of impulsive noise events over the frequency band of 10 Hz to 10 kHz causing a “considerable” displacement (http://ices.dk/data/data-portals/Pages/underwater-noise.aspx). “Considerable” displacement is defined as displacement of a significant proportion of individuals for a relevant time period and at a relevant spatial scale. Maps downloaded on 4 Sept 2020 showing the blocks with activity for each of the main source types for the years 2008-19, are depicted in Figures 12-15.

Denmark, Germany and Sweden have all contributed data to although there are probably more still to come before these maps fully reflect the usage of a variety of sources of impulsive sound active within the Western Baltic, Belt Sea and Kattegat. These are three types of gaps: 1) activities that have to be reported but are not. These should reduce as procedures for reporting improve; 2) activities that can be reported, but are not mandatory, including military activities. It is to be hoped that navies will cooperate to ensure as comprehensive reporting as possible; and 3) activities that do not have to be reported, but are likely to cause significant disturbance. Those include sources above 10 kHz such as seal scarers and some sonars. Work is underway in TG-Noise and elsewhere, to address this issue.

In some areas, seal scarers have the potential to be a significant issue although there is no evidence as yet that it is one in the WBBK area. Since it may become an issue in the future, some regulation of their use now would be advisable.

The ICES noise register also allows for the calculation of pulse block days by time period (e.g. year) for each of the five categories of sources. A start on this has been made in the Western Baltic and Belt Seas (Figure 16). An example of how marine noise budgets might be examined is discussed in (Merchant et al., 2018). This method could usefully be adapted for use by HELCOM in the WBBK and Baltic areas, and more generally for the entire OSPAR area.

Of impulsive sound sources, pile driving during marine construction (for example of offshore wind turbines) has received much research attention in the last two decades. As noted in ASCOBANS (2012), During the construction phase of the Nysted wind farm in the Danish Western Baltic a strong decrease in harbour porpoise presence up to 10 km away from the construction site was found to have occurred (Carstensen et al., 2006). Subsequent monitoring of the operational phase showed that the negative effect persisted even after several years (Teilmann et al., 2009). Pile driving has generally been found to be the most disturbing activity during wind farm and other construction work, causing a decrease in porpoise density up to 17 km away, although porpoises appear to react differently at different sites and to sometimes come back to the area after construction has finished (Brandt et al., 2011; Dähne et al., 2013; Scheidat et al., 2011; Siebert et al., 2012; Tougaard et al., 2009). This probably depends on the nature of the construction activity, noise attenuation due to seabed features, prey availability, and the importance of the area to the porpoises, as well as the presence of other disturbance factors besides noise. Studies on the effectiveness of different mitigation measures have taken place in German waters in recent years. These include the use of gravity-based foundations or alternative installation procedures (Koschinski and Lüdemann, 2014), air bubble curtains (Dähne et al., 2017; Lucke et al., 2011), and acoustic deterrents such as seal scarers (Brandt et al., 2013).

The production of guidelines on the impacts of particular impulsive sound sources, and when new noisy activities can commence, have formed a series of publications as well as reports funded by the Danish Energy Agency. Noise sources include pile driving (Clausen et al., 2018; Danish Energy Agency, 2015; Nabe-Nielsen et al., 2018; Tougaard et al., 2015) and seismic surveys (Tougaard, 2016; van Beest et al., 2018). Tougaard & Dähne (2017) have emphasised the importance of consideration to frequency weighting in the context of underwater noise regulatory frameworks. Whether and how this is applied has significant implications, as indicated also from several reviews of noise exposure criteria (Finneran, 2016; Houser et al., 2017; NMFS (National marine Fisheries Service), 2016; Southall et al., 2007).

