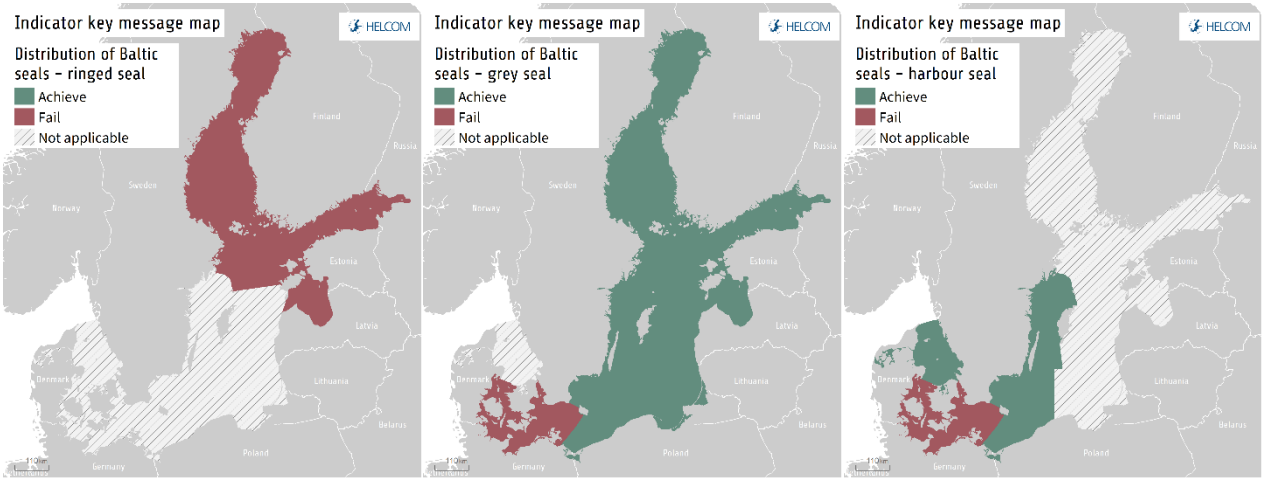
HELCOM core indicator report
July 2018

Distribution of Baltic seals

Key Message

This core indicator evaluates the state of the marine environment based on the distribution of the three species of seals that occur in the Baltic Sea. The core indicator has three components for each species: distribution of haul-out sites, breeding sites, and foraging areas. Good status is achieved when the distribution of 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 2011-2016.



Key message figure 1. Status assessment results based on evaluation of the indicator 'distribution of Baltic Seals' – Ringed seal (left), Grey seal (centre) and Harbour seal (right). The assessment is carried out using grouping of scale 2 HELCOM assessment units (defined in the HELCOM Monitoring and Assessment Strategy Annex 4). **Click here to access interactive maps at the HELCOM Map and Data Service: ringed seal, grey seal and harbour seal.**

State of ringed seals: The state of distribution of ringed seals is not good since the area of occupancy is currently more restricted compared to pristine conditions in the four applicable areas where ringed seals occur for breeding and moulting, namely the Bothnian Bay, Archipelago Sea, Western Estonia (Gulf of Riga and Estonian coastal waters), and the Gulf of Finland. Breeding distribution is confined to suitable breeding ice in all subpopulations (Key message figure 1, and results section).

State of the Baltic grey seal: Kattegat grey seals are not evaluated because a modern baseline cannot be defined, and because the vast majority of grey seals in this area are visitors from the North Sea (Fietz et al. 2016). The area of occupancy of grey seals achieves the threshold value and indicates good status since grey seals forage in the entire Baltic. A "modern baseline" is used for the evaluation of distribution on land sites, since some haul-outs in the Southern Baltic have vanished due to human exploitation of sand. Grey seals achieve the threshold value and indicates good status in most of the Baltic except for the Southwestern areas (Arkona basin, Bay of Mecklenburg, Kiel Bay, Great Belt and the Sound) (Key message figure 1).

State of harbour seals: The state of distribution of harbour seals achieves the threshold value and indicates good status in Kattegat and Limfjord where the distribution and area of occupancy are at pristine levels. Harbour seals in most parts of the Baltic Sea are distributed on historically used sites, however the status is not good for some areas of Denmark, since although the area of occupancy are at pristine levels, some land sites are not used and thus the threshold value is failed in the Western Baltic (Arkona basin, Bay of Mecklenburg, Kiel Bay, Great Belt and the Sound). In the Kalmarsund the harbour seals are distributed among available land breeding sites, and sites used for moulting, but the area of occupancy is not known (Key message figure 1).

Confidence of the indicator evaluation is considered to be **moderate** for ringed seals and **high** for grey and harbour seals, in the applicable assessment units.

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, however no haul-out sites currently occur in Latvia and Lithuania.

Relevance of the core indicator

Marine mammals are top predators of the marine ecosystem and good indicators for the state of the food web, contamination by hazardous substances, and direct and indirect human disturbance.

Policy relevance of the core indicator

	BSAP segment and objectives	MSFD Descriptor and criteria
Primary link	Biodiversity • Viable populations of species	D1 Biodiversity D1C4: The species distributional range and, where relevant, pattern is in line with prevailing physiographic, geographic and climatic conditions
Secondary link	Hazardous Substances • Healthy wildlife	D1 Biodiversity D1C2: The population abundance of the species is not adversely affected due to anthropogenic pressures, such that its long-term viability is ensured. D4 Food-web D4C4: Productivity of the trophic guild is not adversely affected due to anthropogenic pressures D8 Contaminants D8C2: The health of species and the condition of habitats are not adversely affected due to contaminants including cumulative and synergetic effects
Other relevant legislation: In some Contracting Parties also EU Water Framework Directive – Chemical quality, Habitats Directive		

