NORWAY - PROGRESS REPORT ON MARINE MAMMALS 2017

Compiled by Nils Øien & Tore Haug

I INTRODUCTION

This report summarises Norwegian research on pinnipeds and cetaceans conducted in 2017 and conveyed to the compilators. The research presented here was conducted at, or by representatives and associated groups of,

The Institute of Marine Research (IMR);
The Norwegian Polar Institute (NP);
The Arctic University of Norway, Forskningsgruppe for arktisk marin systemøkologi (UiT-AMSE);
University of Oslo - Centre for Ecological and Evolutionary Synthesis (CEES).

II RESEARCH BY SPECIES 2017

PINNIPEDS

The use of traditional photo aircrafts to assess **harp** and **hooded seal** populations in remote areas, such as the West Ice, is expensive, and has also become more difficult to operate during recent years. With funding from the Norwegian Research Council (NRC), IMR has now started experiments with alternative (and cheaper) methods to perform photo-based aerial surveys of seals in the West Ice, including the use of UAVs (Unmanned Aerial Vehicles) or drones. Manual analysis of images obtained in aerial photographic surveys is extremely time consuming and costly, and involves subjective human interpretation by trained experts. For this reason, the UAV project, also aims at developing methodology for automating the process of counting seals from aerial images. This will be achieved through the development of new image analysis and pattern recognition techniques tailored to detect seals in digital color images. Techniques including machine learning and deep neural networks are applied, and the preliminary results are very promising. This part of the work now occurs in the IMR project REDUS which is running in close cooperation with the Norwegian Computing Center, Oslo. (IMR)

In 2008 and 2010, satellite based tags were deployed on 18 **hooded seals** (9 adult females, 3 adult males, 6 juveniles) in the Greenland Sea. The main goal was to assess and define the ecological niche of the species and to better understand how changes in physical conditions might affect its distribution or behaviour. Overall, foraging occurred most commonly in relatively shallow areas with high sea surface temperatures, corresponding to continental shelf areas with Atlantic Water masses. All age and sex classes overlapped spatially to a degree, but the different age and sex groups did show differences in the bathymetry of their foraging areas as well as showing vertical segregation in the water column. When foraging, pups dove in the upper part of the water column, but in relatively deep areas compared to the adults. Adult females foraged relatively shallowly in deep water areas too, while males foraged close to the bottom in shallower areas. Despite considerable changes in ice cover, the current migration patterns of hooded seals seem not to be very different from observations made in the early 1990s. (NPI – IMR)

In a recent study of a study of selection and foraging response of **harbour seals** in an area (Porsangerfjord, Finnmark, Norway) of changing prey resources, the foraging behavior of seals was investigated by assessing their preference and foraging response to the seasonal dynamics of prey distribution. The movement and dive patterns of individual seals were tracked with GPS devices. Foraging locations were compared to the availability of potential prey species in the fjord. Results

suggested that harbour seals in Porsangerfjord had a preference for small-sized fish (<25 cm). Small codfish were preferred during autumn, but a response to the presence of pelagic fish was seen when the latter aggregated to overwinter in cold deep waters in the inner parts of the fjord. The formation of ice during late winter, however, provoked a shift in preference for small codfish, due to the sudden inaccessibility of pelagic fish. A strong reversed trend was observed in spring when the ice melted. The results indicate preference for small aggregated fish and the presence of a foraging response to changes in resource distribution. (IMR – UIT)

Harbour seals were counted along the entire mainland Norwegian coast at known haul-out sites during the molting period from mid-August to early September 2011-2016. In 2011 and 2012, molting areas from Rogaland to Finnmark counties and in Østfold county were covered by aerial photo surveys. Usually three independent surveys were conducted. In 2016, also an electric drone (helicopter) was used to photograph harbour seal colonies along the Norwegian Skagerrak coast. Visual counts using binoculars from small boats and land were also carried out in areas not covered by aerial surveys, or where results from the aerial surveys seemed to be incomplete. The surveys revealed a total minimum population of 7712 harbour seals along the mainland Norwegian coast in 2011-2016. In western Finnmark, 395 harbour seals were counted in 2013. West Finnmark was not covered in the two previous surveys. The count of 7317 harbour seals (not including West Finnmark) seems to be a small increase compared to 6938 in 2003-2006, but slightly lower than 7465 in 1996-1999. (IMR). Six harbour seals were tagged with GPS phone tags in late August 2017 in Telemark. However, the tags did not last very long and one of the seals were shot in the hunt shortly after tagging. (IMR)