Continuous noise

For indicator 11.2, the trends of ambient noise measured in 1/3 octave bands centred at 63 and 125 Hz are to be monitored. In the Baltic marine region, the LIFE+ project called BIAS (Baltic Sea Information on the Acoustic Soundscape), running from September 2012 – August 2016, measured the ambient noise during 2014 and modelled monthly soundscape maps based on the measurements, data on AIS traffic and environmental covariates (www.bias-project.eu). In addition to the MSFD centre frequencies, BIAS also measured the ambient noise at 2 kHz, as a compromise between the hearing ranges of herring, seals and the harbour porpoise. Figure 18 shows the 38 recording stations used to monitor continuous noise.

The BIAS project produced soundscape maps in 2016, showing the underwater noise generated by commercial vessels, the major source of human-induced underwater noise in the Baltic Sea. The study area extended into the western Baltic and Belt Seas but not the Kattegat. Seasonal soundscape maps were produced for each of the demersal, pelagic and surface zones. These soundscape maps will serve as a baseline for the development of monitoring and assessment of ambient noise in this region. Figure 19 shows noise maps across the whole water column for the three centre frequencies, 63 Hz, 125 Hz, and 2 kHz.

It is important to note, however, that since porpoises are high frequency echolocators with a hearing range most sensitive above 15 kHz (maximum sensitivity c. 125 kHz) (Kastelein et al., 2015, 2002), the MSFD frequencies are unsuitable for assessing direct impact of continuous noise on this species (Dyndo et al., 2015; Hermannsen et al., 2014; Wisniewska et al., 2018). On the other hand, they may function as proxies for higher frequencies. The issue with higher frequencies of course is that they do not propagate very far from the source (just a few hundred metres at frequencies above 100 kHz), which means that a noise map may simply be a map of the location of the sources.

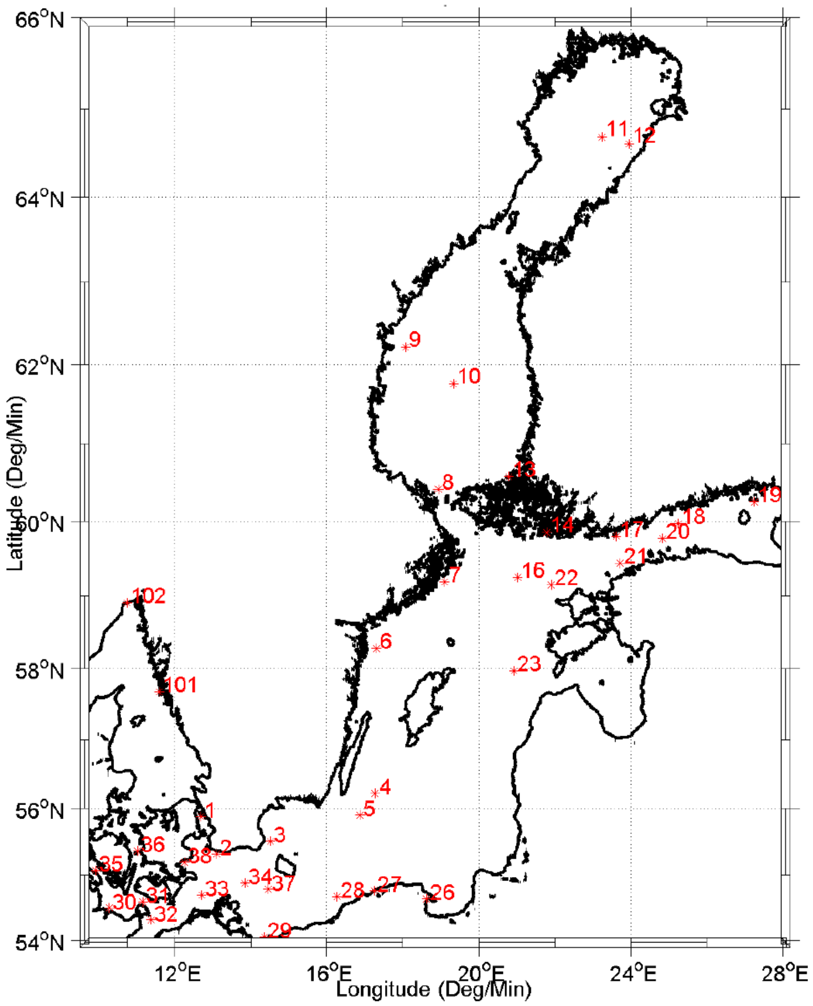

Figure 17. Baltic Sea Regional Map showing the positions of the acoustic measurements in the BIAS project. carried out by the BIAS Project (Source: Folegot et al., 2016)

