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THE BALTIC RINGED SEAL

An Arctic Seal in European Waters

Antti Halkka and Petteri Tolvanen (eds.)

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FOREWORD



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The Baltic ringed seal (*Pusa hispida botnica*) population has declined drastically during the past century. The population, which was about 200,000 in the beginning of the 20th century, is now estimated at about 20,000 individuals. Especially the southern subpopulations in the Gulf of Finland, the Archipelago Sea and the Gulf of Riga are small and vulnerable.

In Finland the Saimaa ringed seal is a national symbol of nature conservation but few are even aware of its relatives living in the Baltic Sea. The subpopulations in the Archipelago Sea and the Gulf of Finland are just as small and endangered as the famous Saimaa seal population, if not even more so.

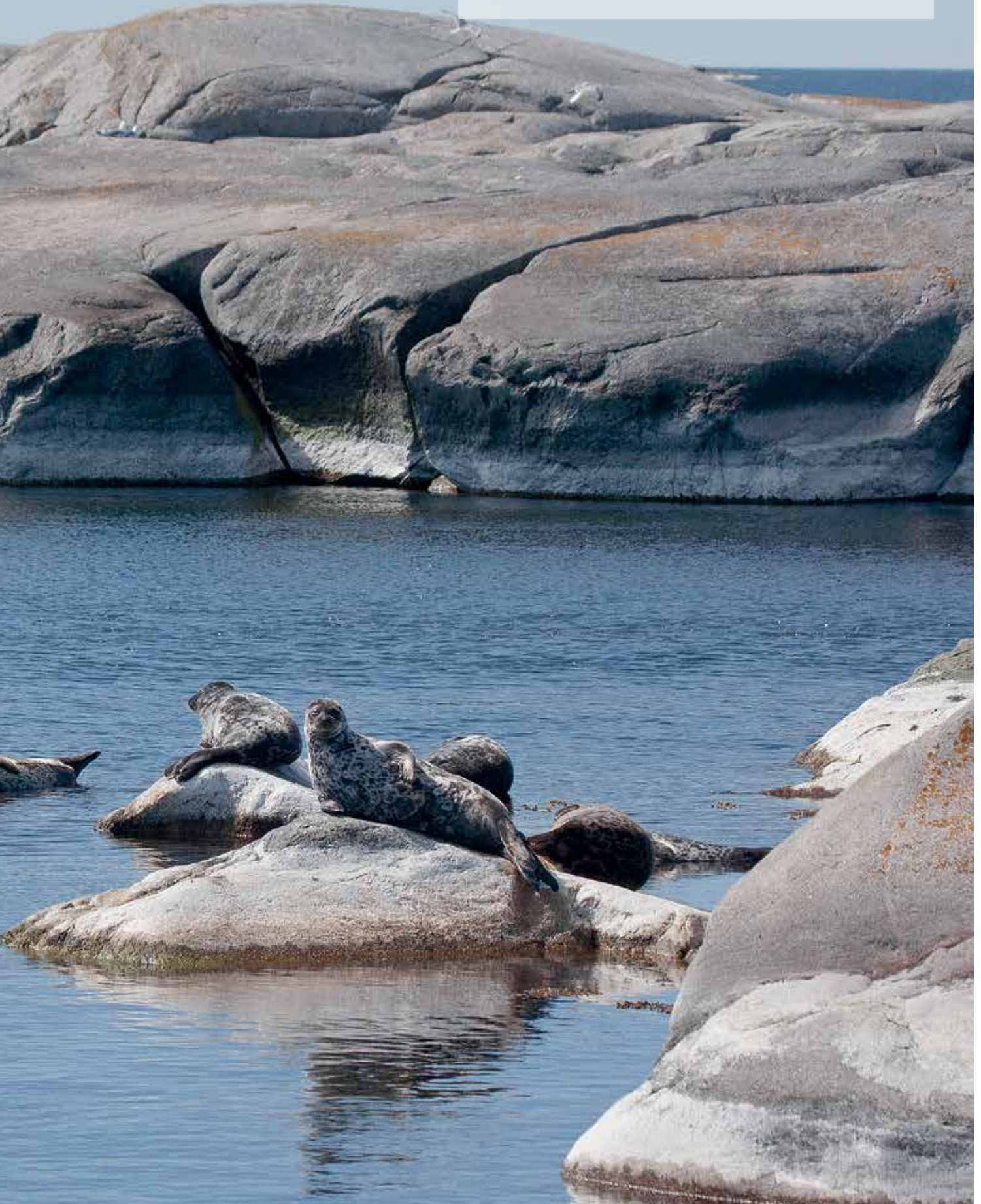
Climate change poses a great threat to the southern subpopulations of the Baltic ringed seal. The seal needs ice to thrive, but it's not uncommon for the Archipelago Sea and the Gulf of Riga to not have ice at all and the winters are not getting colder. If we lose the southern subpopulations the subspecies would continue to exist only in the Bothnian Bay. We need to make sure that doesn't happen.

We know very little of the southern subpopulations and need to learn more. We also need to raise awareness of these beautiful animals and hope this report will help us do just that.

Liisa Rohweder
CEO
WWF Finland



Ringed seals hauling out on the skerries of the Archipelago Sea in southwestern Finland. Although the species was very abundant in the area in the 1920s, now only a small number inhabits the area. Ringed seals are seen on land after the ice melts in spring.



THE BALTIC RINGED SEAL - SHARING A SEA FOR 10,000 YEARS WITH HUMANS

Antti Halkka

Humans and ringed seals have shared the Baltic sea for more than 10,000 years. During 20th century, anthropogenic factors such as hunting and environmental contaminants brought the population close to extinction. Although the population is at present growing in the northern Bay of Bothnia, the more southern populations in the Gulf of Finland, Archipelago Sea, and Gulf of Riga remain small, are not increasing, and are under threat.

The ringed seal (*Pusa hispida*) has traditionally been the most numerous seal species in the Baltic Sea, with a population of approximately 200,000 individuals at the beginning of last century. The larger grey seal (*Halichoerus grypus*) has

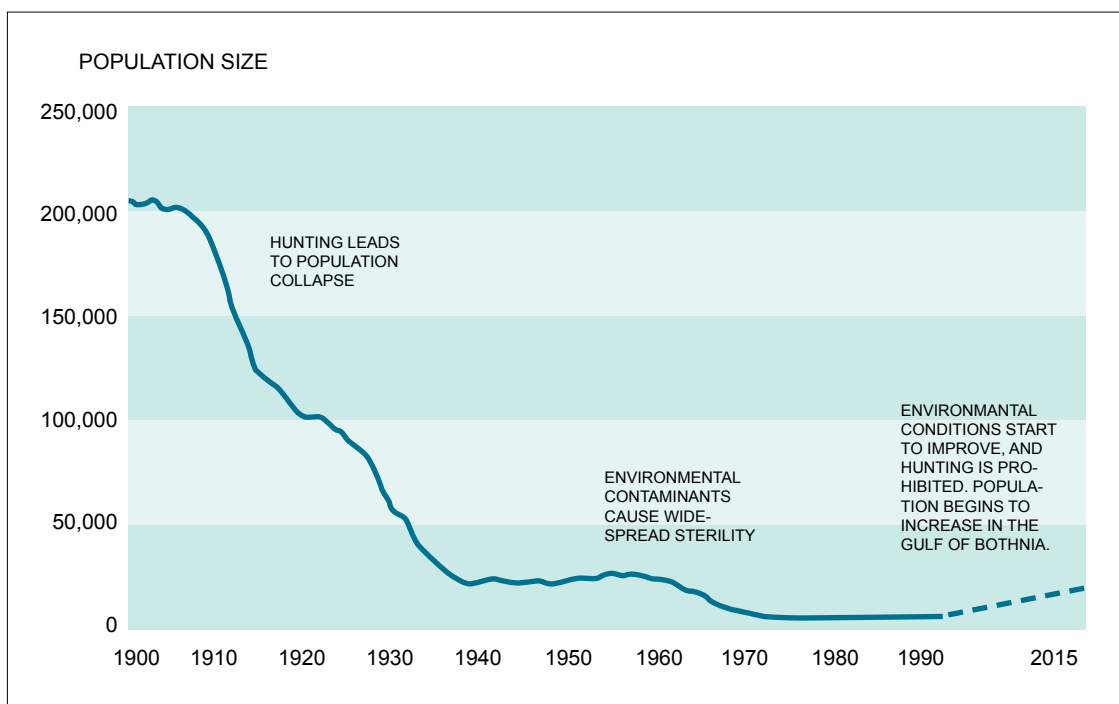


Figure 1. Population development of the Baltic Ringed seal since the beginning of the 20th century. Adapted after Hårding & Härkönen (1999); recent population estimate from IUCN (Härkönen, 2016).

probably never been as numerous, while the harbour seal (*Phoca vitulina*) has never been widely distributed in the inner Baltic, and the prehistorically numerous harp seal (*Pagophilus groenlandicus*) disappeared from the fauna already in prehistoric time.