A population model is used to describe the dynamics of the Norwegian **grey seal** population based on data from pup counts covering the entire grey seal distributional area in 1996-2008. The model also requires estimates of natural mortality and female reproductive rates, but since empirical data on these parameters were outdated or absent, they were estimated by the model using a Bayesian approach. Model runs indicated an increase in abundance of the total Norwegian grey seal population in the 30 most recent years, suggesting a total of 7120 (5710 - 8540) animals (1+) in 2011. Including an estimated pup production of 1620 (95% CI 1410-3050), it was estimated a total number of 8740 (95% CI 7320-10170) grey seals in 2011. However, new boat based surveys carried out in the entire area from Froan in Sør-Trøndelag to Lofoten in Nordland in 2014-2015 showed a significant decrease in pup production and yielded numbers ranging between 34.8% and 47.5% of the counts in 2007-2008. In Finnmark (2015), Troms (2016) and Rogaland (2017) pup production was approximately equal to the results in 2006-2008. Including all pup counts in 2014-2017 in the population model, the current total number of grey seals in Norway was estimated to 3850 animals (95% CI: 3504-4196). (IMR).

Walrus (*Odobenus rosmarus):* 40 walruses were previously equipped with GPS loggers (20 in 2014 and 20 in 2015) on their tusks. These loggers log one GPS position per hour and download these data to receiving stations that are placed on 5 different haul-out sites (in masts that was initially deployed for a camera surveillance project). The longevity of the batteries in the loggers should be minimum 5 years. The receiving stations were visited and serviced summer 2017 and data from 15 walruses were collected. This project is mainly funded by the Norwegian-Russian Environmental Commission. (NP).

Ringed seals (*Pusa hispida):* Ten ringed seals were equipped with GPS-CTD Satellite Relay Data Loggers for detailed studies of space use, and especially their affiliation with glacier fronts. The hydrographic data collected by the seals are parts of a Norwegian Research Council funded project in geophysics (TIGRIF: Tidewater Glacier Retreat Impact on Fjord circulation and ecosystems") (NP).

Mainly from the Isfjorden area, Svalbard, 25 Ringed seals were collected to the Norwegian Environmental Specimen Bank. Data on morphometrics, age, sex and various tissue are delivered to this Specimen Bank (NP).

CETACEANS

Minke whales (*Balaenoptera acutorostrata)*
During the period 20 June to 14 August 2017, a sighting surveys was conducted with the chartered vessel *Acc Mosby* in the Barents Sea area. The area which was covered was the IWC *Small Area EB* (the Barents Sea proper east of 28°E). This was the fourth year of the six-year program 2014-2019 to cover the northeast Atlantic to provide a new abundance estimate of **minke whales** every sixth year as part of the management scheme established for this species. A total of 2,944 nautical miles was surveyed with independent double platforms on primary effort. During primary search effort, the number of observations from the primary platform (crow's nest) was 153 sightings of **minke whales**. Sightings of other cetacean species include **fin whales** (15 primary sightings), **humpback whales** (34 primary sightings), Greenland Right Whale (5 primary sightings), h**arbour porpoises** (60 primary sightings), **white-beaked dolphins** (78 primary sightings) and beluga (1 sighting). In addition harp seals were seen in open sea as well in the drift ice in the northern Barents Sea. (IMR).

Minke whale catch data for the 2017 season have been computerised and evaluated. (IMR).