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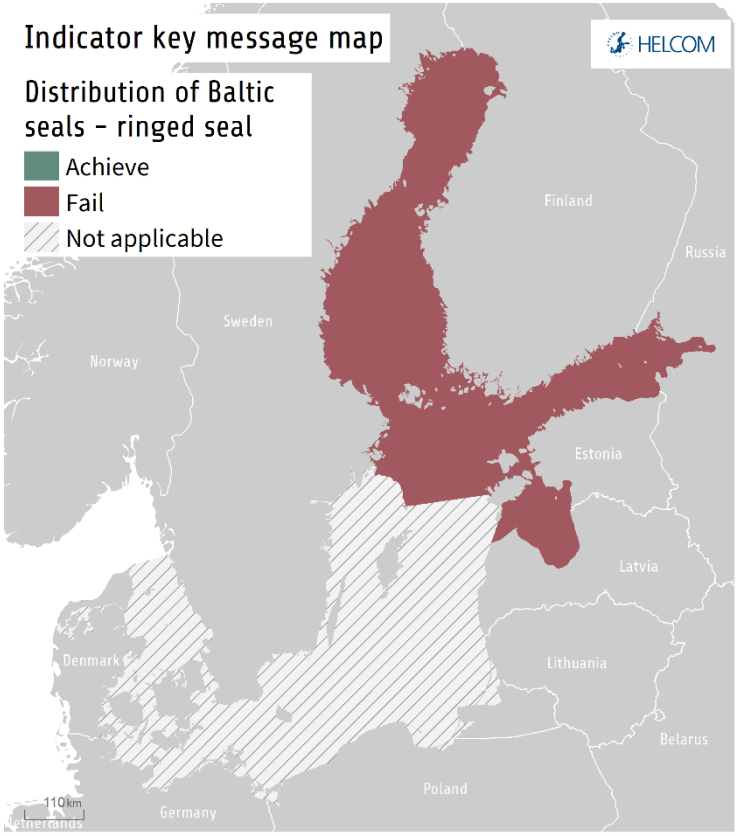
Results and Confidence

Ringed seal

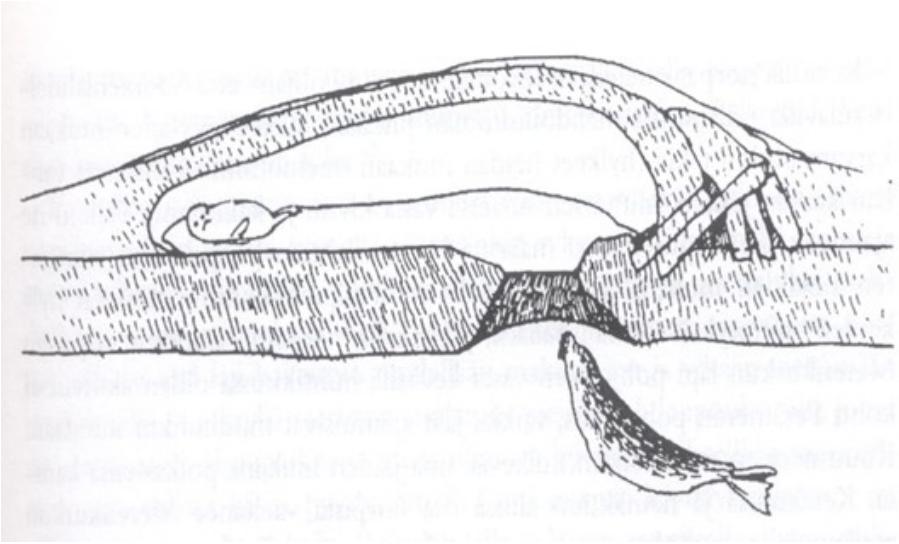
In breeding and moulting times the ringed seal occurs in the Bothnian Bay, Archipelago Sea, Western Estonia (Gulf of Riga and Estonian coastal waters), and the Gulf of Finland. Breeding distribution is confined to suitable breeding ice in all subpopulations. Currently the area of occupancy is more restricted compared to pristine conditions, and thus the status of ringed seal distribution does not achieve the threshold value and indicates not good status (Results figure 1).



Result figure 1. Status evaluation outcome for ringed seal distribution.

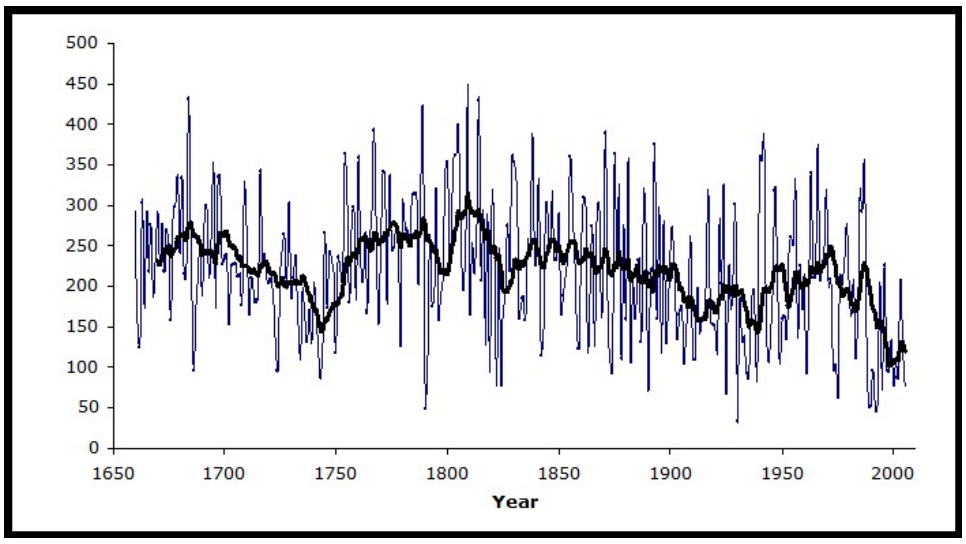
Distribution during breeding and moult

The winter distribution of ringed seals is tightly linked to the extent of sea ice fields suitable for building lairs (Results figure 2). Highest concentrations of seals are seen in broken consolidated ice that trap snow heaps. Females give birth to their pups in the lairs, which protect the pups against the elements and predators. Formation of this type of ice is critical for the breeding success of this species.