However, the current population of the Baltic ringed seal (15,000–20,000 individuals) is smaller than that of the grey seal (at least 30,000 individuals). Even though the populations of both species collapsed in the 20th century, the ringed seal has been much slower to recover. The Baltic ringed seal is currently listed as vulnerable in the HELCOM (Baltic Marine Environment Protection Commission) assessment.

If the ringed seal was eradicated from the Baltic Sea, this would end a very long common postglacial history of the species and the basin. Ringed seals were present at the entrance of the sea when it was still covered by the Scandinavian Ice Sheet and ringed seal remains from the Kattegat area have been dated to 11,000–15,000 years BP. When the ice receded, the seals were ready to enter the basin. The oldest subfossil ringed seal finds from the inner Baltic are from the Gulf of Bothnia with Finnish finds from Nurmo (Ostrobothnia) and Oulainen (near Oulu) dating to 10,200–10,500 years BP (Ukkonen *et al* 2014).

For an ice-breeding seal, the Baltic was an attractive area as predators were scarce. Polar bears had been present in Denmark and southern Sweden, but disappeared at the time when ringed seals entered the Baltic. The Baltic Sea was a very suitable habitat for the species as it offered both food resources and a seasonal ice cover perfectly suited to the needs of this Arctic ice-loving pinniped. Ringed seals use ice platform for breeding, moulting (shedding hair and skin), and resting.

As the climate warmed and the distribution of the ringed seal moved polewards, the Baltic population became effectively isolated from the large Arctic population of ringed seals. With time the isolation led to a new subspecies, the Baltic ringed seal (*Pusa hispida botnica*).

When ringed seals migrated to the newly formed sea, they were soon targets for hunter-gatherers who inhabited the coastal areas. Ringed seals were hunted with harpoons and nets, and later also with firearms.

Both firearms and the introduction of a bounty system led to a collapse of the Baltic seal populations at the beginning of the 20th century. From a total population of more than 200,000, only 20,000–30,000 ringed seals were probably remaining by the 1930s and similar decline happened to grey seals (Hårding and Härkönen 1999).

This was a large change for the ecosystem as the seals had been abundant top predators and obvious parts of the fauna. The ringed seal had been a common sight along the coasts and archipelagoes of the northern Baltic. The numbers of animals hunted reflect this lost abundance well: in many years more than 500 ringed seals were hunted in the Gulf of Finland, while in one exceptional year, almost 2,000 were hunted in the Archipelago sea area alone.

The Baltic ringed seal population was further reduced by environmental contaminants, which caused widespread sterility – in the 1970s more than 60% of the females examined in the Bay of Bothnia were permanently sterile. This burden has



Baltic ringed seal pups are born in February-(March) preferably in lairs under snow cover. This pup was photographed in the Gulf of Riga.

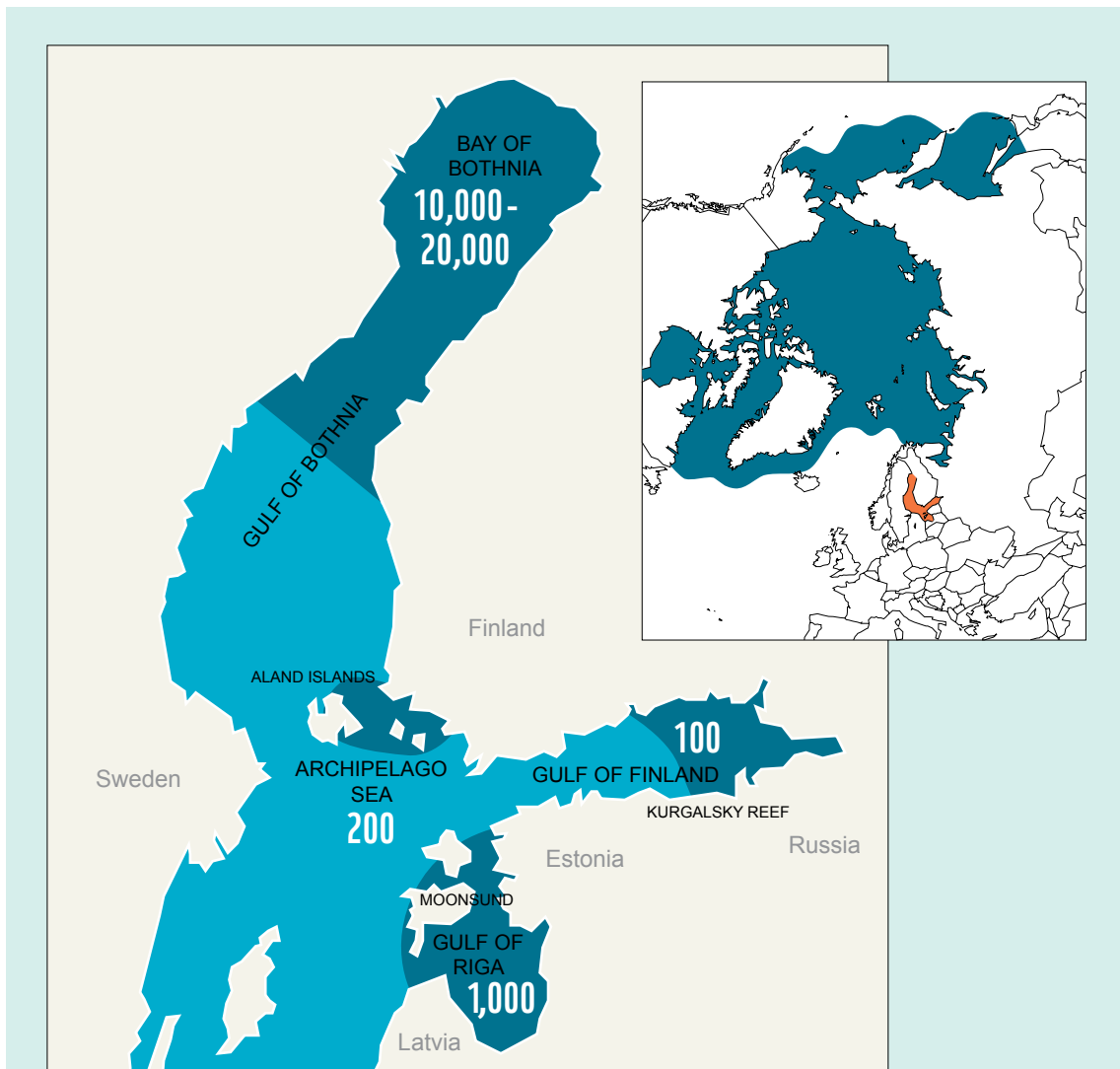
slowly been reduced and no sterile individuals have been found during the last few years.

In the 1970s and 1980s, only about 5,000 ringed seals remained and the population collapse had split the Baltic ringed seal population into four breeding sub-populations found in the Gulf of Bothnia, the Archipelago Sea, the Gulf of Finland, and the Gulf of Riga (Map 1). Of these, only the Gulf of Bothnia population is definitely increasing, at a rate of about 4–5 % annually and has exceeded 10,000 individuals. Both Finland and Sweden have introduced hunting in the area, with yearly quota to take circa 300 ringed seals (summing both countries together). The Archipelago Sea and Gulf of Finland populations are very small, consisting only of a few hundred animals.

At present, the Baltic ringed seal population faces a third human-induced threat: climate change. Warmer winters mean less ice and snow, which are critical factors for this species' breeding success. Ringed seals give birth in subnivean lairs on the ice and are adapted to relatively stable ice conditions. Breeding is a sensitive period, and the ringed seal lactation period is long, lasting more than a month (five to six weeks).

This WWF publication presents the current status of the southern Baltic ringed seal populations and discusses what can be done to protect this species.

THE SOUTHERN SUB-POPULATIONS OF THE BALTIC RINGED SEAL



Map 1. Ringed seals in the Baltic.