The "weShare" project studies causes and consequences of the massive herring superabundance events that have taken place in the Kaldfjord/Vengsfjord system over the past 5 winter seasons. The project has 1) carried out extensive and repeated echosounder surveys for herring approximately monthly every season (Oct-Feb) to study the dynamics and estimate the biomass of herring, 2) used highly advanced electronic accelerometer/camera tags, attached with suction cups to ~25 **humpback whales**, to study in detail their foraging behavior, estimate their prey consumption rates, and estimate their body condition, 3) carried out a pilot study to evaluate the use of aerial drones to estimate whale abundance, and 4) supported the collection of photo IDs of humpback whales. The photo ID efforts have so far resulted in over 900 individual humpbacks having been identified in the region since 2010, and these represent the North Norwegian Humpback Whale Catalogue (NNHWC, www.hvalid.no). Photographs of the majority of these individuals have been submitted to the North Atlantic Humpback Whale Catalogue (NAHWC), and several matches have been discovered with whales from Iceland, Ireland, Cape verde islands and the Caribbean. In addition, weShare has partnered with two other Fram Centre funded projects focused on describing the ecosystem-wide effects of herring superabundance on the general fjord ecosystem, in terms of water mass characteristics and nutrient composition, oxygen depletion, sediment structure and composition. Data from this project has been complemented by fisheries data provided by the Fisheries Directorate, as well as AIS (Automatic Identification System) data on general vessel traffic in the region, to evaluate the overlap between various human activities and whale presence. The project has so far produced one MSc thesis at the Arctic University of Tromsø (Kevin Ochoa, August 2017), and data are actively worked up by research scientists at the UiT and IMR, and specifically by one PhD candidate at UiT (Evert Mul). As part of weShare's other collaborations with researchers from Scotland, France and Japan, we are also involved with ongoing studies of the behavioural response of humpback whales to natural underwater sounds, specifically those of fish-eating and mammal-eating **killer whales**. Results from several of these projects have been presented at major international conferences, such as the recent 22nd Biennial Conference on the Biology of Marine Mammals, held in Halifax Oct 22-29th 2018. (UiT – IMR)

The "WhaleTrack" project studies whale behavior and fishery interactions during extreme winter arrivals of herring into northern fjord systems: The recent winter arrivals of herring into fjords in northern Norway have been followed by an extreme aggregation of top-predators feeding on this superabundant resource, including predatory fish, birds and whales. The Whaletrack project is a sub-project under the weShare, and focuses on measuring the behaviour of **humpback** and **killer whales** using different electronic tracking methods, ID-photo and genetic identification in the area. Since 2013, a total of about 40 humpbacks and 7 killer whales have been tagged with different data storage tags lasting from an hour to one week. In addition, 15 killer whales and 10 humpback whales (https://en.uit.no/prosjekter/prosjekt?p_document_id=505966) have been tagged with transdermal satellite tags during 2014-2017 giving us valuable data of the behaviour of the humpback and killer whales during their feeding period in winter in the northern fjords and during spring after leaving the

fjords. These data will be compared with fishery statistics from the same area and former history of the whales obtained from photo identification. (UiT-AMSE, IMR).

Killer whales in Norway have been documented preying on either fish or marine mammals in several regions, suggesting that this odontocete species has the ability to specialize on different types of prey. Off Norway, killer whales have been shown to rely on the Atlantic herring as a main prey resource. Infrequent observations have revealed seals as an additional component of their diet, yet the extent of predation on marine mammals has remained largely unknown. Jourdain et al. (2017) present the findings of 29 years of photographic and observational data on seal-feeding killer whale groups identified in Norwegian coastal waters. Four groups have been observed preying and feeding on seals over several years, taking both harbor and grey seals. These stable groups are shown to adopt small group sizes, and were typically observed in near-shore areas and were not encountered on herring wintering grounds. Behavioral and social traits adopted by these groups are like those of pinniped-feeding killer whales from other regions. (NP)

Bowhead whales
Satellite tags were deployed on 16 bowhead whales in the Fram Strait May-June 2017.Tags were deployed from a helicopter with RV *Lance* as a base. In addition, biopsies for genetic studies were collected from 10 individuals. (NP).

Five acoustic recorders (AURALs) listening for **bowhead whales, white whales** and **narwhals** (but also other species- and anthropogenic sounds) were deployed autumn 2016 and was retrieved during autumn 2017. Data were downloaded, new batteries installed and the AURALs were redeployed (NP).