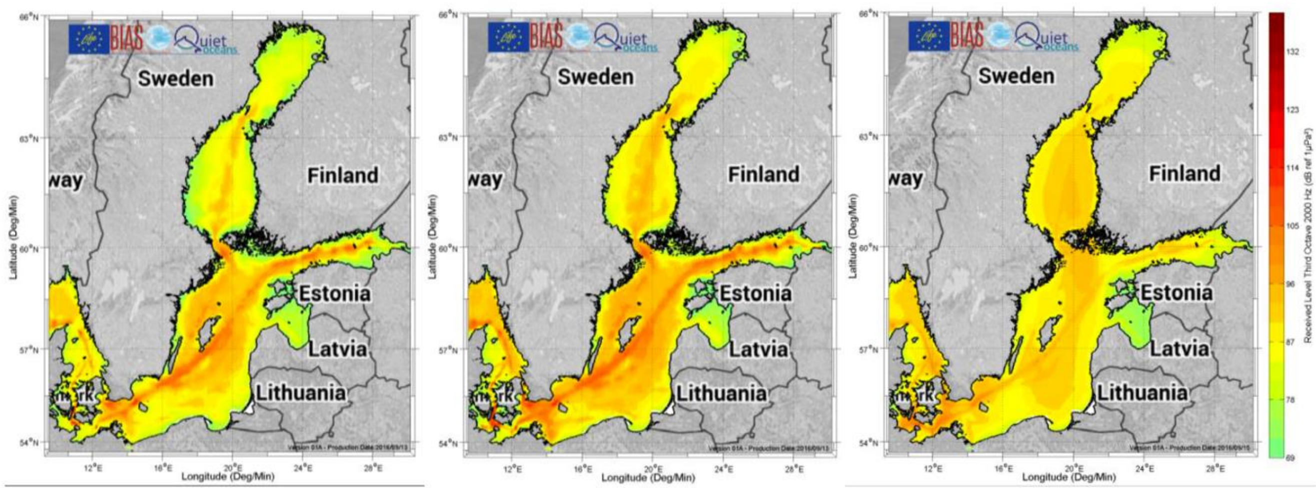

Figure 18. Annual median noise maps for the full water column for the 63 Hz third-octave (left), the 125 Hz third-octave (middle), and the 2kHz third-octave (right) (Source: Folegot et al., 2016)

Since the end of the BIAS Project, countries were asked to maintain at least some of their recording stations (Figure 17). In Sweden there are currently three stations: one on the Northern Midsea Bank in the Baltic Proper, and one at Hönö on the Swedish west coast, which have both been active since 2015. Monitoring was also started at another BIAS station in the Bothnian Bay in 2018. However, from approximately summer 2019 until summer/autumn 2020, there is a gap in monitoring, mostly due to the fact that there is no long-term planning or funding for this monitoring. In the Belt Seas, Denmark in 2018 increased the number of recording stations from one to four, and further to a total of six stations in 2019. Unfortunately, there is no Baltic-wide coordination, and although it is hoped that this can be done through the HELCOM expert network on underwater noise (EN NOISE) it is not yet happening. The BIAS data-sharing platform where monitoring data can be shared, has been adopted by ICES and will probably be launched in autumn 2020.

