HELCOM

Grey seal distribution

INDICATOR TYPE: Core
INDICATOR CATEGORY: State
BSAP SEGMENT: Biodiversity
MSFD CRITERIA: D1C4

Distribution of Baltic Grey seals

Table of contents

1 Key message

This core indicator evaluates the state of the marine environment based on the distribution of grey seal (*Halichoerus grypus*) in the Baltic Sea. The core indicator has three components: Breeding distribution, Moulting distribution and Area of occupancy (i.e. at-sea distribution and access to sites and foraging grounds). Good status is achieved when the distribution of grey seals is close to pristine conditions (e.g. 100 years ago), or where appropriate when currently available haul-out sites are occupied (modern baseline), and when no decrease in area of occupation occurs. The current evaluation covers the assessment period 2016-2021.

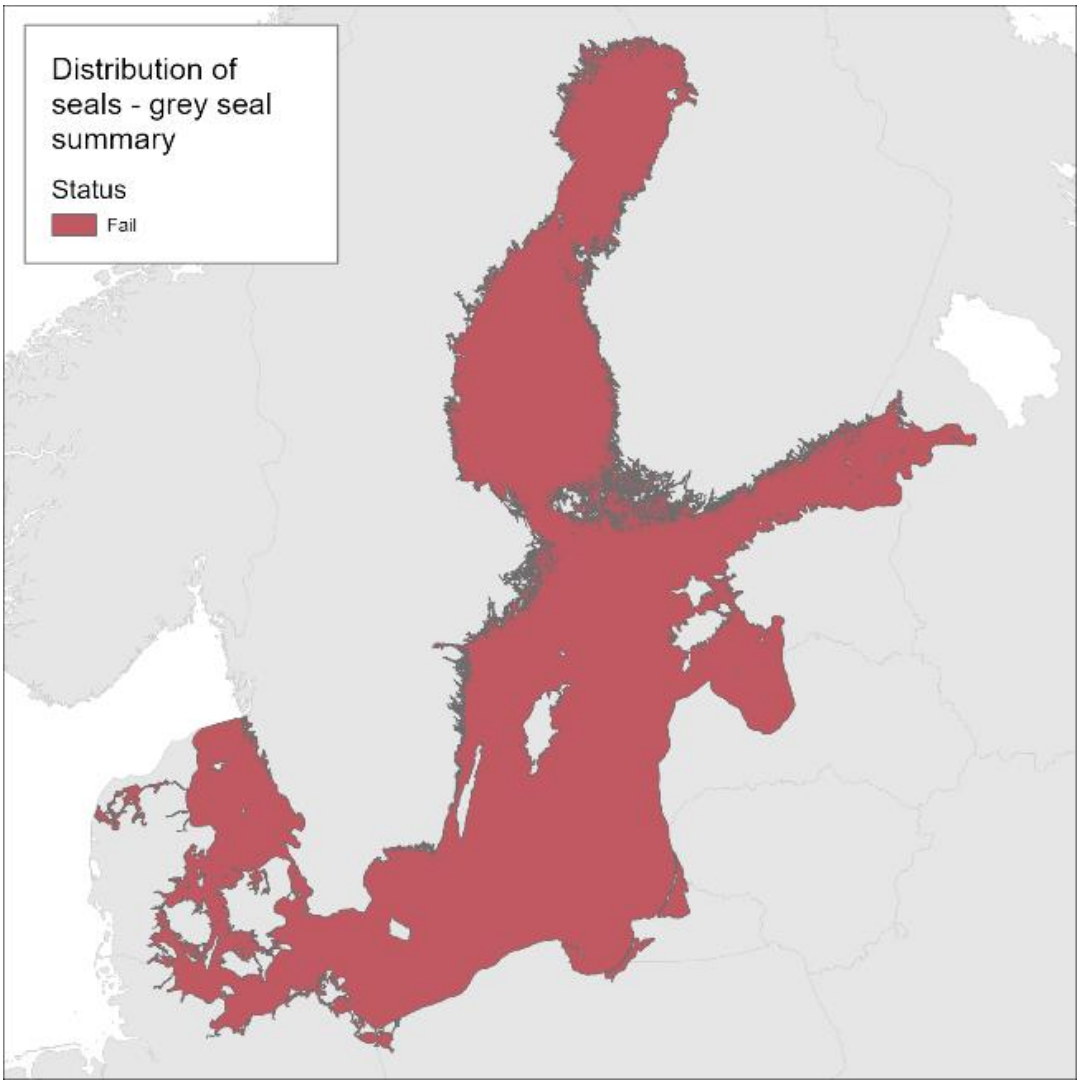

Figure 1. Status evaluation results based on evaluation of the indicator 'distribution of Baltic Seals' – Grey seal. The evaluation is carried out using grouping of scale 2 HELCOM assessment units (defined in the HELCOM Monitoring and Assessment Strategy Annex 4) to match with the range of the seal management unit. **See 'data chapter' for interactive maps and data at the HELCOM Map and Data Service.**

State of the Distribution of the Baltic Sea grey seal: The component Area of occupancy for grey seals achieves the threshold value for good status, since grey seals forage in the entire Baltic Sea. For the evaluation of land haul-outs, "modern baseline" is used since some haul-outs in the southern Baltic have vanished due to human exploitation of sand. Grey seals achieve the threshold in most areas of the Baltic except a few HELCOM assessment units in the southwestern areas. Arkona basin, Bay of Mecklenburg, Kiel Bay, Great Belt, the Sound and Kattegat fail for both Breeding and Moulting distribution and, in addition, Bornholm and Gdansk basins fail for Breeding distribution. Considering the one-out-all-out approach, the Baltic grey seal fails to achieve good environmental status for the Distribution.

1.1 Citation

The data and resulting data products (e.g. tables, figures and maps) available on the indicator web page can be used freely given that it is used appropriately and the source is cited. The indicator should be cited as follows:

HELCOM (2023) Distribution of Baltic seals – grey seals. HELCOM core indicator report. Online. [Date Viewed], [Web link].