Biopsies for various investigations (genetics, diet and pollution) were collected from **blue** (N=4) and **fin whales** (N=6) in the Svalbard area. (NP).

Other species
Research vessels, coastguard vessels and other providers have collected incidental observations of marine mammals. Recorded data include date, position, species and numbers. During 2017 a total of 808 cetacean observation incidents have been reported. The most frequently observed species were **minke whales** (141 groups), **Lagenorhynchus dolphins** (214), **fin whales** (76), **humpback whales** (95), **killer whales** (76), **harbour porpoises** (60 groups), **blue whales** (6), **sperm whales** (32), **long-finned pilot whales** (24), **bottlenose dolphins** (5), **sei whales** (7), **common dolphins** (1 group) and **Northern bottlenose whales** (4 groups). (IMR)

During 2017 photo IDs have been collected from more than 300 **humpback whales** during field work and from incidental sources. In addition, biopsy samples have been collected from 17 humpback whales. (IMR).

III ONGOING (CURRENT) RESEARCH

PINNIPEDS

Publication of **hooded seal** demographic and reproduction data (historical as well as new, sampled in 2008 and 2010) from the Greenland Sea are in the last phase of completion. (IMR)

Analyses of historical and new data on demography and reproduction of **harp seals** in the Greenland Sea and Barents Sea / White Sea are in progress. (IMR)

Collection of material to assess efficiency and animal welfare issues in the Norwegian commercial sealing of **harp seals** in the Greenland Sea in April/May was conducted in 2013 and 2014 – analyses and publication are in progress. (IMR)

Conduct a new aerial survey to assess the harp and **hooded seal** pup production in the West Ice in March/April 2018. (IMR)

Collect new data on biological parameters for **harp seals** in the East Ice during the commercial hunt 2018. (IMR)

In April 2017, satellite based tags were deployed on 26 harp seal pups (beaters) in the Greenland Sea. The project aims to assess how the young harp seals use the habitat in Greenland coastal waters and how this may influence on future plans for oil activity in the area. New tagging will be attempted in 2018. (IMR – UiT)

Tagging with satellite based tags, **harp seals** in the White Sean - funding secured, will be attempted in April/May 2018. (IMR)

Ship based registrations of **grey seal** pups, including tagging, counting and staging of pups, will be conducted in Nordland in October 2018 to check if the observed reductions in pup production prevail in the area. (IMR)

Ship based counting of **harbour seals**, using electronic helicopter drones with camera, will be conducted in western Norway (from Sogn and northwards) in September. This will continue the work further south in 2017, aimed aimed to provide a new abundance estimate for the species along the entire Norwegian coast. (IMR)

Final analyses of **grey seal** diet data from the Norwegian coast are in progress, an article will be submitted. (IMR)

Publication of results from genetic and population studies of **harbour** and **grey seals** is in progress. (IMR)

CETACEANS

Sampling of **minke whale** stomach contents and life history parameters will be performed during the commercial hunt in August. (IMR)

Studies of **harbor porpoise** ecology and population biology were initiated in 2016 and continues in 2018. Samples are obtained from bycatches. (IMR, UiT)

GENERAL

Research related to marine mammals at CEES is focused on the role of the marine mammals in the ecosystem.
Work has been related to stomach content analysis (including harp seal and minke whale) and to include dynamic
species models for marine mammals into dynamic community models for fish and zooplankton.
This work has not resulted in any publications in 2017. (CEES)

During autumn (August-September) surveys to assess the oceanographic and ecological conditions in the Arctic Ocean (between Svalbard and the ice edge further north; the SI_ARCTIC project at IMR, running during 2014-2017), visual observations of all **marine mammals** are conducted along all sampling transects. (IMR)

IV ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

Sealing

Advice on the management of harp and hooded seals is based on deliberations in the ICES / NAFO / NAMMCO Working Group on Harp and Hooded Seals (WGHARP). WGHARP met during 26-30 September 2016 at the ICES HQ in Copenhagen, Denmark, to assess the status and harvest potential of stocks of Greenland Sea harp and hooded seals and harp seals in the White Sea. The advice given subsequently by ICES, were used by the Joint Norwegian-Russian Fisheries Commission to establish management advice for 2018.

