Appendix 8

The 46th Session of the Joint Norwegian - Russian Fisheries Commission, Moss, Norway, 17-20 October 2016

REPORT OF THE WORKING GROUP ON SEALS

Participants:

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Contents:

1. EXCHANGE OF INFORMATION AND SUMMARY OF SEAL CATCHES IN 2016

Norwegian catches in the Greenland Sea (West Ice) in 2016 was taken by 1 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 2016. Only 18 animals (whereof 10 were pups) was taken for scientific purposes. The 2016 TAC for harp seals in the Greenland Sea was set at 21 270 1+ animals (where 2 pups balance one 1+ animal), i.e. the removal level that would reduce the population with 30% over the next 10 year's

period. Total catches in 2016 were 1,442 (including 426 pups) harp seals, representing only 6% of the identified sustainable levels.

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 19,200 1+ animals (where 2 pups balance one 1+ animal) in the White and Barents Sea in 2016. The Joint Norwegian-Russian Fisheries Commission has followed this request and allocated 7,000 seals of this TAC to Norway. 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 and 2016. Also, no Norwegian vessels aimed for the hunting area in the southeastern Barents Sea (the East Ice) in 2016. In September 2016, 28 harp seals (1+ animals) were taken for scientific purposes north of Svalbard – presumably from the White Sea / Barents Sea population.

Norwegian and Russian catches in 2016, including catches under permits for scientific purposes, are summarized in the table below:

Area/species	Norway	Russia	Sum
GREENLAND SEA			
Harp seals			
Pups	426	0	426
Older seals (1yr+)	1016	0	1016
Sum	1442	0	1442
Hooded seals			
Pups	10	0	10
Older seals (1yr+)	8	0	8
Sum	18[1]	0	18
Area subtotal	1460	0	1460
BARENTS SEA / WHITE SEA			
Harp seals			
Pups	0	0	0
Older seals (1yr+)	28	0	28
Sum	28[1]	0	28
Area subtotal	28	0	28
TOTAL CATCHES	1488	0	1488

[1] Taken under permit for scientific purposes

2. EXCHANGE OF INFORMATION AND SUMMARY REPORTS OF RESEARCH ACTIVITIES IN 2016

2.1 Norwegian research

2.1.1 Estimation of harp and hooded seal pup production in the Greenland Sea

The use of traditional photo aircrafts to assess 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 occurs in close cooperation with the Norwegian Computing Center, Oslo.

2.1.2 Studies of life history parameters

Morphometric data for adult female Greenland Sea hooded seals collected over the period 1958-64 to 2008-10 showed a reduction in length at age in samples collected in the 1970s and 1990s and a small increase in the most recent sample from 2008-10. Throughout the period, however, length-at-age was lower in Greenland Sea hooded seals than in Northwest Atlantic hooded seals collected over the period 1956-1976. Ventral blubber thickness of breeding females was also significantly lower in all Greenland Sea breeding samples (1958-1999) compared to a breeding sample from the Northwest Atlantic in 1967-1972.

Data on age at maturity and fertility in Greenland Sea harp seal females were collected from the commercially hunted seals in the West Ice in 2014. Preliminary results from the analyses seems to indicate that conditions must have improved for the stock. Age at maturity has decreased significantly from 7.6 years in 2009 to 6.15 years, whereas fertility rate has increased to 91 %.

2.2 Russian research

As in 2015, traditional Russian multispectral aerial research of pup production in the White Sea was not conducted in 2016 (last survey was in 2013). For this reason, PINRO scientists have focused on monitoring of ice conditions in the White Sea and adjacent areas in the Barents Sea. Similar work was made also in 2015. This research is very relevant for evaluation of conditions for harp seal pup production in the White Sea (and potentially also in neighboring areas). All accessible satellite information was used. Satellite-based information was obtained from Internet

(Norwegian Meteorological Institute - NMI; NOAA, USA – Terra/MODIS and Aqua/MODIS) and satellite images were received from the Northern Hydrometeorological Center (Arkhangelsk) - NHMC by e-mail. Additionally, information was received from vessels and other sources about localization of pup production patches. In Figs 1-4 below we present example images from 2016, obtained from different sources.