The BIAS project focused upon modelling shipping noise. which generates most sound at low frequencies, below 1 kHz. However, Hermannsen et al. (2014) using a broadband recording system in four heavily ship-trafficked marine habitats in Denmark, found that vessel noise from a range of different ship types substantially elevated ambient noise levels across the entire recording band from 0.025 to 160 kHz at ranges between 60 and 1000 m. These ship noise levels are estimated to cause hearing range reduction in harbour porpoises of >20 dB (at 1 and 10 kHz) from ships passing at distances of 1190 m and >30 dB reduction (at 125 kHz) from ships at distances of 490 m or less. They conclude that a diverse range of vessels produce substantial noise at high frequencies, where toothed whale hearing is most sensitive, and that vessel noise should therefore be considered over a broad frequency range, when assessing noise effects on porpoises and other small toothed whales. Ship noise extending to higher frequencies and thus potentially affecting toothed whales and dolphins has been reported also by other authors (see for example McKenna et al., 2012; Southall et al., 2017; Veirs et al., 2016; Williams et al., 2014). Of relevance to the porpoise in particular is that recreational craft are generally not equipped with AIS and so are un-monitored, yet those craft usually produce sounds at frequencies of 1-15 kHz. (Veirs and Veirs, 2005) found that recreational vessels on average increased background noise 5 – 10 dB higher than the average of large commercial ships. It would therefore be prudent to establish better ways to monitor these craft.

Whereas shipping noise is thought to have greatest potential effect upon baleen whales due to their good hearing at low frequencies, where ships produce most noise power, recent findings indicate significant energy also generated at medium- to high-frequencies. (Dyndo et al., 2015) conducted an exposure study inside Kerteminde harbour in the Danish Belt Sea where the behaviour of four harbour porpoises in a net-pen was logged while they were exposed to 133 mainly small or medium vessel passages. Using a multivariate generalised linear mixed-effects model, they showed that low levels of high frequency components in vessel noise elicit strong, stereotyped behavioural responses in porpoises. Since such low levels will routinely be experienced by porpoises in the wild at ranges of more than 1,000 metres from vessels, this suggests that vessel noise may be a substantial source of disturbance in shallow water areas where there are high densities of both porpoises and vessels.

Wisniewska et al. (2018) used animal-borne acoustic tags to measure vessel noise exposure and foraging efforts in seven harbour porpoises in highly trafficked coastal waters of Denmark. Tagged porpoises encountered vessel noise 17–89% of the time and occasional high-noise levels coincided with vigorous fluking, bottom diving, interrupted foraging and even cessation of echolocation, leading to significantly fewer prey capture attempts at received levels greater than 96 dB re 1 mPa (16 kHz third-octave). They postulated that if such exposures occur frequently, porpoises, with their high metabolic requirements (see for example Wisniewska et al., 2016), may be unable to compensate energetically leading to negative long-term fitness consequences. Bas et al. (2017) studied the effects of marine traffic on the behaviour of porpoises in the Istanbul Strait at the entrance to the Black Sea. This was significant in looking specifically at responses of porpoises to large ships under natural conditions. The observations indicated reaction ranges of some few hundred metres. Some years earlier, Evans et al. (1994) studying reactions of porpoises to different vessels in Shetland, found strong negative reactions to large ships at ranges of two kilometres. One might expect similar findings to occur in the presence of large vessels in the Baltic Sea Region.

In 2019, a decision was made to move a shipping lane in Kattegat closer to the Swedish coast. Since 2019, Aarhus university, the Swedish Defence Research Agency, the Swedish Museum of natural History and SLU Aqua have been cooperating in the TANGO study to gather before and after data in the area, to examine the effects of this move on harbour porpoise distribution. The shipping lane was moved on 1 July 2020, and data collection is still ongoing.