ISSN 2343-2543.

2 Relevance of the indicator

2.1 Ecological relevance

The distribution of seals reflect changes in the number of marine top predators in the Baltic Sea. The distribution is affected by availability of suitable habitats, food and other resources, as well as anthropogenic disturbance. It is also affected by the abundance of seals since following a low phase in the abundance, the recolonization of depleted areas can take time.

Being top predators of the marine ecosystem, marine mammals are good indicators of the state of food webs, levels of hazardous substances and direct human disturbance. Seals are exposed to bottom-up effects of ecosystem changes at lower trophic levels, but also to variations in climate (length of seasons and ice conditions) and human impacts. These pressures can affect seals indirectly through for example the decline of fish stocks, the levels of harmful substances, the reproductive success in addition to causing direct mortality by hunting or by-catch. The vulnerability of seals to these pressures make them good indicators for measuring the environmental status of ecosystems.

This indicator is applicable over the whole Baltic Sea for the grey seal except Kattegat where a large proportion of the visiting grey seals originate to Atlantic population.

2.2 Policy relevance

The core indicator(s) on the distribution of Baltic seals addresses the Baltic Sea Action Plan (BSAP 2021) Biodiversity segment goal of a "Baltic Sea ecosystem is healthy and resilient". The following ecological objectives under this goal are also clearly relevant: 'Viable populations of all native species', 'Natural distribution, occurrence and quality of habitats and associated communities', and 'Functional, healthy and resilient food webs'.

The HELCOM Recommendation 27/28-2 Conservation of seals in the Baltic Sea area outlines the conservation goals of seals agreed under HELCOM. The recommendation is implemented to reach the BSAP goals. The recommendation conservation goals are used as the basis for defining this indicator's threshold value.

The indicator also has clear relevance for the EU Marine Strategy Framework Directive (MSFD), for those Contracting Parties that are also EU Member States. In particular the relevance is high for the MSFD Descriptor 1 that addresses species and habitats and also for Descriptor 4 that addresses ecosystems, including food webs.