The basis for the advice was a request from Norway in October 2015 where ICES was requested to assess the status and harvest potential of harp seal stocks in the Greenland Sea and White Sea/Barents Sea and of the hooded seal stocks in the Greenland Sea, and to assess the impact on the harp seal stocks in the Greenland Sea and the White Sea/Barents Sea of an annual harvest of: 1) Current harvest levels; 2) Sustainable catches (defined as the fixed annual catches that stabilizes the future 1+ population); 3) Catches that would reduce the population over a 10-year period in such a manner that it would remain above a level of 70% of current level with 80% probability.

ICES have developed a Precautionary harvest strategy for the management of harp and hooded seals. The strategy includes two precautionary and one conservation (limit) reference levels. The reference levels relate to the pristine population size, which is the population that would be present on average in the absence of exploitation, or a proxy of the pristine population (which in practical terms is referred to as the maximum population size historically observed, N_{max}). A conservation, or lower limit reference point, N_{lim}, identifies the lowest population size which should be avoided with high probability. The first precautionary reference level is established at 70% (N_{70}) of N_{max}.When the population is between N_{70} and N_{max}, harvest levels may be decided that stabilise, reduce or increase the population, so long as the population remains above the N_{70} level. ICES has suggested that this could be done by designing the TAC to satisfy a specific risk criterion which implicate 80% probability of remaining above N_{70} over a 15-year period. When a population falls below the N_{70} level, conservation objectives are required to allow the population to recover to above the precautionary (N_{70}) reference level. N_{50} is a second precautionary reference point where more strictly control rules must be implemented, whereas the N_{lim} reference point (set by ICES at 30% (N_{30}) of N_{max}) is the ultimate limit point at which all harvest must be stopped.

The ICES management of harp and hooded seals require that the populations in question are defined as "data rich". Data rich stocks should have data available for estimating abundance where a time series of at least three abundance estimates should be available spanning a period of 10-15 years with surveys separated by 2-5 years, the most recent abundance estimates should be prepared from surveys and supporting data (e.g., birth and mortality estimates) that are no more than 5 years old. Stocks whose abundance estimates do not meet all these criteria are considered "data poor", and should be managed more conservatively.

Population assessments were based on a population model that estimates the current total population size, incorporating historical catch data, estimates of pup production and historical values of reproductive rates. The modelled abundance is projected into the future to provide a future population size for which statistical uncertainty is provided for various sets of catch options. In case of "data poor" populations, catch limits are estimated using the more conservative Potential Biological Removal (PBR) approach.

Using the population assessment model, the size of the **Greenland Sea harp seal** population was estimated as 676 500 (95% C.I. 490 190 – 862 810) animals in 2017. ICES consider this population to be data rich, and above the N_{70} level (i.e., more than 70% of known maximum abundance measured). Thus, it is appropriate to provide catch advice using the assessment model and to apply the Precautionary harvest strategy. Current catch level will likely result in an increase in population size of

76% over the 15-year's period 2017-2032, whereas a catch of 21 500 1+ animals, or an equivalent number of pups (where one 1+ seal is balanced by 2 pups) per year would sustain the population at present level over the same period. Catches that would reduce the population over a 15-year period in such a manner that it would remain above a level of 70% of current level with 80% probability are 26 000 1+ animals, or an equivalent number of pups (where one 1+ seal is balanced by 2 pups), in 2017 and subsequent years. Any allowable catch should be contingent on an adequate monitoring scheme to detect adverse impacts before it is too late for them to be reversed, particularly if the TAC is set at a level where a decline is expected.

Recent Russian aerial surveys of the **White Sea/Barents Sea harp** seal stock suggest that there may have been a sudden reduction in pup production after 2003. ICES have suggested that the reduced pup production does not appear to be a result of poor survey timing, poor counting of imagery, disappearance or mortality of pups prior to the survey or increased adult mortality. The most likely explanation for the change in pup production seems to be a decline in the reproductive state of females.