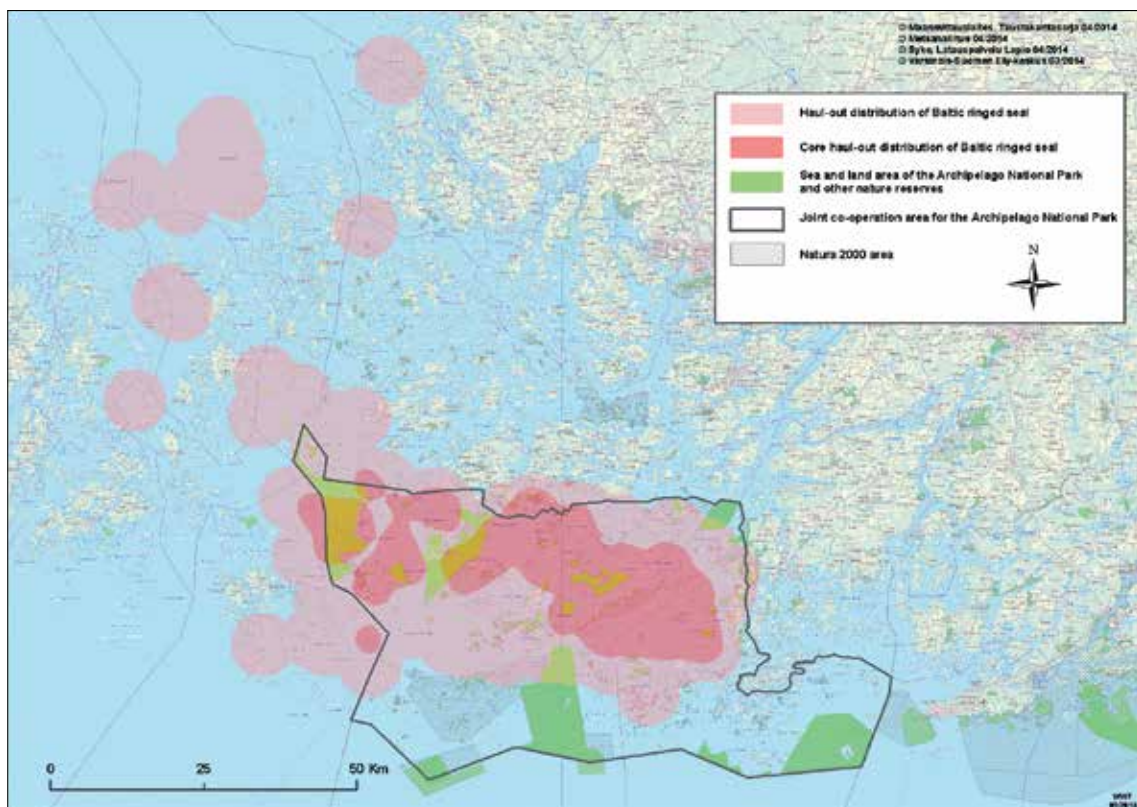
The ringed seal is an arctic species with a separate population and subspecies in the Baltic Sea. The Baltic population is currently split into four separate breeding areas located in the Bay of Bothnia, the Archipelago Sea and both the Gulfs of Riga and Finland. The largest of the southern breeding populations is found in the Gulf of Riga. Although the subpopulations are thought to be semi-isolated, satellite telemetry has shown some movements between areas. Before the population collapse of the 20th century, the ringed seal was numerous in the southern areas, and had been hunted there since prehistoric times as part of a specialised hunting culture. At present, up to 90 per cent of the Baltic population inhabit the Gulf of Bothnia. The locations of the breeding areas roughly correspond to areas which form relatively good ice cover in normal ice years. However, as Baltic winters have already warmed considerably, poor ice years are now relatively common.

THE ARCHIPELAGO SEA (Markus Ahola and Mikael Nordström)

Ringed seals were abundant in the Archipelago Sea (SW Finland, including the Åland Islands, see Map 2) at the end of the 19th and beginning of the 20th century and the area was considered to be one of the most important areas for the ringed seal in Finland (Bergman 1958). Bounty rewards for killed seals were initiated in many parts of the Baltic Sea in the 1890s and early 1900s. This bounty system was practiced in Finland until 1975. The statistics from these bounties give us some information on the population trend in the Archipelago Sea.

The annual hunting tally typically exceeded 400 ringed seals in the period 1925–1934, while in the exceptionally mild winter of 1930, approximately 1,800 seals were hunted, of which 1400 were taken in Åland (Bergman 1958).

In many years, more than 100 pups were included in the catch. The most severe ringed seal decline took place in the 1930s, a decade characterised by mild winters and an unremitting hunting pressure. In the Åland Islands, rewards were paid for 8,026 ringed seals between 1925 and 1945; however 70 % of these were paid from 1925 to 1933 (Stenman *et al.* 2008). After the second World War, numbers declined rapidly. Although there were no systematic inventories on ringed seal numbers, the information gathered from sporadic observations in the 1980s and 1990s indicated the species to be uncommon and it was thought to be restricted to certain sites. Concern for this southern population of ringed seal was raised by WWF Finland in the early 21st century.



Map 2. Distribution of ringed seals in the Archipelago Sea during the recent aerial surveys (2010, 2011, 2013).



Archipelago Sea ringed seals have recently been photographed by game cameras located in haul-out sites. The photo-id project provides information on longevity, site-fidelity and movements of the seals.

Thus, between 2002 and 2011, WWF Finland surveyed Archipelago Sea ringed seals in close cooperation with the Game and Fisheries Research Institute (Since 2015 known as the Natural Resources Institute Finland – Luke), and Metsähallitus' Parks & Wildlife, Finland. Various survey methods were used: ringed seals were surveyed from boats, from fixed points during hovercraft surveys, and most importantly, using transect line aerial counts by fixed wing aircraft in 2005, 2010, 2011 and 2013. The aerial surveys were based on transects using two nautical miles between lines, with a flight altitude of 500–600 ft (circa 150–180 m). Two observers covered the entire ice area to a distance of more than one nautical mile. Theoretically, the method should reveal all observable seals on even ice without thick snow, i.e. the common fast ice conditions for the area.

In the boat surveys of 2002–2005, the observed number of ringed seals was 150–200 per season. The aerial surveys of 2010 and 2011 had a good coverage during the beginning of the moulting period in mid–April, resulting in a maximum number of circa 140 observed seals in 2010, and almost as many in 2011. Approximately 60 individuals were observed during each of the two aerial surveys in 2013. In boat surveys conducted after a practically ice-free winters in mid–May 2015 and 2016, slightly less than 100 individuals were seen hauling out on land in a few separate locations.

The distribution of ringed seals was centred on the eastern part of the archipelago (Map 2) with more than 100 seals observed during aerial surveys in the Archipelago Sea National park and adjacent areas, which has the highest probability of fast ice formation. In ice-free conditions, ringed seals are found in certain locations with suitable shoals and skerries, both within and outside of the core area of occurrence during the fast ice period.



A pup with female in the Aland islands side of the Archipelago Sea. Islands can be seen in the background. February 2006.

Based on the field inventories carried out until 2011, the real ringed seal population size in the Archipelago Sea was roughly estimated to be 200–300 individuals. This estimate is based on the general observability of the arctic population on ice during the moulting period. However, no such observability data exists for the Baltic region and, in the Archipelago Sea, insufficient ice-cover may lead to some proportion of individuals to haulout on land. We believe that due to decreasing observability with increasing distance, our aerial survey method may have failed to catch a small proportion of seals otherwise observable on the ice. Due to the lack of continuous long-term monitoring data, a trend in the population development cannot be identified, but the relatively small number of individuals observed in the surveys in 2013, 2015 and 2016 did not indicate an increase in the stock.

Breeding of ringed seals in the area has been documented during the surveys with a total of more than 20 ringed seal pups observed. In the mild winter of 2008, an almost newborn pup was found on an island. This is one of the first cases of documented land-breeding in the species, yet the occurrence of such events is inevitable during mild winters.

With the changing climate, future projections for sea ice occurrence in the Archipelago Sea pose a major threat to the seal population. The projected mean duration of the ice winter will be only two or three weeks at the end of this century. Therefore, it is evident that the winter will be of insufficient length to complete the five to six week lactation period, which in optimal conditions should take place entirely within the subnivean birth lair. To better understand the chances for the ringed seals to cope with the warming climate, more information on their habitat use and breeding success in poor ice-conditions are needed.

THE ESTONIAN COAST (Ivar Jüssi and Mart Jüssi)

The Gulf of Finland

Up until 1992, the coastal waters of Estonia belonged to the Soviet Union sea area and seal counts on ice were given for the total observed ice area by Zheglov and Chapskii (1971), Tormosov and Rezvov (1978) and Tormosov and Esipenko (1986). Although these seal counts were non-systematic and the reports do not allow the estimation of the abundance of ringed seals along the Estonian coastline, the evidence from seal hunting reports suggests that in the middle of the 20th century, ringed seals were distributed along the whole Estonian north coast.

Tormosov and Esipenko (1986) presented data from ship surveys along the coast, which indicated the presence of several tens of ringed seals in the main haul-out area of the Estonian coast, i.e. the reefs around Põhja Uhtju Island. Ringed seals were also reported from the islands of Mohni and Prangli, which confirms the earlier westerly distribution of the species in the Gulf. Moreover, occasional observations confirmed the presence of several tens of ringed seals in the Uhtju area in the late 1980s (Himot Maran pers. comm., Jüssi unpubl.). However, in the 1990s, observations of ringed seals in the Estonian waters of the Gulf of Finland became rare and even at the historically important site of Põhja Uhtju, the numbers of observed ringed seals did not exceed more than a few individuals. Today, only lone ringed seals are casually observed near the islands of Vaindloo and Uhtju, and combined with a falling population in the Gulf of Finland, seals have evidently vacated the once regularly inhabited Estonian coastal sea.