A summary overview of policy linkages is provided in Table 1, below.

In some Contracting Parties, the indicator also has potential relevance for implementation of the EU Habitats Directive. The WFD includes status categories for coastal waters as well as environmental and ecological objectives. The EU Habitats Directive (European Commission 1992) specifically states that long-term management objectives should not be influenced by socio-economic considerations, although they may be considered during the implementation of management programmes provided the long-term objectives are

not compromised. All seals in Europe are also listed under the EU Habitats Directive Annex II, and Member States are obliged to monitor the status of seal populations.

Table 1. Overview of policy relevance for this indicator.

	Baltic Sea Action Plan (BSAP)	**Marine Strategy Framework Directive (MSFD)**
Fundamental link	Segment: Biodiversity Goal: "Baltic Sea ecosystem is healthy and resilient" • Ecological objective: "Viable populations of all native species ", and "Natural distribution, occurrence and quality of habitats and associated communities". • Management objective: "Effectively managed and ecologically coherent network of marine protected areas ", "Minimize disturbance of species, their habitats and migration routes from human activities"; "Effective and coordinated conservation plans and measures for threatened species, habitats, biotopes, and biotope complexes".	Descriptor 1 Species groups of birds, mammals, reptiles, fish and cephalopods. • Criteria 4 The species distributional range and, where relevant, pattern is in line with prevailing physiographic, geographic and climatic conditions. • Feature – Species groups (seals). • Element of the feature assessed – Species lists (grey seals).
Complementary link	Segment: Biodiversity Goal: "Baltic Sea ecosystem is healthy and resilient" • Ecological objective: "Functional, healthy and resilient food webs". • Management objective: "Reduce or prevent human pressures that	Descriptor 1 Species groups of birds, mammals, reptiles, fish and cephalopods. • Criteria 2 The population abundance of the species is not adversely affected due to anthropogenic pressures, such that its long-term viability is ensured. • Feature – Species groups (seals). • Element of the feature assessed – Species lists (grey seals).

	lead to imbalance in the foodweb". Segment: Hazardous substances and litter goal Goal: "Baltic Sea unaffected by hazardous substances and litter" • Ecological objective: "Marine life is healthy". • Management objective: "Minimize input and impact of hazardous substances from human activities".	Descriptor 4 Ecosystems, including food webs. • Criteria 4 Productivity of the trophic guild is not adversely affected due to anthropogenic pressures. • Feature – Species groups (seals). • Element of the feature assessed – Trophic guilds. Descriptor 8 Concentrations of contaminants are at levels not giving rise to pollution effects. • Criteria 2 The health of species and the condition of habitats (such as their species composition and relative abundance at locations of chronic pollution) are not adversely affected due to contaminants including cumulative and synergetic effects. • Feature – Species (seals). • Element of the feature assessed – Species lists (seals). •
Other relevant legislation:	In some Contracting Parties also EU Water Framework Directive – Chemical quality, Habitats Directive UN Sustainable Development Goal 14 (Conserve and sustainably use the oceans, seas and marine resources for sustainable development)	

2.3 Relevance for other assessments

The results of the Distribution of Baltic seals – Grey seals is utilised in the HELCOM Biodiversity integrated assessment (BEAT tool) to support an overall evaluation of marine mammals.

This HELCOM core indicator is comparable to the OSPAR common indicator M-1; 'Distributional range and pattern of harbour and grey seal haul-outs and breeding colonies', which also applies a modern baseline approach. The difference between the OSPAR 'common indicator' and the HELCOM 'core indicator' is that the latter also encompasses the range of seals at sea during foraging and transport.

3 Threshold values

Good status reflected through the distribution of seals in the Baltic Sea is based on concepts developed for the conservation of seals. The concept for defining threshold values to indicate good status is derived from the general management principle in the HELCOM Recommendation 27/28-2, which states the aim to allow breeding seals to expand to suitable breeding distribution in all regions of the Baltic Sea.