Results figure 2. Access to broken consolidated sea ice is critical for ringed seal breeding success (Sundqvist et al. 2012).

The extent and quality of ice show considerable inter-annual variation, but there has been a significant reduction of the formed sea ice area since the 1970s, when compared to historical data (Results figure 3). Climatological modelling shows that the situation is predicted to result in diminishing ice fields and shorter ice covered seasons in the future. This will likely result in the extirpation of the ringed seal sub-population in the Gulf of Riga and severely reduce the population growth rate in the Gulf of Finland and the Bothnian Bay (Sundqvist et al. 2012).



Results figure 3. Extent of maximum annual sea ice fields in thousands of square km since 1650 (Sundqvist et al. 2012). A significant drop occurred after 1970. Predicted future changes will reduce suitable breeding ice for ringed seals and grey seals.

Ringed seals have been surveyed during moult via aerial surveillance since 1988 in the Bothnian Bay, and the distribution has been very similar when ice fields extended down to the northern Quark area. Highest concentrations have always been in the central northern part of the Bothnian Bay (Results figure 4), which is similar to the situation in 1930 (Olofsson 1933). In 1996 also the Gulf of Finland and the Gulf of Riga were covered by ice, permitting the first comprehensive survey of ringed seals in the entire Baltic (Results figure 4). In years when ice fields are more limited the distribution of seals also changes.

Results figure 4. Winter distribution of ringed seals hauled out on ice during the 18th to 25th of April 1996, when ice fields extended to the northern Quark area in the Bothnian Bay, much of the Gulf of Finland and the Gulf of Riga.

The breeding distribution is identical to the distribution during moult in years when the ice fields are vast and remain intact up to late April. However, when ice fields break up early, ringed seals show a completely different pattern of distribution and gather in larger groups along ice cracks or leads, and when ice is scarce they haul out on rocks. Consequently, ringed seal breeding distribution is closely linked to the extent and composition of the ice cover, which has deteriorated over the past four decades and is predicted to do so also in the future.

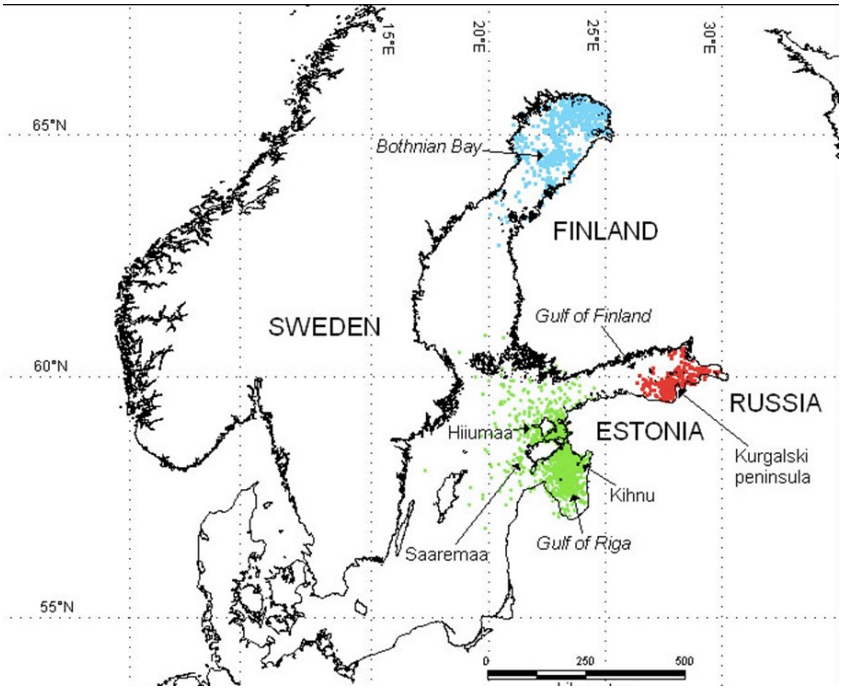
Since breeding and moulting areas are being reduced, ringed seals cannot be seen as having achieved good status as the threshold value is failed in this evaluation.

Distribution during the ice free period

Some Baltic ringed seals have been equipped with satellite transmitters which have provided data on distribution during the ice free period as well as area of occupancy. During the summer, ringed seals spend about 85% of their time in water - feeding, travelling and resting. Studies have shown that ringed seals mainly stay in the basins where they were tagged (Results figure 5; Härkönen et al. 2008), although some animals can move long distances (Oksanen et al. 2015).

Data from data loggers also show that ringed seals regularly return to the same rocks to haul out during the night. The distribution of these haul-out sites is well known in Estonia and Russia, but not to the same extent in Sweden and Finland.