The Gulf of Riga and Moonsund (Väinameri Archipelago)

In the Western Estonian Archipelago (Moonsund), ringed seals have been commonly hunted throughout history, although data on their numbers and distribution before the 1970s is mostly anecdotal. The first aerial surveys on ice by Soviet researchers are summarised by Tormosov and Rezvov (1978), where an estimate of 1,000–1,500 animals was given for an observable population hauling out onto the ice.

Boat surveys for summer to autumn periods indicated the presence of ringed seals in several tens in most of the known haul-out areas of the Gulf of Riga. These observations generally agree with those distribution patterns which were known from earlier history and have since been confirmed by recent telemetric tracking. While modern aerial counts began in 1994, the first survey which fulfilled the criteria of internationally agreed methodology took place in 1996. The “modern” Gulf of Riga population size of ringed seals established by this survey was $1,407 \pm 590$ (95% CI¹).

Since this survey method is very sensitive to ice conditions, in most springs after this initial effort, ringed seals could not be counted from the ice. There were several attempts, but due to the early break-up of ice, reliable haul-out population estimates could not be calculated. The only successful survey in terms of natural conditions and counting method requirements was carried out in 2006. The number of seals on the spring ice in the Gulf of Riga was estimated at $1,475 \pm 442$ (95% CI) individuals. In April 2013, the ice of both Moonsund and the Gulf of Riga was covered by aerial observation. Even though the standard census methodology could not be applied due to the relatively small ice area, it achieved a 92% coverage of sea ice suitable for ringed seals. A total of 854 adult seals were observed on the ice, with a population estimate of $1,077 \pm 449$ (upper 95% CI) individuals derived from this count.

¹ confidence interval



Ringed seals in the Gulf of Riga.

These three available abundance estimates are spaced sufficiently apart in time to indicate that the ringed seal population has shown no measurable trend since 1996. Nevertheless, since the numbers of ringed seals hauling out on stones at the southern (Kihnu) and northern (Kadaka) limits of the distribution area have fallen and given a wide confidence interval from the aerial survey data, the population stability should be treated with caution. As the southernmost ringed seals in the Baltic (and the whole world), the Moonsund population is particularly exposed to the adverse effects of mild winters resulting in the early loss of sea ice as their breeding platform. In recent years, when the sea ice breaks apart at the end of March or early April, several pups have been observed either on the ice remnants or on the coast. The breeding seals are often accompanied by white-tailed sea eagles, which are capable of taking the pups, while red foxes and dogs have also been observed on the ice. Some ringed seal pups are nursed by their mothers on stones or in reed-beds after the ice has melted. This leads to increased pup mortality due to predation and the lower post-weaning condition. This in turn affects the survival of the seals to reproductive age, with a consequent loss in the breeding population in the future.

Telemetric studies of the ringed seals in the Moonsund area have shown relative high site fidelity. They gather regularly to rest on certain reefs, mainly in the archipelago between Hiiumaa and Muhu. The seals also have rather distinct seasonal and diurnal activity patterns, which together with their habit to return to certain stones, might provide an alternative opportunity to assess their abundance and trends therein.

Ringed seals are not considered to be a “menace” to fisheries in the area as they are seldom seen near fishing gear. Since the incidental by-catch is in general reported

very poorly, the mortality of seals in gear cannot be determined accurately. However, given that only some young individuals are known to be caught in fishing gear each year, it is assumed that the by-catch of ringed seals is low compared to that of the much more numerous grey seals in this area. Nevertheless, now ringed seals are facing a new risk of being shot by accident during the grey seal hunting season, which was introduced in Estonia in 2015. Grey seal hunting is allowed in habitats where both seal species are present and thus, there is a substantial risk that inexperienced hunters will confuse the two.

THE RUSSIAN PART OF THE GULF OF FINLAND

(Mihail Verevkin and Vadim Vysotsky)

Ringed seals inhabit predominantly the Eastern part of the Gulf of Finland because this sea area is covered with ice in winters, and ice is necessary for their successful breeding. The number of ringed seals hauling out onto the spring ice can be used as an index of the population size.

In the Soviet part of the Gulf of Finland, the first aerial survey of ringed seals hauling-out on spring ice was carried out in 1970, resulting in a population estimate of 5,000 individuals (Zheglov and Chapskii 1971). Based on the 1973 survey, the population of ringed seals hauling out on ice was estimated to be 3,560 individuals (Tormosov and Rezvov 1978), while in 1982, the relevant number was 2,800 (Tormosov and Esipenko 1986). The latest survey in the Soviet period, carried out in 1985, resulted in a count of 2,085 seals (Tormosov and Esipenko 1989).

Further aerial surveys in the Russian part of the Gulf of Finland were carried out after 1993 (Härkönen *et al.* 1998; Stenman *et al.* 2005). In the period spanning 1993–2002, surveys were done annually and showed quite stable results, i.e. the number of ringed seals hauling out onto the ice ranged from 150–170 individuals. The best coverage of the survey was achieved in 1997, when prolonged Westerly winds condensed the ice in the Eastern part of the gulf, followed by calm, sunny weather during the survey period. The population estimate of ringed seals on the ice was then estimated at 280 individuals (Verevkin & Sagitov 2004). In April 2002, an aerial survey in the Russian part of the Gulf of Finland resulted in an estimated 164 seals on the ice (Stenman *et al.* 2005).

Data from recent aerial surveys

The most recent aerial surveys were carried out in the Russian part of the gulf in 2010 (Verevkin *et al.* 2012), 2012 (Verevkin *et al.* 2012), and 2013 (Trukhanova 2013). In April 2010, a synchronised survey was carried out with Finland, while in Estonia the study was not performed at all due to the absence of ice. It was assumed that there were no ringed seals in Estonian coastal waters because the seals prefer to be on the ice as long as it lasts in spring. Although the Finnish survey covered 100% of the spring ice, only three ringed seals were found (Antti Halkka pers. comm.). In the Russian sea area of the gulf, the population was estimated at 45 individuals (Verevkin *et al.* 2012). With this survey, the total hauling out population on the ice of the Gulf of Finland was estimated to be 48 individuals. This included the reservation that there were no grey seals in the count.

On the 10th and 11th of April 2012, a Cessna Centurion was used to cover the ice of the Gulf of Finland in optimal weather conditions (Verevkin and Vysotsky 2012). At the same time, the Estonian sea area was also covered aurally, resulting in almost full coverage of the suitable ice area. In a sampling frame of 4316 square kilometres,



Ringed seals are nowadays rare in the Finnish part of the Gulf of Finland. This ringed seal was hauling out on last remnants of ice near Hamina in 2014, a poor ice winter.

17 systematically placed transects were used along meridian lines. Of the total of 24 seals observed, 14 and 10 were ringed and grey seals, respectively (species ratio 7:5), although a reliable species identification is only possible from hi-resolution photographs.

According to the results from 2013 (Trukhanova *et al.* 2013), the hauling out ringed seal population was estimated at 237 individuals (95% confidence levels 138–336) and thus, it was concluded that there is an increasing trend in the population.

However, it is noteworthy that in the 2013 survey by Trukhanova (2013), 23 ringed seals and 2 grey seals were recorded (R.Sagitov, pers. comm). Unfortunately, with the absence of photographic evidence, species determination could not be verified. Grey seals are common in the area. In the spring of 2014, of the 28 seal pups gathered from the Russian sea area of the Gulf of Finland and treated in the seal rehabilitation centre run by SUE Vodokanal, St.Peterburg, 23 were grey seals and only 5 ringed seals.