Good status is achieved when the threshold values for all considered parameters are achieved. Good status is achieved when the distributions of seals are close to pristine conditions (e.g. 100 years ago), or where appropriate when all currently available haul-out sites are occupied (modern baseline), and when no decrease in area of occupation occurs. Three different parameters of distribution are given for all species of seals:

1) Breeding distribution on land or ice,

2) Moulting distribution on land or ice, which refers to haul-outs used for moulting and resting and

3) Area of occupancy, which includes sea areas used for transport and foraging.

3.1 Setting the threshold value(s)

The following criteria are used to evaluate whether the threshold value is achieved or failed:

- Breeding distribution: grey seals are facultative land breeders that partially switch between breeding on land and ice, where ice is favoured if available (Jüssi *et al.* 2008). The threshold value is achieved when available land breeding sites are colonized, and distribution is not diminishing.
- Moulting distribution: the islands grey seals select for moulting and resting are partially different from breeding islands and areas on ice used for breeding. The threshold value is achieved when available haul-out sites are colonized and not diminishing.
- Area of occupancy: the threshold value is achieved when seals have access to all feeding grounds and they can move freely among haul-out sites as well as feeding grounds.

The modern baseline approach is applied for grey seal distribution since formerly used haul-out sites have disappeared in the southern Baltic as a consequence of exploitation of sand for industrial use. This type of a modern baseline should be defined so that the species will thrive and persist in the future.

4 Results and discussion

The results of the indicator evaluation that underlie the key message map and information are provided below.

4.1 Status evaluation

The Baltic grey seal population is evaluated as one unit covering the whole Baltic.

Overall evaluation

The population achieves the threshold for the area of occupancy, but not for the breeding and moulting distributions. As a result, Baltic grey seal fail to achieve good environmental status for the indicator Distribution of Baltic seals (Figure 6).

Moulting distribution

In most of the Baltic sea, grey seals are observed at all the historical on-land haul-out areas. However, in the southwestern range of the distribution, specifically the Arkona basin, Bay of Mecklenburg, Kiel Bay, Great Belt, the Sound and Kattegat, some historical moulting haulouts are still unoccupied. In HOLAS II, the subbasins within the Baltic were evaluated separately for distribution. For this current evaluation, the population is evaluated as one unit. As such, Baltic grey seals do not achieve good environmental status for moulting distribution.

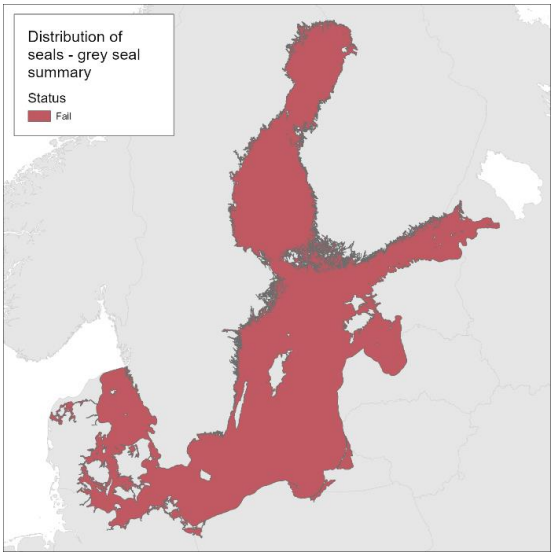

Figure 6. Overall status of Distribution of Baltic seals – grey seal. Grey seals in the Baltic are evaluated as one management unit. Grey seals have not yet occupied all the available and historically used breeding and moulting/resting haulouts in parts of the Distribution area. Therefore they do not achieve good environmental status for the Distribution indicator.

Breeding distribution

The grey seals are expected to use the historical breeding areas in the core of their distribution, although there is no coordinated monitoring of breeding-sites across the Baltic. However, it is clear that they have not yet occupied parts of available sites in The Sound, Great Belt, Bay of Mecklenburg, Arkona Basin, Bornholm Basin, Gdansk Basin and Kattegat. There is no monitoring of breed on ice and the extent to which it occurs in relation to on-land breeding is unknown. As a result, Baltic grey seals do not achieve good environmental status for Breeding distribution.