HELCOM work

Presently, shipping (continuous noise) and piling (impulsive noise) are considered to constitute the two major sources of underwater noise in the Baltic Sea. In the 2013 HELCOM Copenhagen Ministerial Declaration, it was agreed that the level of ambient and distribution of impulsive sounds in the Baltic Sea should not have a negative impact on marine life, and that human activities that are assessed to result in negative impacts on marine life should be carried out only if relevant mitigation measures are in place. Also, as soon as possible and by the end of 2016, using mainly already on-going activities, countries should have:

- established a set of indicators including technical standards which may be used for monitoring ambient and impulsive underwater noise in the Baltic Sea;
- encouraged research on the cause and effects of underwater noise on biota;
- mapped the levels of ambient underwater noise across the Baltic Sea;
- set up a register of the occurrence of impulsive sounds;
- considered regular monitoring on ambient and impulsive underwater noise as well as possible options for mitigation measures related to noise taking into account the ongoing work in IMO on non- mandatory draft guidelines for reducing underwater noise from commercial ships and in CBD context;

The indicator on impulsive noise was not included in HOLAS II as an operational indicator, but there is a chance that it could be fully operational for HOLAS III. The indicator on continuous noise seem to be further from being operational. The register of occurrence of impulsive sounds is up and running, hosted by ICES at http://ices.dk/data/data-portals/Pages/underwater-noise.aspx, see above. Some monitoring on underwater noise is in place with some of the BIAS stations being continued by some countries, see above. Mitigation of impulsive underwater noise is done for some events such as piling and detonations of unexploded ordinance, and there are guidelines for this in for example Germany, while in other countries the knowledge on possible mitigation techniques is limited. For continuous noise there are no mitigation measures in place except the IMO non-obligatory Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life (http://www.imo.org/en/MediaCentre/HotTopics/Documents/833%20Guidance%20on%20reducing%20underwater%20noise%20from%20commercial%20shipping%2C.pdf).

The aim of the Baltic underwater noise roadmap was to prepare a knowledge base towards a regional action plan on underwater noise to meet the objectives of the 2013 Ministerial Meeting. This action plan is now under development and is currently being discussed in HELCOM EN NOISE with the aim to bring it to HOD 59-2020.

By 2018, a review of sound sources and their impacts upon marine life had been made, along with a summary of potential underwater noise mitigation measures that could be employed for the different sound sources (HELCOM, 2018b). Harbour porpoise was identified as one of the priority species (along with harbour seal, ringed seal, grey seal, cod, herring and sprat). A map compiling noise sensitive areas derived from biological data on noise sensitive species so far identified has also been produced (see,

Figure 19), and incorporated in the latest version of the State of the Baltic Sea report (HELCOM, 2018b). An inventory of noise mitigating measures already used in the Baltic Sea region has been compiled (HELCOM, 2017b). The inventory shows that at least three countries (Germany, Denmark, Sweden) are implementing measures to reduce the impact of noise on the marine environment, i.e. by exclusion of noise generating activities for a certain time period or from certain areas, restriction of anthropogenic underwater noise to a certain level, and use of noise reducing techniques (Table 3).