The dynamics of ringed seal numbers at haul-out sites

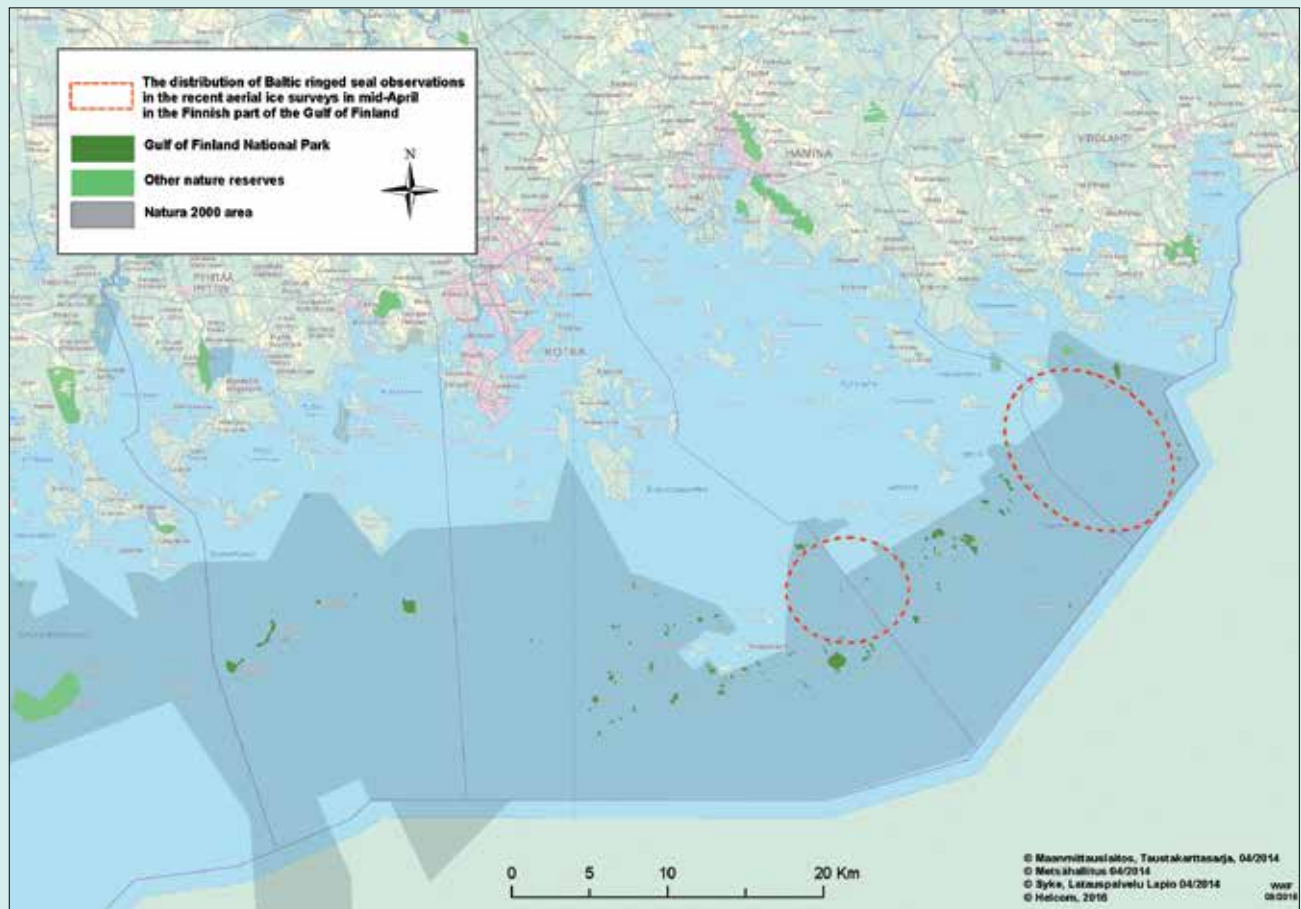
The main haul-out sites of ringed seals in the Russian part of the Gulf of Finland during the ice-free period are located in the south in the region of the Kurgalsky Peninsula, and in the north on the reefs of the islands of Moshny and Malyy. Most of the local ringed seal population can be found here in spring, after the break-up of the ice. In the mid-1990s, more than 100 ringed seals were counted on Kiskolsky Reef.

THE GULF OF FINLAND, FINNISH WATERS (Ari Laine)

In the easternmost Finnish territorial waters on the northern coast of the Gulf of Finland, the number of observed ringed seals has shown a high degree of variation in recent annual aerial surveys (mid-April 2010, 2011 and 2013), with numbers ranging from zero to 16 individuals. The highest numbers have been observed in conditions when dense drifting ice has prevailed. Typically, only 1 to 3 individuals have been observed by breathing holes on fast ice in the eastern archipelago areas (see Map 3). In mid-April 2014, up to ten ringed seals were observed resting at the retreating ice edge in the inner archipelago close to the mainland off Hamina. Although considerably higher numbers were reported by hunters in 2004 and 2009 when about 100 and 50 ringed seals were counted, respectively, in the easternmost areas close to Finnish-Russian border, a 100-percent species identification was not achieved.

Very little is known about the breeding behaviour of the ringed seal in Finnish waters on the northern coast of the Gulf of Finland, except for a recent anecdotal case in 2009 when breeding took place under a boathouse on Tammio Island (Teemu Tast, pers. comm.). In addition, two other cases of ringed seal pups have been reported, where an adult ringed seal with an already dark coloured pup were observed on the edge of the fast ice in the middle archipelago of Hamina (Jari Kolmela, pers. comm.) However, while the lair site locations in these latter cases remained unknown, based on the average size (ca 2 km²) of a ringed seal pup's nursing period home range in Lake Saimaa, the pups were most likely born less than 1 km away from the observation point, i.e. well within Finnish territorial waters.

Summertime observations are rare and hardly even occur annually as observing ringed seals is not easy, and systematic surveys are lacking. In June and July 2014, single ringed seals were seen in three different areas.



Map 3.

Thereafter, a drop in the hauling-out population numbers was observed. In 2004, 57 seals were observed, while in 2007, the largest single count in 15 years was recorded (95 individuals).

However, in the period spanning 2009–2012, the observed number rarely exceeded 40. Conversely, in 1978–1983, from 100 to 200 ringed seals were counted in the Kurgalsky Reef area (Tormosov and Esipenko 1986). It is also noteworthy that on the nearby Malyy Island, the numbers of counted ringed seals hauling-out dropped from 10–15 down to 2–3. Similarly, while up to five individuals had been seen near the island of Malyy Tjuters, no sightings have occurred in recent years.

Therefore, the numbers of ringed seals have reached critically low limits here, which may ultimately lead to local extinction of the species in this sea area.

SATELLITE TELEMETRY REVEALS THE MOVEMENTS OF BALTIC RINGED SEAL INDIVIDUALS

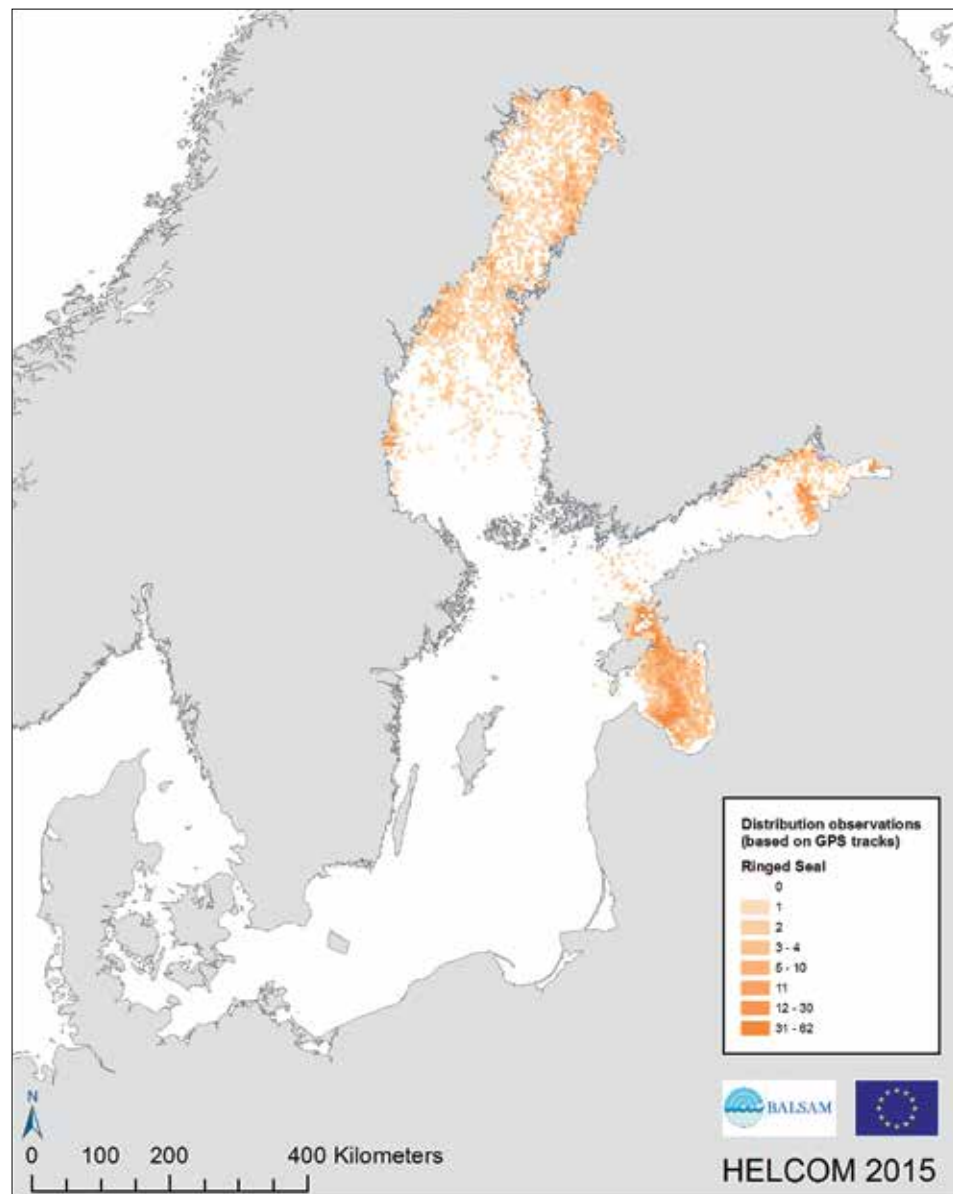
(Markus Ahola and Mart Jüssi)

Arctic ringed seals have shown both the ability to travel up to two thousand kilometres from their breeding and moulting areas during the open water season, as well as demonstrating a high fidelity in returning to these areas (Martinez-Bakker *et al.* 2013, Hamilton *et al.* 2015).