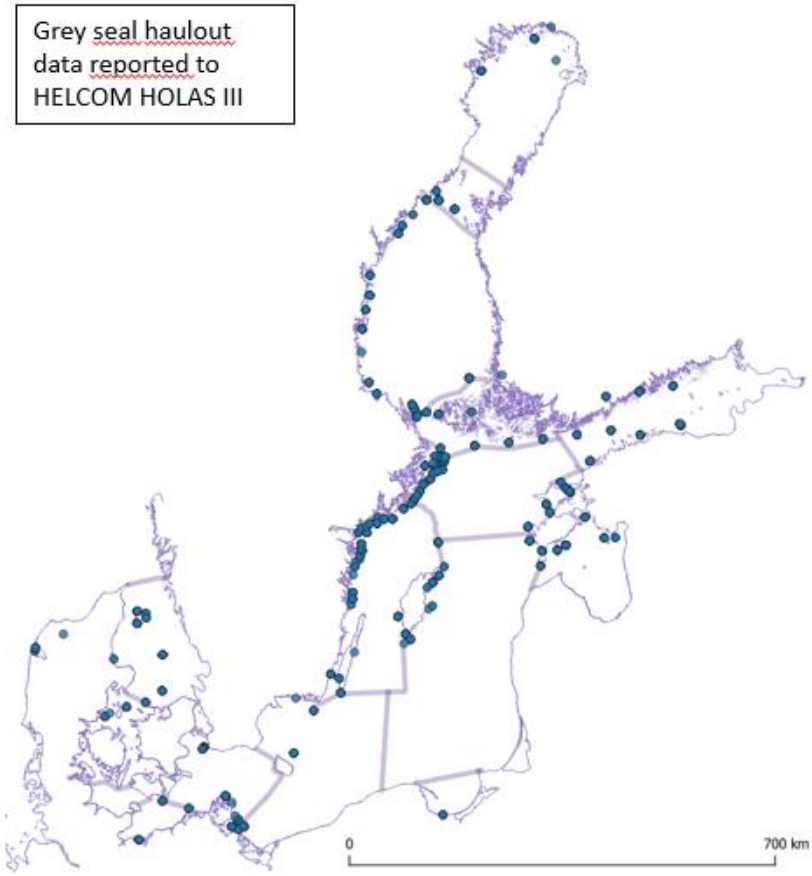

Figure 7. Distribution of grey seal moulting haulouts in the Baltic Sea according to the data reported to HELCOM HOLAS 3. The map includes all currently known haul-out sites, but their geographical accuracy varies from exact locations to 10*10 km grid cells depending on the countries reporting the data. Grey seals have not yet recolonized all the historically known breeding and moulting haul-out sites in southwestern Baltic.

Area of Occupancy evaluation

The area of occupancy encompasses the entire Baltic Sea ecosystem and grey seals can freely access sites and foraging grounds. Although there is no structured monitoring of at sea occupancy, the occupancy was evaluated in HOLAS 3 based on data collected from satellite tracking devices that show seals behaviour and movements at sea. Based on these data, it was evident that they forage and travel in the entire Baltic Sea, although no haul-out sites occur along the Latvian and Lithuanian coasts (Figure 8). There is no

evidence to show that this behaviour has changed in 2016-2021 or that there are any impediments to the grey seal movements at sea. Although we do not have data showing movements of grey seals in all basins, we are also not aware of any barriers for them to move freely among foraging grounds and haul-outs. As such, Baltic Grey seals are evaluated as having achieved good status with regard to area of occupancy.