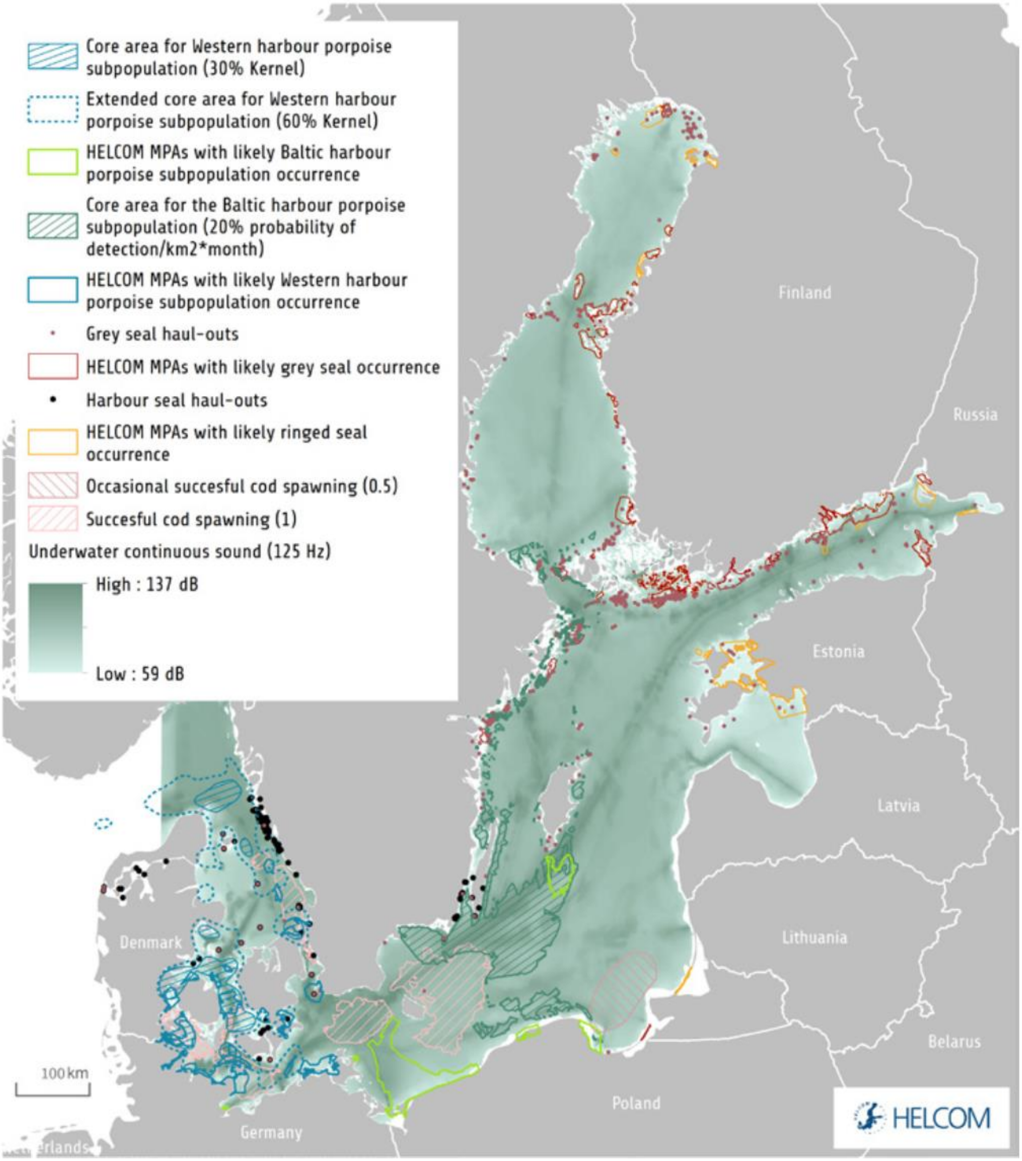

Figure 19. Example of how information on the distribution of sound can be compared with important areas for species that are sensitive to sound. The example shows areas identified so far (based on HELCOM, 2016). The soundscape shown is the sound pressure level (dB re 1uPa) for the 125 Hz frequency band occurring 5% of the time, for the whole water column (surface to bottom) in June 2014 (Source: HELCOM, 2018b).

Table 3. Summary of Progress made by countries within the Baltic Sea on noise mitigation actions (Source: Ruiz and Lalander, 2017)

Exclusion of noise generating activities for a certain time period	DK*, FI*, SE
Exclusion of wind farms in Nature Conservation Areas (Maritime Spatial Planning)	DE
Restriction of anthropogenic underwater noise to a certain level	DE, DK, SE
Exclusion of noise generating activities from certain areas (e.g. wind farms)	DE, SE
Spatio-temporal exclusion or limitation of noise causing activities	DK*, SE
Usage of alternative techniques	SE
Modification of operational state of noise source, e.g., reducing ship speed	SE
Refraining from applying activities (e.g. by refrain from using explosives when decommissioning offshore constructions)	SE
The environmental courts may impose any of these restrictions as conditions for granting a project license. For shipping over 500 tonnes, the Swedish Transport Agency may propose "Areas to be avoided" through the IMO. Two such areas were implemented in the Baltic in 2005. No speed restrictions for larger vessels have been proposed, though regional authorities have implemented coastal "Consideration Areas" which include speed restrictions for motorboats. The Swedish Armed Forces use a marine biological calendar when planning exercises to minimize environmental disturbance.	SE