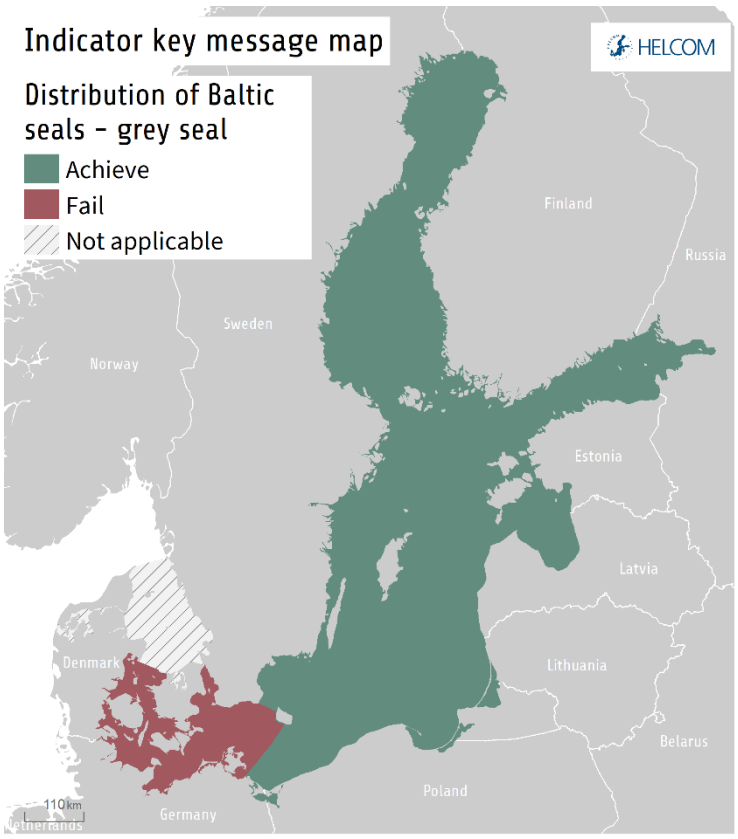
Ringed seals have free access to haul-out sites and foraging areas, which is why they can be evaluated as having achieved the threshold value and indicating good status with regard to area of occupancy.



Results figure 5. Positions of ringed seals tagged with satellite transmitters in the Bothnian Bay (blue), the Gulf of Finland (red), and Estonian coastal waters (green) during the ice free period of the year.

Grey seal

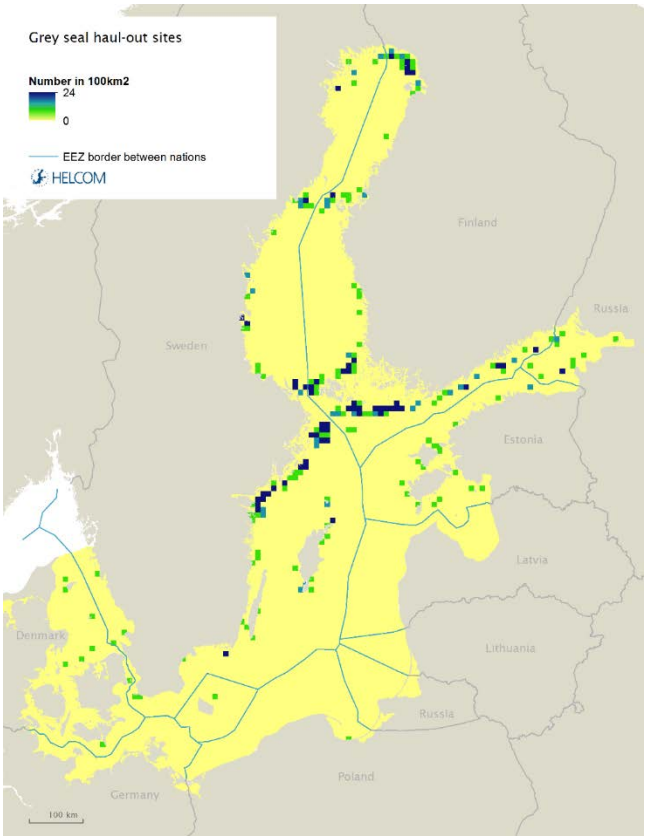
The grey seal population in the Baltic Sea area, excluding the Kattegat, achieved the threshold values for the three parameters evaluated and indicate good status, namely the parameters breeding and moulting sites and area of occupancy in all of the Baltic except for the Southwestern areas (Arkona basin, Bay of Mecklenburg, Kiel Bay, Great Belt and the Sound) (Results figure 6). In the Southwestern areas some sites formerly used for reproduction have not been recolonized.



Results figure 6. Status evaluation outcome of grey seal distribution in the Baltic Sea.

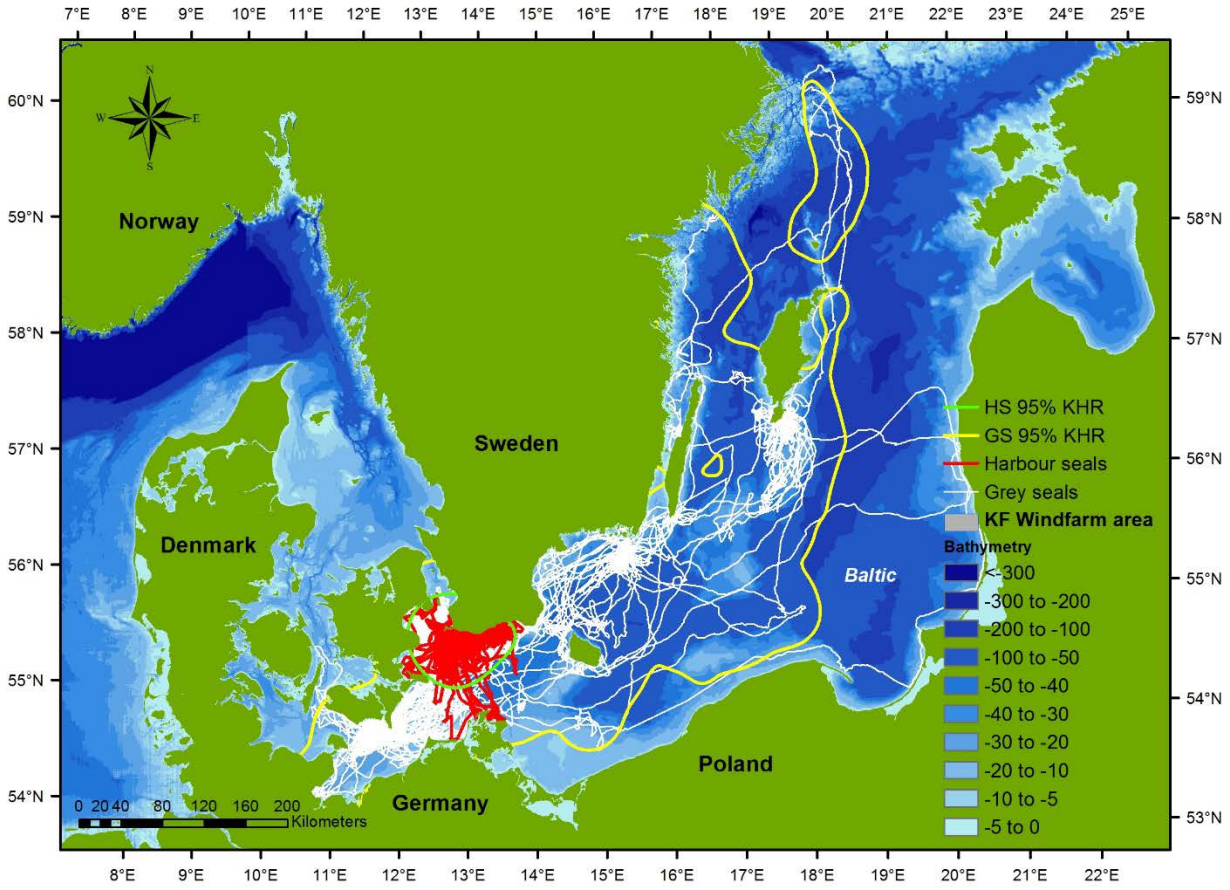
The distribution of grey seals has been expanding to the south over the last decades and this species is now present at Christiansø and Rødsand in Denmark and the Polish coast, and many former haul-out sites have thus been colonized (Results figure 7). The colonization process follows a specific repeatable pattern, where new sites are visited by single animals for up to ten years, after which numbers slowly increase. At some point numbers of sub-adult and adult seals start to increase sharply and few pups are being born. After some five to ten years, the numbers of pups start to increase dramatically. Different phases of this process can be seen at colonized sites along the North Sea coast, Måkläppen in southern Sweden and Rødsand in southern Denmark (Härkönen et al. 2007). Some of the land sites are used for both breeding and moulting, where a majority of pups are born at "older" sites.