Conversely, Baltic ringed seals have been considered to have only relatively small home ranges. According to Härkönen *et al.* (2008), the movement ranges of individuals tagged with satellite transmitters in the Bay of Bothnia (5), the Gulf of Riga (10) and in the Gulf of Finland (4) did not overlap with those from separate tagging areas. More recent tagging studies in the West Estonia area (20) and in the Gulf of Finland (5) during the period 2008–2015 also suggest that ringed seals are predominantly residential, with only a few making primarily exploratory trips out of their main distribution area. Although the hot-spots for West Estonian ringed seal haul out sites are located in the Hiiumaa islets at Väinameri (Moonsund), their preferred foraging area is located close to the Latvian coast in the Gulf of Riga. In the Gulf of Finland, the seals stayed in the Kurgalsky area and its adjacent islands. Seals can also be seen in the metropolitan area of St. Petersburg, with one notable marked female making use of artificial islands and passing under the highway bridges at the St. Petersburg Dam.

Another recent tagging study of 30 Baltic ringed seals in the Bothnian Bay in the autumn seasons of 2011 to 2014 showed that these pinnipeds also make long distance movements, with home ranges as large as grey seals: most visited the central Bothnian Sea, while two adult females overwintered in the Gulf of Riga, which was assumed to be their breeding area (Oksanen *et al.* 2015).

The first ringed seal was tagged in the Archipelago Sea area in May 2015. This male also travelled widely after leaving its moulting area in late May. After passing through the Northern Baltic Proper into and around the Bothnian Sea, then north to the Kvarken area, it returned to where it had been tagged in late August (Ahola *et al.* unpubl.). In addition, it is interesting to note that in spring 2016, a female ringed seal released from the St. Petersburg seal rehabilitation centre, left the eastern part of the Gulf of Finland and spent the rest of the ice-free season in the Archipelago Sea.



Map 4. Helcom data on ringed seal locations obtained by satellite tracking of individuals marked in the Bay of Bothnia, Gulf of Finland and Gulf of Riga. (BALSAM project 2015, partly funded by EU).

These observations indicate the possibility of ringed seals demonstrating different patterns of sea area use. The reasons behind individual decisions to choose between being sedentary and making long-distance movements during the open water season need to be further explored.

Although the observed movement patterns occurred during the non-breeding season, further research is needed to better understand the roles of both natal and breeding dispersal in Baltic ringed seal populations. To implement adequate conservation measures in the future, it is vital to understand the rate of dispersal between the separate subpopulations in the Baltic Sea area.

The Bay of Bothnia harbours the largest number of Baltic Ringed seals (Mervi Kunnasranta)

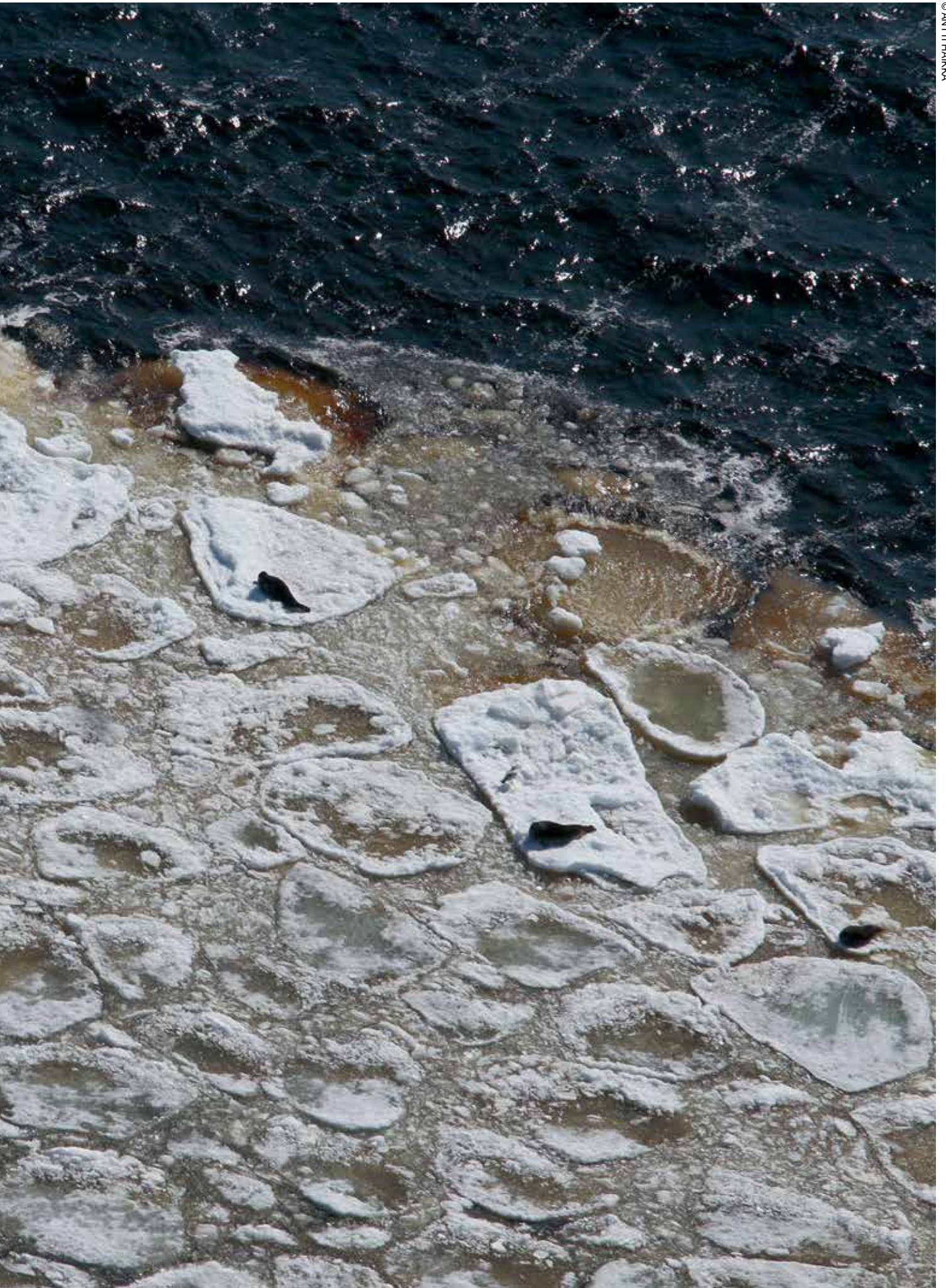
Ringed seals have a circumpolar distribution throughout the Arctic Ocean and also range widely into several adjacent seas. Moreover, subspecies exist in the Sea of Okhotsk, the Baltic Sea, as well as in the freshwater lakes of Ladoga (Russia) and Saimaa (Finland). Although the world-wide population size of ringed seals is not accurately known, the species is considered one of the most abundant northern pinnipeds. Among those ringed seal sub-species found in Fennoscandia, the Baltic ringed seal is the most abundant, yet their population is not equally distributed through the Baltic Sea, with the majority located in the Bothnian Bay.

The Bay of Bothnia typically provides relative stable ice conditions even during the mildest winters and is therefore a suitable breeding habitat for the ringed seal. Over a 25-year period, aerial transect surveys of the Bothnian Bay have shown that the numbers of individuals counted in censuses increased from 2,000 to 8,100. In 2013, it was estimated that the mean annual growth rate was around 4.6%. However, compared with earlier surveys, significantly greater numbers of individuals were seen hauling out during the poor ice conditions of 2015. Therefore, the last haul out estimate has more than doubled compared to those surveys of earlier years, and is not comparable to earlier estimates. In 2015, the estimated number of hauled out seals was 17,600 (Tero Härkönen, pers. comm.). This seal population is divided between Sweden and Finland.

The Bothnian Bay area is by far the most important breeding area for Baltic Ringed seals. The only other Baltic sea area with over a thousand ringed seals occurred in the Gulf of Riga, where an estimate from 1996 was 1,400 individuals.

Due to its population size in the Bay of Bothnia, this region has been estimated as the only sea area where Baltic ringed seals have achieved a 'good environmental status' (GES). Based on their population development in the Bothnian Bay, Baltic ringed seals do not meet the criteria for a threatened species listing and are listed as of Least Concern (IUCN Red list 2016). By comparison, in the HELCOM Red List of Species, it is listed as Vulnerable (VU). Ringed seals occurring in the Bothnian Bay form their own management unit, formed to control and monitor the population, and ringed seals have been hunted there since 2015. Hunting is considered one way to mitigate the ringed seal-fishery interaction, which with the growing seal population has increased during recent years. The current annual hunting quota is 200 and 100 individuals, in Finland and Sweden respectively. Climate change impacts are particularly acute for ringed seals living in restricted habitats such as the Baltic Sea. It is expected that there will be an increasing frequency of winters with very poor ice cover, which also forms later and melts earlier. This means a decline in the reproductive success of the seals, with reduced survival of their lanugo pups. Based on climate scenarios, the only long term and regular suitable sea-ice habitats will be found in the northernmost part of the sea, which highlights the marked importance of the Bothnian Bay as a Baltic ringed seal breeding habitat.