**Potential measure*

It should be borne in mind that a comparison of progress across countries is not entirely straightforward. For example, the Danish legislation works differently from German legislation especially. It is not based on fixed exposure limits, but underwater noise must be included in any environmental impact assessment, and is thus part of the assessment for any new activity and project proposed. In fact, most countries operate a similar procedure to Denmark under EU regulations.

Key Conclusions and Recommendations *Underwater noise has the potential to be an important human stressor affecting porpoises and their habitat. It can cause a range of effects from the masking of sounds through behavioural responses affecting foraging or reproduction to actual physiological damage. Under the Marine Strategy Framework Directive, countries are obliged to monitor both continuous noise as produced by shipping, and impulsive noise from sources such as seismic, sonar, pile driving, seal scarers, and explosions. Some of this has started in the WBBK area, although there is still more to be done before one can establish that the region is in good environmental status.*

It is highly recommended that all countries that do not have national guidance documents on EIA procedures to assess noise impact on e.g. harbour porpoises, noise limits/thresholds and control programmes, should develop and implement such documents and programmes.

Summary status assessment of progress of the implementation of the plan

Table 4 provides a qualitative assessment of progress by each of the Member States on the various actions identified as priorities. Progress has been variable since the adoption of the plan in 2012. Some aspects (e.g. the monitoring of noise and understanding of the potential impacts of different sources) have received a lot of attention, whereas others (e.g. adequate monitoring to derive robust bycatch estimates, and implementation of effective mitigation measures to reduce bycatch) have made less progress.

Priority Recommendations

1) Monitor and estimate bycatch. Specifically estimate total annual bycatch
2) Set up stranding/reporting schemes and collection of stranded/bycaught animals in Denmark so that the number of necropsies can be increased
3) Put in place guidelines for underwater noise in the entire WBBK and Jastarnia areas, similar to those existing in the German North Sea
4) Continue studies to examine habitat exclusion and long-term effects of pinger deployments
5) Continue large-scale as well as national surveys and monitoring of abundance and distribution

Table 4. Summary of Progress in the Implementation of the Conservation Plan

	Actions from the WBBK Conservation Plan for HP	Priority		SE	DK	DE
1	**Implementation of the CP: co-ordinator and Steering Committee**	**High**		Co-ordinator for 2020		
2	**Actively seek to involve fishermen in the implementation of the plan and in mitigation measures to ensure a reduction in bycatch**	**High**		1	1	1
3	**Cooperate and inform other relevant bodies about the conservation plan**	**High**		0		
4	**Protect harbour porpoises in their key habitats by minimizing bycatch**	**High**		1	1	1
5	**Implement pinger use in fisheries causing bycatch**	**High**		1	1	1
6	**Replacement of high risk gillnets with alternative gear**	**High**		1	1	1
7	**Estimate total annual bycatch**	**High**	Estimate total annual bycatch	0	1	0
			Facilitate landings of bycaught harbour porpoises	1	1	1
8	**Estimate trends in abundance in the Western Baltic, the Belt Sea and Kattegat**	**High**	Population-wide surveys	1		
			Reg/survey	2	2	2
			Identify a survey interval for poulation-wide surveys	0		
9	**Monitoring population health status, contaminant load and causes of mortality**	**Medium**		2	0	3
10	**Ensure non-detrimental use of pingers by examining habitat exclusion and long-term effects of pingers**	**Medium**		1	1	0
11	**Include monitoring & management of important prey species in national HP management plans**	**Medium**		0	0	0
12	**Restore or maintain habitat quality**	**Medium**		1	1	0

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