The grey seals have achieved the threshold value for the breeding sites component of the indicator except for the Southwestern Baltic. A modern baseline is used in the status evaluation since some breeding sites in the southern Baltic have disappeared as a consequence of exploitation of sand for industrial use. No baseline can be identified for grey seals in the Kattegat which mainly consists of visiting animals from the North Sea population (Fietz et al. 2016).



Results figure 7. Grey seal haul-out sites in the Baltic Sea. The map includes all currently known haul-out sites, but seals were historically known to use haul-out sites Southwest of Samsø and around Fyn in Southwestern Baltic.

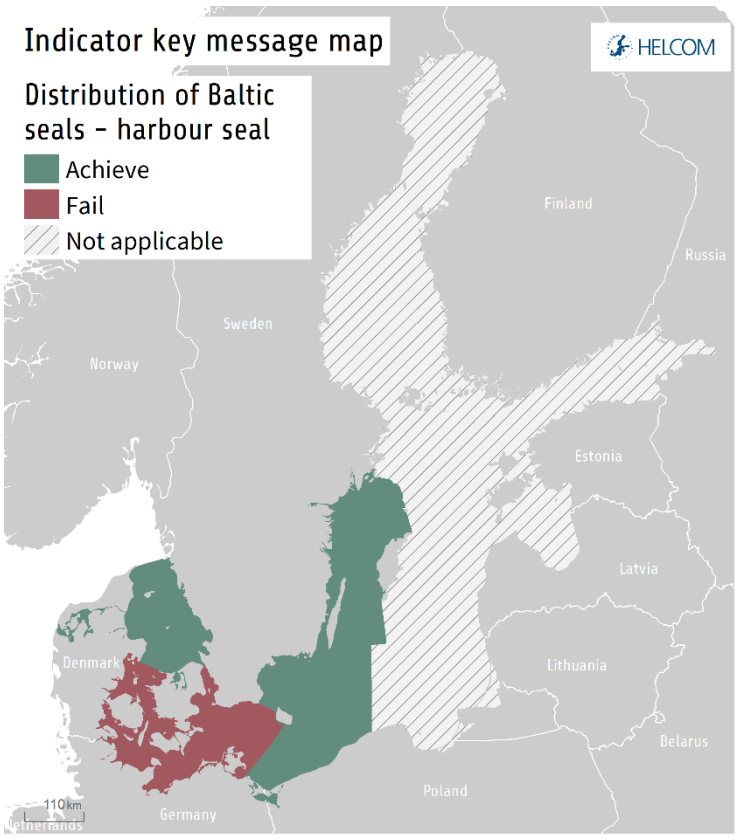
The area of occupancy encompasses the entire Baltic Sea ecosystem and grey seals can freely access sites and foraging grounds. Grey seals are evaluated as having achieved good status with regard to area of occupancy. Large numbers of satellite and GSM transmitters have been deployed on Baltic grey seals, and it is evident that they forage and travel in the entire Baltic Sea, although no haul-out sites occur along the Latvian and Lithuanian coasts (Results figure 8).



Results 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.