The population assessment model used for the White Sea/Barents Sea harp seal population provided a poor fit to the pup production survey data. Nevertheless, ICES has decided to continue to use the model which estimated a total 2017 abundance of 1 408 200 (95% C.I. 1 251 680 – 1 564 320). The modelled total population indicates that the abundance decreased from 1946 to the early 1960s, increased from the early 1960s to the early 1980s, but then declined again until around 2007. The model suggests an increase in population size after 2007. Based on current data availability, this population is considered "data poor". The equilibrium catch level is 10 090 1+ animals, or an equivalent number of pups (where one 1+ seal is balanced by 2 pups), in 2017 and subsequent years. Using the traditional PBR approach, removals were estimated to be 39 985 seals (irrespective of age). However, this catch option indicates a 33% reduction of the 1+ population over the next 15 years. More conservative PBR approaches (but still within the defined framework of the method) were attempted as well, but they also resulted in population reductions (of 10-25%) over the next 15 years. Despite that this population is now classified as data poor, ICES expressed concerns over the high removals and declining population resulting from the PBR estimations, and concluded that the estimated equilibrium catches were the most preferred option.

Results from the most recent (2012) pup survey suggest that current **Greenland Sea hooded seal** pup production remains very low, and lower than observed in comparable surveys in 1997, 2005 and 2007. Due to some uncertainty regarding the historical data on pregnancy rates, the population model was run for a range of pregnancy rates (assuming 50%, 70% or 90% of the mature females produced offspring, respectively). All model runs indicated a population currently well below N_{30} (30% of largest observed population size). Recent analyses have indicated that pregnancy rates have remained rather constant around 70% in the period 1958 – 1999. Using this scenario, the model estimates a 2017 total population of 80 460 (95% C.I. 59 020 – 101 900). Following the Precautionary harvest strategy and the fact that the population is below N_{lim}, ICES recommend that no harvest be allowed for Greenland Sea hooded seals at this time.

Traditionally, both Russia and Norway have participated in the sealing operations in the West Ice and the East Ice and have, therefore, allocated quotas on a bilateral basis in negotiations in the Joint Norwegian-Russian Fisheries Commission. However, the Russians cancelled their sealing operations in the West Ice in 2001. The Norwegian shares of the 2017 quotas would be the total TAC of harp seals in the West Ice. In the East Ice, the Norwegian quota was set at 7,000 harp seals.

In 1996 new regulations for the **coastal seal hunt**, including catch reports, were introduced. Quotas were set based on the available information on seal abundance along the coast. In 2003, quotas were increased substantially compared to the recommendations based on scientific advice, when they were set at 1186 grey seals (25% of abundance estimate) and 949 harbour seals (13% of abundance estimate). In 2003-2010, annual catches varied between 302-516 grey seals and 457-905 harbour seals. In 2010, new management plans for harbour and grey seals were implemented. The goal is to ensure

sustainable populations of grey and harbour seals within their natural distribution areas. Regulating measures should be designed to ensure that they have the greatest impact in areas where there is documented significant damage to the fishing industry caused by seals. Target population sizes were decided to be 7000 harbour seals counted during moult and a grey seal population producing 1200 pups annually along the Norwegian coast. Hunting quotas should be set to regulate the seal populations in relation to the target levels. For 2011, quota for harbour seals was set to 460 and 230 seals were taken. For grey seals recommended quota was 460, set quota was 1040 but only 111 grey seals were taken. Compensations paid for shot seals were stopped for 2011. For 2012, 2013, 2014, recommended and set quotas were 460, 482 and 425 harbour seals, respectively. For the period 2015-2017 the quota was set at 455 seal per year. For grey seals quotas were 460 animals in 2012-2014, but due to observations of declines in pup production the quotas were reduced to 315 in 2015 and further down to 210 and 200 in 2016 and 2017, respectively. Compensations paid for shot seals were again introduced in 2012 (250 NOK/seal): 355 harbour seals and 64 grey seals were taken in 2012; 483 harbour seals and 177 grey seals in 2013; 406 harbour seals and 213 grey seals in 2014; 297 harbour seals and 82 grey seals in 2015; 362 harbor seals and 33 grey seals in 2016, and 338 harbor seals and 81 grey seals in 2017.