CLIMATE CHANGE AND THE SOUTHERN BALTIC RINGED SEAL POPULATIONS – CAN THE RINGED SEAL SURVIVE OUTSIDE THE BOTHNIAN BAY AREA IN THE FUTURE?

Antti Halkka

Climate change is a new emerging threat to the Baltic ringed seal. The species is dependent on ice for breeding; all populations and subspecies of the ringed seal breed on ice, and successful land breeding is unknown from their distribution area. A degradation of the breeding habitat combined with less snow upon the sea-ice may lead to population declines and threaten the Baltic ringed seals' future.

Poor ice winters have already become increasingly common in the Baltic. In the long (300yr) time series of Baltic ice winters, the winters of 2007–2008 and 2014–2015 have so far been the mildest ones on record.

Mild winters give us a glimpse of what the average ice winter may look like in the 2080s. Climate models predict that if greenhouse gas emissions are not abated, such extremely mild ice winters will be very common at the end of this century.

The southern breeding populations had very little ice in 2008 and 2015. In the Gulf of Finland, ice was restricted to the heavily trafficked easternmost part, while the Archipelago Sea and the Gulf of Riga were almost ice free.

Although emergency pupping on land was documented in 2008 in the Gulf of Riga and in the Archipelago Sea, it was unclear if the pups survived. Pupping in poor and moderate ice winters suggests that a pattern of migration to the ice fields in the Bay of Bothnia does not exist in such conditions.

Ringed seals have a generation time of about 18 years and they can live for more than 30. Therefore, populations can survive mild ice winters and poor breeding conditions if they occur rarely, as has been the case in the highly variable ice climate of the Baltic Sea. For example, the winters of 1924–1925 and 1929–1930 were extremely mild.

Ringed seals preferably need ice for two to three months to be able to breed and moult during winter. Stable ice is needed for the construction of the breeding lair; the lair has to be ready before the end of February when Baltic ringed seals give birth. The lactation period lasts five to six weeks. Stable ice is also required throughout this period because if the early break-up of ice interrupts lactation, it can negatively affect both the condition and growth of the seal pups.



In a future with high greenhouse gas emissions, models predict the mean length of ice period to be two to four weeks in the core areas of the southern ringed seal populations, with a considerable proportion of completely ice-free years. Such a drastic change in the ice climate will probably lead to poor breeding success. However, if such emissions peak in the near future and then start to decline, the predicted change in the ice climate is not as large and the ringed seal populations may at least persist longer, taking advantage of the prevailing conditions and the ice climate of cold winters.

An additional problem is that in mild winters ringed seals concentrate on the available ice that exists. When snow is absent, as is nearly always the case in mild winters, pups are born on the open ice, without a lair to shelter them from weather or predators. In the extremely mild ice winter of 2008, a concentration of 50 ringed seals and about the same number of white-tailed eagles was documented upon the last remaining ice in the Gulf of Riga (personal comment, Ivar and Mart Jüssi and Antti Halkka). Further, the sea-ice near the coast is also accessible to foxes and susceptible to human disturbance. In a mild winter, ringed seals also tend to occur near fishing gear and high by-catch losses have been documented in mild ice years, e.g. in 1989 in the Gulf of Finland (Stenman 1990). Here, the remaining ice in poor ice winters is restricted to the easternmost part and seals are forced into an area with heavy and ever-increasing ship traffic.

In all future emissions scenarios, the mean ice cover is still predicted to be sufficient for breeding in the northern parts of the Bay of Bothnia at the end of this century. This does not mean that problems cannot occur, since in extremely mild winters, even the Bay of Bothnia is projected to be almost completely ice free (for high emissions and from the 2080s onwards). In most future winters the stability of the ice cover is affected as the sea does not completely freeze over, while storms may fracture the ice cover and damage the breeding ice.

If future breeding is restricted to the Bay of Bothnia, the entire Baltic population becomes more vulnerable as it is concentrated to one small part of the Baltic Sea area. Poisoning caused by unknown factors decimated the population of ringed seals from the Gulf of Finland at the beginning of the 1990s, probably killing 150 seals in an already weakened population (Härkönen et al 1998).

While a poorer ice climate in the Baltic Sea is unavoidable, it is still possible to curb greenhouse gas emissions so that the ringed seal can survive in the Baltic, and in the best case scenario breeding is also possible outside of the Bay of Bothnia. It is extremely important to keep the population level high enough as the ice climate progressively worsens. The chances of survival are further enhanced if all other burdens to the population are as light as possible. Disturbances should be reduced as much as possible, reproductive health maintained, and by-catch and hunting mortality kept to a minimum.

Experiments using artificial lairs are currently being performed in the Lake Saimaa area, where seals normally build snow lairs on the lake shoreline. If these experiments succeed, this method can perhaps also be tested in sheltered areas throughout the southern Baltic breeding areas. Shipping could be restricted in areas where ringed seals concentrate, to avoid or minimize commercial ship traffic breaking the ice field.

Of course, one of the most important measures would be to restrict emissions to meet the 1.5°C climate change target agreed in Paris in December 2015.

CURRENT THREATS FOR THE SOUTHERN POPULATIONS OF THE BALTIC RINGED SEAL

Petteri Tolvanen

Compared with the closely related Saimaa ringed seal the threats for the southern populations of the Baltic ringed seals are very poorly studied. Living in roughly similar climate conditions albeit in a land-locked freshwater lake system, the greatest threats facing the critically endangered Saimaa ringed seal are by-catch mortality in fishing nets, reduced pup survival in mild winters (due to climate change), and the effects of their small population size and severely depleted genetic diversity. Global warming as a major threat for the Baltic ringed seal is dealt with in more detail in the preceding chapter, while other potential threats are discussed below (Table 1).

Nordström et al. (2011) assessed the threats for the ringed seal population of the Finnish Archipelago Sea. In general, although the same threats apply for all of the southern subpopulations of the Baltic ringed seal, individual threats vary in importance between the regions and subpopulations. However, due to the lack of research, the importance of the potential threats can only be estimated.



Traditional ringed seal hunting in the 1980s.



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During the latest 20 years, nature photographer Seppo Keränen has observed a previously unknown symptom in ringed seals in the Finnish Archipelago Sea. The seals appear to have an upper respiratory tract infection with thick nasal discharge. The symptom seems to be rather common at least locally: e.g. in spring 2015 roughly one fourth of the photographed ringed seals showed signs of it. The cause of the nasal discharge as well as the distribution and possible effects of the condition on the ringed seal population remain to be studied.

Threat	Effects	Seriousness and trend	Description
Global warming	Winters without ice and snow cover become more frequent, and the ringed seals cannot nest in lairs (snow cavities).	Very high for southern populations, increasing	The pup mortality of the ringed seal increases markedly in the absence of sheltering snow, or in some winters with the complete loss of suitable ice habitat. More detail in the chapter 5.
Oil and chemical spills	Toxication via food chain. Degradation of habitats. Direct effects.	High, risk increasing	Oil transportation in the Gulf of Finland has increased markedly and thus, the risk for oil accidents and oil spills has also increased. In the ringed seal habitats in open sea and outer archipelago, the effective restriction and cleanup of oil spills is very difficult. The effects are transferred to seals mostly via food chain but e. g. pups could be vulnerable to direct effects.
Persistent organic pollutants (POPs)	May cause diseases and decreased fertility for seals, which are the top predators in the Baltic Sea ecosystem.	High, decreasing	There have been very high concentrations of several Persistent Organic Pollutants (POPs) (such as PCBs and DDT) and PFAS-substances in the Baltic Sea ecosystem. POPs have been linked to the reduced fertility of ringed seals. During the last decades, the concentrations of PCBs and DDT have been decreasing, while the fertility of the seals has recovered. PFAS pollutants may be an increasing threat with still poorly known effects.
Small size and isolation of the subpopulations	Stochastic events, genetic bottlenecks, lack of suitable mating partners, inbreeding.	Not actual, but present situation regarding the connectivity between the southern Baltic subpopulations is very poorly known	Probably most serious for the very small and isolated subpopulation of the eastern part of the Gulf of Finland. More research (DNA studies on the population structure, satellite tracking) is needed.
By-catch mortality in fisheries, other effects of fishing	Baltic ringed seals are killed by fishing nets and traps, and especially winter fishing may cause disturbance in some areas. Fishing nets are especially harmful for the young seals during their first year and bad ice winters have been linked to increased bycatch mortality.	Medium	No official statistics on the by-catch mortality of seals are available, in spite of EU obligations for the member states to register the by-catch mortality. According to Vanhatalo <i>et al.</i> (2014), the total yearly by-catch of grey seals by trap and gill nets in Finland, Sweden and Estonia in 2012 was probably between 2,180–2,380 individuals, i.e. a large proportion of the Baltic population. Lunneryd <i>et al.</i> (2004) estimated that some 50 ringed seals drowned in Swedish commercial fisheries in 2001. In Lake Saimaa, it is estimated that 40% of the young ringed seals are killed as bycatch.
Hunting and poaching	Ringed seals are shot legally (in Finland and Sweden) or accidentally (during legal hunting of grey seals) or illegally and deliberately.	Medium if hunting increases from the current level	No data available.
Changes in the land use; increased yachting and boat traffic in the breeding areas of Baltic ringed seals	Disturbance due to increased human activity (summer houses).	Medium	The Baltic ringed seals mainly occur and breed in the last undisturbed areas of the archipelago without summer houses and intensive pleasure boat traffic. Conversely, there is normally very little free-time traffic in the breeding areas during the breeding season.
New sea lanes and increased traffic	Traffic and underwater noise increases and expands to new areas due to the construction of new sea lanes.	Medium	In most years, the Baltic ringed seals can breed in undisturbed areas. In the Archipelago Sea and in the eastern part of Gulf of Finland, disturbance may occur especially in poor ice years. Ship traffic affects breeding habitats by separating ice fields, which then start to drift and may be vulnerable to storm damage and may lead in breeding losses.
Construction of wind power	Underwater noise from offshore wind farms may disturb ringed seals (Tougaard <i>et al.</i> 2009), and lead to seals abandoning certain parts of the feeding or breeding grounds.	Low	Very little data available, but studies on, e.g. harbour seals, have shown impacts especially during the construction phase. The effects of operational wind farms are not yet well understood.
Eutrophication of the Baltic sea including cyanobacteria blooms	The effects of eutrophication in the Baltic Sea on ringed seals are still poorly known.	Unknown	No data available.