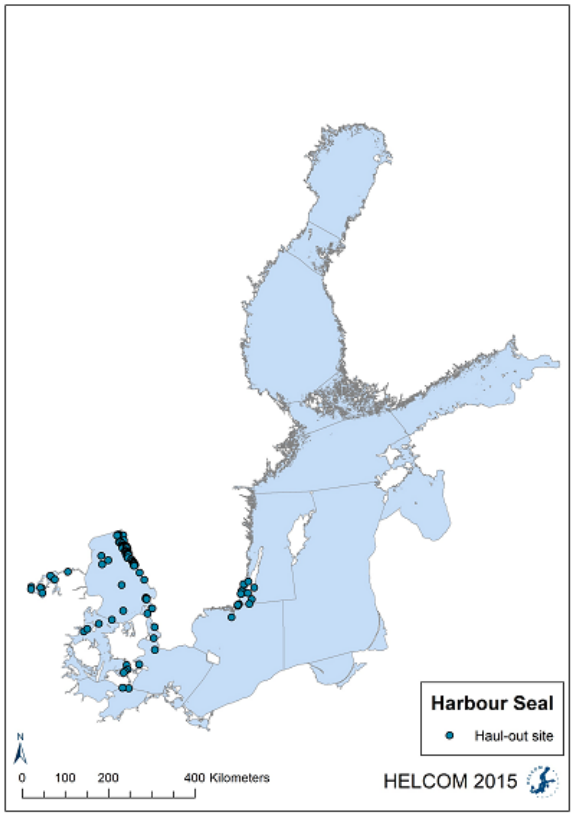
Harbour seal

In the areas of Kalmarsund, Kattegat and Limfjord the harbour seal populations are evaluated as having achieved the threshold value with regard to distribution on land sites, but the population in the Western Baltic (Arkona basin, Bay of Mecklenburg, Kiel Bay, Great Belt and the Sound) has not achieved the threshold value, and thus indicates not good status (Results figure 9). For the area of occupancy parameter, harbour seals reflect good status in all assessment units.



Results figure 9: Status evaluation outcome for harbour seal distribution in the Baltic Sea.

The harbour seal occurs on all suitable haul-out sites in the Kalmarsund, the Kattegat and the Limfjord (Results Figure 9). In the Western Baltic, harbour seals do not currently occur regularly at historical localities south of the island of Fyn or in the Great Belt. Haul-out sites (Results Figure 10) are used for breeding, moulting and resting and thus the distribution of sites reflect both the distribution of breeding sites as well as sites used for other activities.



Results figure 10: Haul-out sites of Baltic harbour seals.

Harbour seals have been tagged with GSM transmitters to study their movements in the Kattegat and also in the Western Baltic over the period 1995-2015. Seals can travel freely among sites and feeding grounds and the area of occupancy is not diminishing and thus as the threshold value is achieved, good status can be assigned to all populations of harbour seals with regard to area of occupancy.

Confidence of the indicator status evaluation

The confidence for both harbour seals and grey seals is considered to be **high** in all assessment units, as many observations are available from all years in all the relevant assessment units, with no clear temporal or spatial bias. Monitoring activities are currently carried out at a high spatial and temporal frequency. Survey data is available for harbour seals in the Kattegat since 1979, 1972 in the Kalmarsund, 1990 in Western Baltic, and for grey seals data is available since 2000 for in the entire Baltic Sea. For grey seals there are data from Sweden also two decades before this time.

The confidence for the ringed seal assessment is regarded as **moderate** since surveys are sporadic in their most southerly management area (Archipelago Sea, Gulf of Riga and Estonian Coastal waters). Annual surveys are carried out for all species and management units except for ringed seals in the Gulf of Riga and Estonian coastal waters. However, surveys from ground have been carried out since the beginning of the 1990s. Main pressures such as diminishing ice fields and sand exploitation are well known on a qualitative level, but more

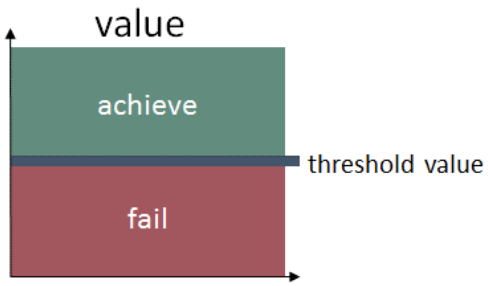
work is needed to quantify those pressures. Survey data for ringed seals is available since 1988 in the Bothnian Bay, while ringed seal data in their most southerly management area is scarce. Although data is scarce in their most southerly management area for ringed seals, this subpopulation is clearly not achieving the threshold value and hence the result of the evaluation of the populations against the set threshold values is deemed to be reliable in indicating a not good status.

Thresholds and Status evaluation

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 that the distribution is 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 1) the distributions of seals are close to pristine conditions (e.g. 100 years ago), 2) or where appropriate when all currently available haul-out sites are occupied (modern baseline), and 3) when no decrease in area of occupation occurs (Thresholds figure 1). Three different parameters of distribution are given for all species of seals:

1. Breeding distribution on land or ice, the threshold value is achieved when available sites are occupied
2. Distribution on land/ice for resting/moulting, the threshold value is achieved when available sites are occupied.
3. The area of occupancy, which includes sea areas used for transport and foraging, the threshold value is achieved when seals are not hindered in executing these activities.



Thresholds figure 1: Good status is achieved when distribution of seals is 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.

Threshold values are defined for the exact haul-out sites for each species as shown in Results figure 6 for grey seals, and Results figure 9 for Baltic harbour seals. The haul-out sites of ringed seals are dependent on the annual sea ice extent and described in Results figure 3.

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

- The distribution of breeding sites for each management unit of harbour seals are evaluated against pristine conditions. The threshold value is achieved when all previously used sites are colonized, and distribution is not diminishing.

- The distribution of haul-out sites used for resting and moult of harbour seals are almost identical to the distribution of breeding sites. The threshold value is achieved when all previously used sites are colonized.
- Grey seals are facultative land breeders that 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.
- Grey seal haul-out sites used for resting and moulting may differ considerably between breeding sites, as moulting and resting sites can be locked in by ice and thereby inaccessible during breeding. The threshold value is achieved when available haul-out sites are colonized and not diminishing.
- Ringed seals breed in lairs constructed in snow covered broken and consolidated ice. The sizes of the breeding areas display substantial inter-annual variation. The threshold value is achieved when the long-term breeding area is stable or not diminishing due to direct human activities
- Ringed seals rest and moult on ice if available. During ice free conditions ringed seals haul out on rocks or small islands. The threshold value is achieved when ringed seals have access to all available haul-out sites and the numbers of haul-outs are not diminishing.
- For the 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 and the feeding grounds.