Whaling

At the IWC Annual Meeting in 1992 Norway stated that it intended to reopen the traditional **minke** whaling in 1993. So far, IWC has accepted the RMP developed by its Scientific Committee as a basis for future management decisions but has not implemented the procedure. The Norwegian Government therefore decided to set quotas for the 1993 and following seasons based on RMP, with parameters tuned to the cautious approach level as expressed by the Commission and using the best current abundance estimates as judged by the IWC Scientific Committee. In recent years research has been conducted on modification and retuning of the procedure to other target levels than the original 0.72, chosen by the Commission.

At, in principle, regular intervals an *Implementation Review* of the RMP for a specific species and management area is conducted. During such reviews, the input data as well as biological information including genetics are critically evaluated and conditioned for simulation trials of management scenarios. The most recent review for North Atlantic common minke whales has been conducted over the period 2014-2017. It has been concluded that there is a single panmictic minke whale population in the Northeast Atlantic and new abundance estimates have been approved for use in RMP. From the 2008-2013 period, the total estimate for the surveyed areas is 100 615 (cv 0.17), of which 89 623 (cv 0.18) animals are in the Eastern area. (IMR).

Starting in 2016, a new six-year block quota 2016-2021, was set with an annual total catch quota of 880 animals of which 710 could be taken within the Northeastern stock area (the E Small Areas, i.e. the EW, EN, ES and EB Small Areas) and 170 within the CM area of the Central **minke whale** stock. The catch quotas are set for each of the five management areas, and untaken quotas may be transferred to following years within the period which the block quota is set for.

For 2017 the total catch quota, including transfers, was set to 999 minke whales. The catch quota for 2018 has not yet been decided. The catching season opens April 1 and are closed medio September.

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VI APPENDIX 1 – CATCH DATA

Sealing

Norwegian catches in the Greenland Sea (West Ice) in 2017 was taken by one vessel, whereas no Russian seal vessels participated in the area. Due to the uncertain status for Greenland Sea hooded seals, no animals of the species were permitted taken in the ordinary hunt operations in 2017. Only 17 animals (whereof 14 were pups) was taken for scientific purposes. The 2017 TAC for harp seals in the Greenland Sea was set at 26 000 1+ animals (where 2 pups balance one 1+ animal), i.e. the removal level that would reduce the population with 30% over the next 15 year's period.

A possible reduction in harp seal pup production in the White Sea may have prevailed after 2003. Due to concern over this, ICES recommended that removals be restricted to the estimated sustainable equilibrium level of 10,090 1+ animals (where 2 pups balance one 1+ animal) in the White and Barents Sea in 2017. The Joint Norwegian-Russian Fisheries Commission has followed this request and allocated 7,000 seals of this TAC to Norway.

Table VI.I shows the Norwegian catches of harp and hooded seals in 20176. The total quotas given were not fulfilled in any area: In the West Ice, only 5% of the given harp seal quota was taken. A ban implemented on all pup catches prevented Russian hunt in the White Sea during the period 2009-2013. This ban was removed before the 2014 season. Unfortunately, however, the availability of ice was too restricted to permit sealing, resulting in no commercial Russian harp seal catches in the White Sea in 2015-2017. Also, no Norwegian vessels aimed for the hunting area in the southeastern Barents Sea (the East Ice) in 2017. In September 2017, 1 harp seals (1+ animal) was taken for scientific purposes north of Svalbard – presumably from the White Sea / Barents Sea population.

Table VI.1. Norwegian catches of harp and hooded seals in 2017. 1+ means one year old or older seals.