Table 1. Potential threats for the southern Baltic ringed seal populations.

REFERENCES

- Bergman, G. 1958. Suomen hyljekannoista. – Suomen Riista 12: 110–124.
- Hamilton C. D., Lydersen C., Ims R. A., Kovacs K. M. 2015. Predictions replaced by facts: a keystone species' behavioural responses to declining arctic sea-ice. *Biol. Lett.* 11: 20150803. <http://dx.doi.org/10.1098/rsbl.2015.0803>
- Hårding, K.C. & Härkönen, T. 1999. Development in the Baltic grey seal (*Halichoerus grypus*) and ringed seal (*Phoca hispida*) populations during the 20th century. – *Ambio* 28 (7): 619–627.
- Härkönen, T. 2016. *Pusa hispida* ssp. *botnica*. The IUCN Red list of Threatened Species 2015. www.iucnredlist.org
- Härkönen, T., Stenman, O., Jüssi, M., Jüssi, I., Sagitov, R. & Verevkin, M. 1998. Population size and distribution of the Baltic ringed seal (*Phoca hispida botnica*). – In: Heige-Jorgessen, M.P. & Lydersen, C. (eds.): Ringed seals in the North Atlantic. – NAMMCO Scientific Publications Vol. 1. Pp. 67–180.
- Lunneryd, S.G., Königson, S., and Sjöberg, N. 2004. Bifångst av säl, tumlare och fåglar i det svenska yrkesfisket. By-catch of seals, harbor porpoises and birds in the Swedish commercial fisheries. – *Finfo* 2004:8.
- Martinez-Bakker, M.E., Sell, S.K., Swanson, B.J., Kelly, B.P. & Tallmon, D.A. 2013. Combined genetic and telemetry data reveal high rates of gene flow, migration, and long-distance dispersal potential in Arctic ringed seals (*Pusa hispida*). – *PLoS ONE* 8(10): e77125. doi:10.1371/journal.pone.0077125
- Miettinen, M., Halkka, A., Högmänder, J., Keränen, S., Mäkinen, A., Nordström, M., Nummelin J. & Soikkeli, M. 2005. The ringed seal in the Archipelago Sea, SW Finland: population size and surveys techniques. – International conference on Baltic seals, 15-18 February 2005, Helsinki, Finland.
- Meier, H. E. M., Döscher, R. & Halkka, A. 2004. Simulated distributions of Baltic Sea-ice in Warming climate and consequences for the Winter habitat of the Baltic Ringed Seal. *Ambio* 33 (4-5): 249-256.
- Nordström, M., Högmänder, J., Halkka, A., Keränen, S., Kunnasranta, M., Nummelin, J., Miettinen, M., Niinimäki, T. & Tolvanen, P. 2011. Itämerennorppa Saaristomerellä – onohdettu uhanalainen. – Maa- ja metsätalouden säätiön WWF Suomen rahaston raportteja 28.
- Oksanen S. M., Niemi M., Ahola M. P. & Kunnasranta M. 2015. Identifying foraging habitats of Baltic ringed seals using movement data. – *Movement Ecology* 3: 33.
- Stenman, O. 1990. Hyljekuolemat itäisellä Suomenlahdella vähäjäisen talven 1988–1989 seurauksena. (Seal deaths in the eastern Gulf of Finland as a consequence to scarcity of ice in the winter 1988–1989, in Finnish). – *Kalamies* 4:12–13.
- Stenman, O., Blomberg, T. & Nordberg, M. 2008: Vikaren på Åland under de senaste hundra åren. *Skärgård* 2008(2): 36–41.
- Stenman, O., Verevkin, M., Dmitrieva, L. & Sagitov, R. 2005. Numbers and occurrence of ringed seals in the Gulf of Finland in the years 1997-2004. – In: Helle, E., Stenman, O. & Wikman, M. (eds.) Symposium on biology and management of seals in the Baltic area. Kala- ja riistaraportteja 346: 45–47.
- Tormosov, D.D. & Rezvov, G.V. 1978. Information on the distribution, number and feeding habits of ringed and grey seals in the Gulfs of Finland and Riga in the Baltic Sea. – *Finnish Game Res.* 37: 14–17.
- Tormosov D.D. & Esipenko A. G. 1986. The abundance of ringed and grey seals in the Gulfs of Riga and Finland. – *Finnish Game Res.* Vol. 44: 33–36.



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Tormosov, D.D. & Esipenko, A.G. 1989. Aircraft counting of seals in the Gulfs of Finland and Riga in spring 1985 and some details of the counting method. – Proceedings of the Soviet-Swedish Symposium on “Effect of Toxic Substances on Dynamics of Seal populations”, Moscow, April 14-18, 1986: 5–9.

Tougaard, J., Henriksen, O.D. & Miller, L.A. 2009. Underwater noise from three types of offshore wind turbines: estimation of impact zones for harbor porpoises and harbor seals. – J. Acoust. Soc. Am. 125(6):3766-3773. doi: 10.1121/1.3117444.

Trukhanova, I. 2013. Positive trends in two endangered ringed seal subspecies in the Eastern Baltic Sea and Lake Ladoga. – Abstracts of the 20th Biennial Conference on the Biology of Marine Mammals 20th Biennial Conference on the Biology of Marine Mammals, Dunedin, New Zealand, 9–13 Dec 2013.

Ukkonen, P., Aaris-Sorensen, K., Arppe, L., Daugnora, L., Halkka, A., Lõugas, L., Oinonen, M.J., Malgorzata, P. & Storå, J. 2014. An Arctic seal in temperate waters: history of the ringed seal (*Pusa hispida*) in the Baltic Sea and its adaptation to the changing environment. – Holocene 24 (12): 1694–1706.

Vanhatalo, J., Vetemaa, M., Herrero, A., Aho, T. & Tiilikainen, R. 2014. By-Catch of Grey Seals (*Halichoerus grypus*) in Baltic Fisheries – A Bayesian Analysis of Interview Survey. – PLoS ONE 9(11): e113836. doi:10.1371/journal.pone.0113836

Verevkin M.V. & Sagitov R.A. 2004. Number and distribution of seals in the Gulf of Finland. In: I.V. Ilinskiy (ed.) Birds and mammals of the North-West of Russia. – Proc. of Biological Research Institute of the St. Petersburg State University, 48: 35-39 (in Russian).

Verevkin M.V., Vysotsky V.G. & Sagitov R.A. 2012. The Baltic ringed seal (*Pusa hispida botnica*) aerial survey in the Russian part of the Gulf of Finland [In Russian: Aviaychet baltiyskoy kolchatoy nerpi (*Pusa hispida botnica*) v rossiyskoy chasti Finskogo zaliva] – Vestnik of St.- Petersburg State University. 3(1): 38–46.

Zheglov V.A. & Chapskiy K.K. 1971. Experience of aerial survey of ringed and grey seals and their breathing holes in the Gulfs of the Baltic Sea and on the Lake Ladoga. [In Russian: Opyt aviaycheta kolchatoy nerpi i serogo tulenya i ih lunok na zalivah Baltiyskogo morya i Ladozhskom ozere] – Proceedings of AtlantNIRO. Kaliningrad. No 39. Pp. 323–342.



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