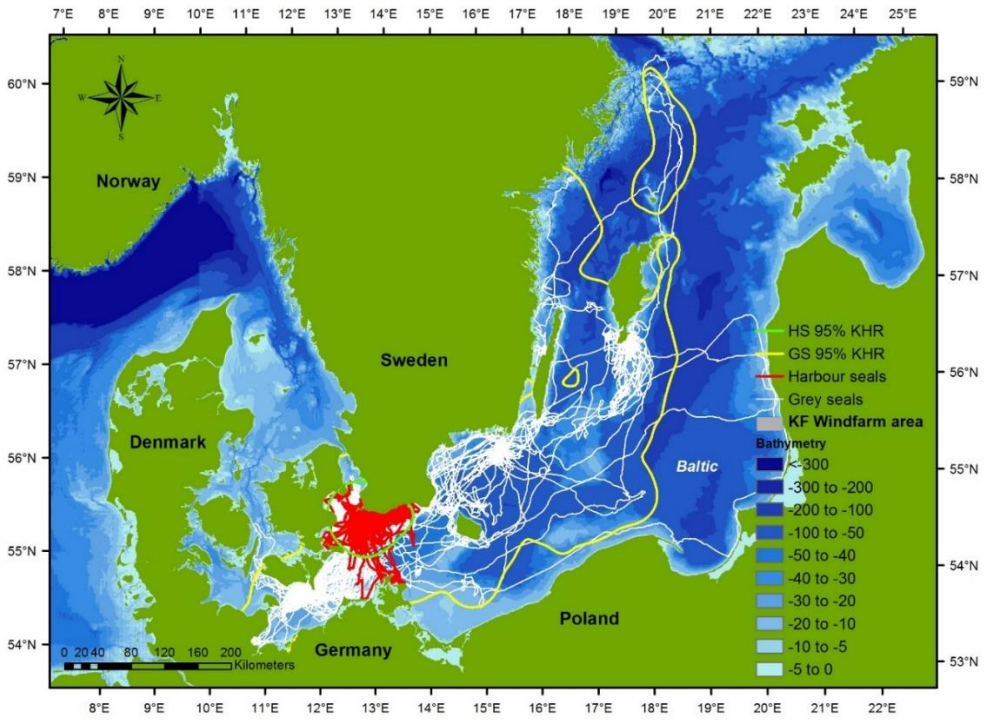

Figure 8: Movements of grey seals (white) and harbour seals (red) tagged with GSM transmitters at Måkläppen in Southern Sweden. Grey seals travel extensively in the Baltic whereas harbour seals are more sedentary.

4.2 Trends

Covered in section 4.1.

4.3 Discussion text

Changes in the status of the distribution come from improved knowledge in some areas and most importantly from the change in the resolution of the evaluation. In HOLAS II grey seal distribution was evaluated by HELCOM assessment units, and then all units with the exception of the SW Baltic achieved good environmental status. In HOLAS 3 grey seal distribution is evaluated as one unit, similarly to the abundance and trends –indicator for the same species (Table 2).

Table 2. Status of the evaluation per assessment unit.

HELCOM Assessment unit name	Threshold value achieved/failed	Distinct trend between current and previous evaluation.	Description of outcomes, if pertinent.
Baltic Sea	Failed	Even though the indicator failed to achieve its threshold value the trends for distribution are stable between this and previous evaluation.	Indicator evaluation failed to achieve the threshold value in many areas primarily due to the change in scale of the evaluation and the "One out-all out" rule. In the areas where the distribution is not considered to achieve the threshold value this is primarily due to long natural recovery times, not a direct deterioration of status.

5 Confidence

The confidence for distribution of Baltic grey seals is considered to be high overall. All moulting sites are monitored annually. Monitoring of breeding sites does not cover all of the Baltic Sea, but the existing regular monitoring shows historical breeding sites which are not yet reoccupied. For area of occupancy there are no barriers for grey seals to move freely among their foraging grounds and haul-outs.

The indicator is applicable in the waters of all the countries bordering the Baltic Sea since the indicator includes all species of seal that occur in the Baltic Sea and since at least one of the species occurs in each HELCOM assessment unit. Distributions of different species encompass the entire Baltic ecosystem, although evaluations for individual species have non-applicable areas.