Catching area:	*The West Ice*			*The East Ice*		
Species	Pups	1+	Total	Pups	1+	Total
Harp seals	1934	66	2,000	0	1	1
Hooded seals	14	3	17			

Whaling

After a temporary suspension, the traditional small type Norwegian **minke whaling** was again permitted in 1993 and quotas were implemented based on the Revised Management Procedure (RMP) developed by the International Whaling Commission's (IWC) Scientific Committee. The RMP allocates catch quotas to specific management areas. There are five such management areas within the region of interest to Norwegian whalers. The present areas are a revision of the original implementation and introduced by the IWC/SC at their Implementation Review of North Atlantic minke whales conducted at the 2003 Annual Meeting and later kept at the Implementation Review made in 2008 and 2014-2017. The areas are (1) the Svalbard-Bear Island area (coded ES), (2) the

eastern Barents Sea (EB), (3) the Norwegian Sea and coastal zones off North Norway, including the Lofoten area (EW), (4) the North Sea (EN) and (5) the western Norwegian Sea-Jan Mayen area (CM).

In total, 11 vessels participated in the 2017 season of whaling and the catching period was 1 April to 15 September. Table VI.2 shows the number of minke whales taken by area in the 2017 season. The quotas are given as six-year block quotas but is not fully utilised in all areas. There are several reasons for that, including problems with processing the catches and accessing remote areas like the Jan Mayen area and the eastern Barents Sea. Unused quotas can be transferred to the following year. The present quota period is 2016-2021. The calculated annual basic quota for this period is 710 animals within Medium Area E and 170 whales within the Small Area CM, giving a total of 880 minke whales. The total catch in the 2016 season was 591 whales so the quota for 2017 was set to 999 minke whales, including transferred unused catches.

Table VI.2. Quotas and catches of minke whales in 2017 by management area as defined in RMP.

2017	Management area					
Small-type whaling	EB	EN	ES	EW	CM	Total
Catch	16	7	375	34	0	**432**
Quota	829				170	999
Stock area	Northeastern				Central	

VII APPENDIX 2 – BY-CATCH DATA (*Arne Bjørge, IMR*)

Harbour porpoises, grey and **harbour** seals are incidentally caught in coastal gillnet fisheries. Large mesh gillnets for cod and monkfish in the Norwegian coastal zone have an annual bycatch of about 3000 harbour porpoises, 555 harbour and 466 grey seals. Data collection for monitoring marine mammal bycatches continued in 2017, but new estimates are not available.

A small pilot study with two types of pingers was conducted in 2017 to assist in the planning of a large-scale experiment in commercial fisheries that will commence in July 2018. The Future Oceans' porpoise pinger and the Fishtek's Banana pinger were used. The Future Oceans pinger emits signals with 0.4 seconds duration at a frequency of 10kHz and a signal strength of 132 decibels repeated every four seconds. The frequency (10kHz) is in the audible frequency range of pinnipeds. The Fishtek pinger emits signals with randomized intervals between 4 and 12 seconds. The signal duration is 0.4 second with a signal strength of 154dB, and the frequency fluctuates between 50 and 120 kHz. This is outside the audible frequency range of pinnipeds. In the cod fishery, 1723 net-weeks with pingers were compared to 2535 net-weeks without pingers. A total of eleven porpoises were caught. In nets with a pinger, one porpoise was caught every 861.5 net-weeks. In nets without pingers one porpoise was caught every 282 net-weeks. That represents a 70% reduction of the risk being bycaught in nets with pingers.

In the fishery for monkfish, 3411 net-weeks with pingers were compared with 7084 net-weeks without pingers. One porpoise was caught in nets with pingers and two in nets without pingers, resulting in no difference in catch rate. It was assumed that this was due to stochasticity with this very small sample size, a total of only three porpoises.

In nets with the Future Oceans pinger, one harbour seal was caught every 861.5 net-weeks compared to one harbour seal every 2535 net-weeks in nets without pingers. The risk of being bycaught was

therefore about three times higher in nets with 10kHz pingers. There was no difference in nets with and without the 50-120kHz pingers.

Both the Future Oceans and the Fishtek pingers produced sounds that were outside the audible range of cod and monkfish, and should therefore have no impact on the catch rate of the target species. For monkfish no change was detected, but cod nets with pingers had 19% higher catches of cod.