The modern baseline approach is applied when pristine conditions cannot be achieved due to irreversible long-term environmental changes (e.g. sandbanks used for haul-out have vanished), or factors such as multi-fold increased human exploitation of fish stocks that will persist for the foreseeable future. Since the environment has changed over the past century, and formerly used haul-out sites have disappeared in the Southern Baltic, current distributions are evaluated against colonization of currently available haul-out sites. This type of a modern baseline should be defined so that the species will thrive and persist in the future.

Especially in cases where a modern baseline is applied, the additional criterion for evaluating whether good status is achieved 'distributional range is not diminishing' can be applicable for populations above the limit reference level (LRL). The LRL has been agreed in HELCOM to be set at 10,000 individuals per management unit, understanding that the haul-out fraction during moult surveys is 70%.

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.

Assessment Protocol

This core indicator uses three different parameters for evaluating the distribution of the three species of seal that occur in the Baltic Sea. These parameters are:

1. distribution during breeding
2. distribution during moulting, which occurs on land or ice, where data is achieved by surveys from land and air in both cases
3. area of occupancy, which is the area used for foraging and transport. Data is given by satellite- and GSM tagging data

All three components are evaluated for each species in the applicable areas. Good status is achieved if a species in a given area achieves the threshold values for all three parameters. If one parameter does not achieve the threshold value, then the result for the evaluation for the given species and area is not good status i.e. the One-Out-All-Out (OOAO) approach.

Assessment units and management units

This core indicator evaluates the distribution of Baltic Sea seal species 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 using grouping of scale 2 HELCOM assessment units Data is available both from land-based surveys starting in the mid-1970s and later aerial surveys.
- The Baltic ringed seal is distributed in the Gulf of Bothnia (northern management area) on the one hand and Southwestern Archipelago Sea, Gulf of Finland and Gulf of Riga on the other (most southerly management area), and is represented by two different management units. This sub-division is justified by ecological data that indicate separate dynamics of the stocks. Since ringed seals from both areas show a high degree of site fidelity, as seen in satellite telemetry data (Härkönen et al. 2008), it is unlikely that extensive migrations occur at current low population numbers, although some individuals can show more extensive movements (Oksanen et al. 2015)
- Harbour seals in the Kalmarsund, Sweden, constitute a separate management unit and is the genetically most divergent of all harbour seal populations in Europe (Goodman 1998). It was founded about 8,000 years ago, and was close to extinction in the 1970s as a consequence of intensive hunting, and possibly also impaired reproduction (Härkönen et al. 2005). The genetic diversity is substantially reduced compared with other harbour seal populations
- Harbour seals in the southwestern Baltic (Danish Straits, Danish, German, Polish Baltic and the Öresund region including Skåne county in Sweden) as well as the Kattegat are genetically connected,

and should be managed as a metapopulation, where sub-populations may have different growth and vital rates. Management actions should take special care dealing with small sub-populations, ensuring that anthropogenic activities do not jeopardise future persistence of such sub-populations.

- Harbour seals in the Limfjord form a separate management unit and are genetically distinct from the Kattegat harbour seals (Olsen et al. 2014).

Relevance of the Indicator

Biodiversity assessment

The status of biodiversity is assessed using several core indicators. Each indicator focuses on one important aspect of the complex issue. In addition to providing an indicator-based evaluation of the distribution of seals, this indicator will also contribute to the next overall biodiversity assessment to be completed in 2018 along with the other biodiversity core indicators.

Policy relevance

The core indicator on distribution of Baltic seals addresses the Baltic Sea Action Plan's (BSAP) Biodiversity and nature conservation segment's ecological objective 'Viable populations of species'.

The core indicator is relevant to the following specific BSAP target:

- 'By 2015, improved conservation status of species included in the HELCOM lists of threatened and/or declining species and habitats of the Baltic Sea area, with the final target to reach and ensure favourable conservation status of all species'.

The core indicator also addresses the following qualitative descriptors of the MSFD for determining good environmental status (European Commission 2008):

Descriptor 1: 'Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions' and

Descriptor 4: 'All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity'.

Descriptor 8: 'Concentrations of contaminants are at levels not giving rise to pollution effects'

and the criteria element ‘seals’ using the following criteria of the Commission Decision on GES criteria (European Commission 2017):

- D1C4: The species distributional range
- D1C2: The population abundance of the species
- D4C4: Productivity of the trophic guild
- D8C2: The health of species and the condition of habitats are not adversely affected due to contaminants

Marine mammals were recognized by the MSFD Task Group 1 as a group to be assessed.

In some Contracting Parties the indicator also has potential relevance for implementation of the EU Water Framework Directive (WFD, Chemical quality) and Habitats Directive. The WFD includes status categories for coastal waters as well as environmental and ecological objectives, whereas 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 (European Commission 1992), and member countries are obliged to monitor the status of seal populations.

Role of seals in the ecosystem

Being top predators in the Baltic Sea ecosystem, seals are exposed to ecosystem changes in lower trophic levels, but also to variations in climate (length of seasons and ice conditions) and human impacts. These pressures can affect fish stocks, levels of harmful substances, as well as direct mortality caused by hunting or by-catch. The vulnerability of seals to these pressures makes them good indicators for measuring the environmental status of ecosystems.

Human pressures linked 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 a threat to the ringed seal that breeds on sea ice Fishery and food availability.	Substances, litter and energy - Input of other substances (e.g. synthetic substances, non-synthetic substances, radionuclides).

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 180,000 for ringed seals, 80,000 for Baltic grey seals and 5,000 for the Kalmarsund population of harbour seals (Harding & Härkönen 1999; Härkönen & Isakson 2011). Similar data from the Kattegat and Skagerrak suggest that populations of harbour seals amounted to more than 17,000 seals in this area (Heide-Jørgensen & Härkönen 1988).