Mid March is considered as the peak time for harp seal pupping in the White Sea. Comparison of ice conditions in the traditional pupping areas in the White Sea in this period in 2016 (Fig. 1) and 2015 (Fig. 4) show considerable better ice conditions in 2016.

Most probably, the level of pup mortality in 2016 must have been less in comparison with 2015. However, correct data about current pup production of the Barents Sea/White Sea harp seal population can only be obtained in new multispectral aerial surveys.

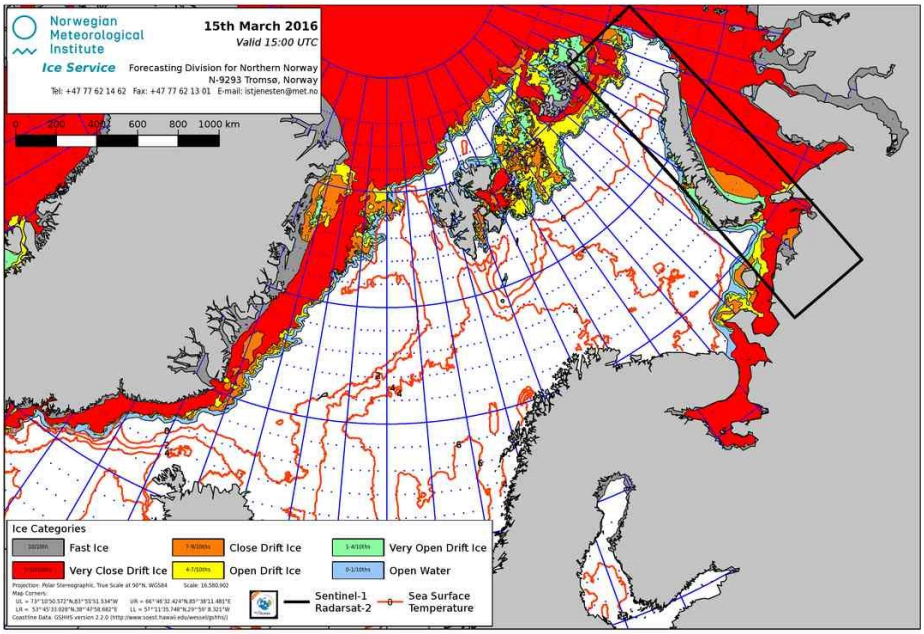

Figure 1 – Ice condition map from 15 March 2016 (from NMI)

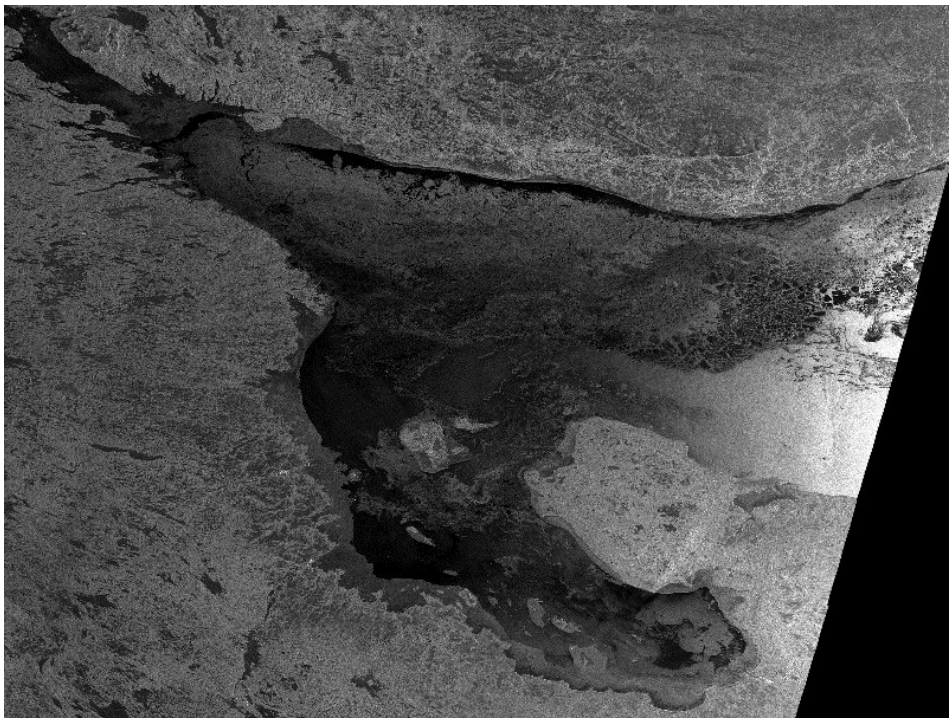

Figure 2 – Satellite image of ice conditions on 12 March 2016 (from NHMC)