6 Drivers, Activities, and Pressures

Historically, hunting of seals has been a major human pressure on all the seal species in the Baltic Sea. A coordinated international campaign was initiated in the beginning of the 20th century with the aim of exterminating the seals (Anon 1895). Bounty systems were introduced in Denmark, Finland and Sweden over the period 1889-1912, and very detailed bounty statistics provide detailed information on the hunting pressure. The original population sizes were about 80,000 for Baltic grey seals.

The hunting pressure resulted in extirpation of grey and harbour seals in Germany and Poland in 1912, and grey seals were also extirpated from the Kattegat by the 1930s. Baltic grey seals were reduced to about 20,000 in the 1940s (Harding & Härkönen 1999).

In the beginning of the 1970s Baltic grey seals were observed aborting near full term foetuses (Helle 1980). Investigations showed a linkage to a disease syndrome including reproductive disorder, caused by organochlorine pollutions (Bergman & Olsson 1985). The reduced fertility resulted in population crashes, where numbers of grey seals dwindled to approximately 3,000 in the beginning of the 1980s (Harding & Härkönen 1999).

General hunting of grey seals was prohibited in 1974 and protective hunting in 1986. This, combined with a ban on PCBs and DDTs stopped the decline of the seal populations and supported growth. Recent samples show that fertility is normal in grey seals (Bäcklin *et al.* 2011; Bäcklin *et al.* 2013). Protective hunting was resumed again in 1997 in Finland and in 2001 In Sweden. Sweden introduced licence hunting for grey seals in 2020 and in Finland grey seal hunt has been run by regional quota only since 2014. Numbers of grey seals that have been allowed to be hunted with these varying regulations in Sweden and Finland have increased from c. 500 seals in the early 2000's to c. 3500 in 2022. Estonia licences grey seals hunting since 2015, the annual hunting quota has been between 37-55 animals.

Increased hunting pressure in certain areas has been observed to affect grey seals behaviour. In Stockholm archipelago number of grey seals observed in the moulting time surveys have dropped dramatically in recent years along with increased hunting in the area. At the same time increased numbers have been observed in Finnish SW archipelago, which does not, however, explain all of the decrease in the Stockholm archipelago. Although a certain causality between these changes cannot be shown, this may be an example of effect of disturbance on distribution of seals. Consequences of hunting in the most remote areas can be unwanted if the seals move to areas where they can cause more issues when interacting with fisheries.

A large proportion of haul-out sites of Baltic seals are protected during the breeding and moulting season when they are vulnerable to disturbance. This is especially important for grey seals, where access to undisturbed land breeding sites delimit the expansion of grey seals in the Southern Baltic Sea. However, the land-breeding sites in the Baltic have not been fully identified and current ice-breeding distribution is not fully understood. They differ somewhat from the haul-out sites during moulting.

Table 3. Brief summary of relevant pressures and activities with relevance to the indicator.

	General	**MSFD Annex III, Table 2a**
Strong link	The main pressures affecting the distribution of Baltic seal populations include hunting, by-catches, disturbance and destruction of haul-out sites.	Biological - Disturbance of species (e.g. where they breed, rest and feed) due to human presence. - Extraction of, or mortality/injury to, wild species (by commercial and recreational fishing and other activities).
Weak link	The effects of climate change are influencing the breeding of grey seal on sea ice. Fishery and food availability.	Substances, litter and energy - Input of other substances (e.g. synthetic substances, non-synthetic substances, radionuclides).

7 Climate change and other factors

Grey seals are facultative ice breeders and their breeding success is considerably greater when they breed on ice as compared with land (Jüssi *et al.* 2008). In the southern Baltic, projected sea level rise would flood many or all haul-outs used by grey seals (Meier *et al.* 2022). However, effects of climate change should not be included in evaluations according to the Habitat Directive.

8 Conclusions

Baltic grey seals fail to achieve good environmental status for the Distribution indicator.

8.1 Future work or improvements needed

There is currently no coordinated monitoring of on-land breeding sites for grey seals across the Baltic Sea. These sites are likely to become increasingly important as the effects of climate change impact the range and extent of ice coverage.

Recent breeding distribution on ice is poorly known, as well as which proportion of the animals are breeding on ice when it is available. A coordinated survey during a good ice year would be desirable.