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. Ringed seals declined to about 25,000 seals in the 1940s, whereas grey seals were reduced to about 20,000 (Harding & Härkönen 1999) over the same

time period. Ringed seal breeding occurred in Stockholm county up to the beginning of the 1940s, but ceased in the mid of that decade (Hult 1943). A similar rate of reduction of harbour seals occurred in the Kalmarsund and the Kattegat (Heide-Jørgensen & Härkönen 1988; Härkönen & Isakson 2011). However, after these heavy reductions, populations appear to have been stable up to the 1960s (Harding & Härkönen 1999).

Then, in the beginning of the 1970s grey seals were observed aborting near full term foetuses, and only 17% of ringed seal females were fertile (Helle 1980). Later investigations showed a linkage to a disease syndrome including reproductive disorder, caused by organochlorine pollution, in both grey seals and ringed seals (Bergman & Olsson 1985). The reduced fertility resulted in population crashes, where numbers of ringed and grey seals dwindled to approximately 3,000 of each species in the beginning of the 1980s (Harding & Härkönen 1999). Increasing numbers of these species were recorded after levels of PCB in biota decreased by the end of the 1980s. Recent samples show that fertility is normal in grey seals, but still impaired in ringed seals (Bäcklin et al. 2011; Bäcklin et al. 2013). The very low numbers of ringed seals in the Gulf of Finland may be caused by impaired female fertility.

Climate change poses a pressure on species breeding on ice because shorter and warmer winters lead to more restricted areas of suitable ice fields (Meier et al. 2004; Results figure 2). This feature alone will severely affect the Baltic ringed seals and the predicted rate of climate warming is likely to cause extirpation of the southern subpopulations (Sundqvist et al. 2012). 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). Consequently, both ringed seals and grey seals are predicted to be negatively affected by a warmer climate. However, effects of climate change should not be included in assessments according to the Habitat Directive.

Monitoring Requirements

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 2014 and currently all monitoring guidelines are being reviewed for inclusion in the Monitoring Manual.

The three regularly occurring seal species in the Baltic Sea: harbour seal, ringed seal and grey seal, are monitored at their haul-outs on land during their annual moulting and pupping seasons, with the aim of estimating the abundance and trends (moulting counts) and pup production (pupping counts). Ringed seals are counted during moult on the ice. Where possible, the monitoring is performed using aerial surveys, where the seal haul-outs are photographed during the relevant periods in areas where there is a significant occurrence of seals.

Detailed descriptions of the survey methodology and analysis of results are given in the BALSAM monitoring manual (Galatius et al. 2014). The monitoring carried out according to these guidelines will not be very sensitive to detecting positive changes in range and mainly constriction in range can be detected. Other means are needed for detecting range expansion, and surveys are adjusted to cover expansions in range based on satellite telemetry data and other observations.

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**.

Description of optimal monitoring

The monitoring strategy is optimal for harbour seals which are surveyed three times annually during the moulting period, and increased effort would not significantly improve results (Teilmann et al. 2010). The same is true for ringed seal surveys on ice in the Bothnian Bay, where a minimum fraction of 13% of the ice area is surveyed. Increasing survey effort would only marginally affect the precision of estimates (Härkönen & Lunneryd 1992). Also the coordinated grey seal surveys would be only marginally improved by increased effort.

However, two management units require modified methodology:

Limfjord harbour seals

The fjord was separated from the North Sea by land until the 1820s and genetic analyses indicate different populations in the eastern and western fjord, with the eastern fjord being predominantly inhabited by the original population of the fjord and the western fjord inhabited by a mix of the original population and immigrants from the North Sea / Wadden Sea (Olsen et al. 2014). In this western fjord area, a study determining the relative abundances of the two populations, the level of interbreeding, and the habitat use of seals with different genetic signatures is necessary for evaluation of monitoring methodology.

Southern ringed seals (their most southerly management area)

Since ice cover has been diminishing over the past decades, monitoring of ringed seals on ice in the Archipelago Sea, The Gulf of Finland, and Estonian coastal waters including the Gulf or Riga (their most southerly management area) has only been possible during a few years over the past 20 years. However, before the aerial surveys started, ringed seals were counted on land in August, when they returned to the coast after having spent most of the summer foraging at sea (e.g. Härkönen et al. 2008). Such data is available from the Gulf of Finland, where numbers of counted ringed seals amounted to 300 animals in 1992 (Härkönen et al. 1998), whereas only 100 ringed seals were observed in the same area in 2014 (Verevkin pers. com.). Consequently, the method of surveying ringed seals hauled out on rocks in August would be an appropriate alternative method for southern ringed seals.

Data and updating

Access and use

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

HELCOM (2018) Distribution of Baltic seals. HELCOM core indicator report. Online. [Date Viewed], [Web link].

ISSN 2343-2543

Metadata

Result: Distribution of Baltic seals - Ringed seal

Result: Distribution of Baltic seals - Grey seal

Data: Distribution of Baltic seals - Grey seal

Result: Distribution of Balti c seals - Harbour seal

Data: Distribution of Baltic seals - Harbour seal

The national survey data is compiled annually by the HELCOM Seal Expert Group. A regional database has been developed and is hosted at the HELCOM Secretariat. The new database will include detailed spatial information and is to be updated annually prior to HELCOM Seal Expert Group meetings. The database will be managed by the HELCOM Secretariat having responsibility for updating and storing data provided by the HELCOM Seal Expert Group.

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

The first compilations for the database have been completed and an intermediate version of the seal database can be accessed. During 2015-2016 work continued to operationalize the database. Further metadata was included at a later stage.

The data collected and used in the indicator are based on national aerial surveys. The survey methodology is described in Galatius et al. (2014). This data covers only haul-out sites and not areas used e.g. as foraging grounds.

Contributors and references

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Archive

This version of the HELCOM core indicator report was published in July 2018:

Distribution of Baltic seals HELCOM core indicator 2018 (pdf)

Earlier versions of this indicator are available at:
HOLAS II component - core indicator report July 2017 (pdf)

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