There is also no coordinated monitoring of at-sea occupancy. Efforts to tag seals are costly and involve a high degree of time and logistics and thus structured monitoring of occupancy in the Baltic is unlikely to be feasible.

9 Methodology

9.1 Scale of assessment

This core indicator evaluates the distribution of Baltic Sea grey seal using HELCOM assessment unit scale 2 (division of the Baltic Sea into 17 sub-basins). The assessment units are defined in the HELCOM Monitoring and Assessment Strategy Annex 4.

The existing management plans for seals operate according to management units that are based on the distribution of seal populations. The management units typically encompass a handful of HELCOM scale 2 assessment units. Evaluations are therefore done by grouping HELCOM assessment units to align with the management units defined for each seal population.

The assessment of grey seals is carried out as one unit covering all of the Baltic except Kattegat.

9.2 Methodology applied

Monitoring methodology:

HELCOM common monitoring relevant for the distribution of seals is documented on a general level in the HELCOM Monitoring Manual in the sub-programme: Seal abundance.

HELCOM monitoring guidelines for seals were adopted in 2018 and currently all monitoring guidelines are being reviewed for inclusion in the Monitoring Manual.

Grey seals are monitored at their haul-outs on land during their annual moulting season and in many regions during pupping seasons, with the aim of estimating the abundance and trends (moulting counts) and pup production (pupping counts). The monitoring is performed using aerial surveys during the relevant periods.

Detailed descriptions of the survey methodology and analysis of results are given in the HELCOM Monitoring guidelines .

As there is no systematic monitoring of distribution at sea, this part of the assessment relies on ad-hoc telemetry projects and expert judgment.

Current monitoring:

The monitoring activities relevant to the indicators that are currently carried out by HELCOM Contracting Parties are described in the HELCOM Monitoring Manual in the Monitoring Concept Table.

Sub-programme: Seal Abundance
Monitoring Concept Table

Current monitoring covers all haul-out sites presently used by seals in the Baltic Sea and is considered to be sufficient to cover the needs of the indicator except for southern ringed seals. See description in the Assessment Requirements of the HELCOM Monitoring Manual.

It should however be noted that there is currently no systematic monitoring of distribution at sea. This part of the evaluation relies on ad hoc telemetry projects and expert judgment.

10 Data

The data and resulting data products (e.g. tables, figures and maps) available on the indicator web page can be used freely given that it is used appropriately and the source is cited as following:

HELCOM (2023) Distribution of Baltic seals. HELCOM core indicator report. Online. [Date Viewed], [Web link]. ISSN 2343-2543.

The national survey data is compiled annually by the HELCOM Expert Group on Marine Mammals (EG MAMA). A regional database has been developed and is hosted at the HELCOM Secretariat. Itincludes detailed spatial information and is to be updated annually prior to HELCOM Expert Group on Marine Mammals meetings. The database is managed by the HELCOM Secretariat having responsibility for updating and storing data provided by the HELCOM Expert Group on Marine Mammals.

Status evaluations are to be accomplished by the Lead and co-Lead countries. The outcome of such evaluations will be presented and discussed at future HELCOM Expert Group on Marine Mammals meetings.

Result: Distribution of Baltic seals - Grey seal

Data: Distribution of Baltic seals - Grey seal

11 Contributors

This indicator report for HOLAS 3 was prepared by Markus Ahola, Anders Galatius and Anja Carlsson.

The evaluation principles, methodology and background information are largely based on the previous evaluation report by Tero Härkönen, Anders Galatius, Karin Hårding, Olle Karlsson, Markus Ahola, Lena Avellan, Petra Kääriä, Morten Tange Olsen.

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12 Archive

This version of the HELCOM core indicator report was published in April 2023:

The current version of this indicator (including as a PDF) can be found on the HELCOM indicator web page.

Earlier versions of this indicator can be found at:

Distribution of Baltic seals HELCOM core indicator 2018 (pdf)

HOLAS II component - core indicator report July 2017 (pdf)

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