Figure 3 – Distribution of Barents Sea/White Sea harp seals (of all ages) during moult in the south eastern part of the Barents Sea (mean position 69.75ºN/57.50ºE) on 16 April 2016 (photo from oil platform “Prirazlomnoe”)

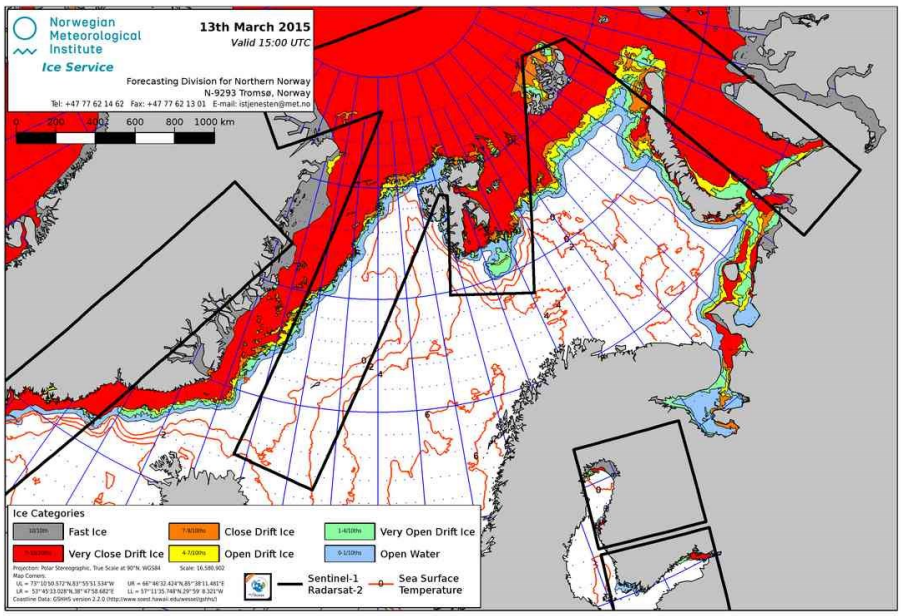

Figure 4 - Ice condition map on 13 March 2015 (from NMI)

2.2.2 Other issues

During late spring, summer and early autumn in 2016, several dedicated expeditions were carried out in the Kola Peninsula coastal zone in the Barents Sea area, using small boats and vessels. In the Barents Sea open area, opportunistic sighting surveys onboard research and fisheries vessels, including the annual joint Russian-Norwegian ecosystem surveys, were carried out. During all surveys mentioned, data on marine mammal distribution and numbers were collected, taking into account also environmental conditions and fish species distributions and biomass. The main aim was to attempt to estimate marine mammals and fisheries interactions on one side, and influence of current climatic changes and human activity on marine mammals on the other. Research on mathematical modeling designed to estimate the total White Sea/Barents Sea harp seal population stock abundance and develop recommendations concerning harvesting strategy were continued.

3. STATUS OF STOCKS AND MANAGEMENT ADVICE FOR 2017

The ICES Working Group of Harp and Hooded Seals (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 by ICES in October 2016, based on the 2016 WGHARP meeting, were used by this Working Group on Seals to establish management advice for 2017 to the JNRFC.

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.

3.1. Greenland Sea

The Working Group **recommends** the opening dates for the 2017 catch season to be between 1 and 10 April for catches of both weaned harp seal pups and adult moulting harp seals. The Group recommends a closing date set at 30 June (2400 GMT) for harp seals. Exceptions on opening and closing terms may be made in case of unfavourable weather or ice conditions.

The Working Group agree that the ban on killing adult females in the breeding lairs should be maintained in 2017.

3.1.1 Hooded seals

Results from the most recent (2012) pup survey suggest that current 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 that 50%, 70% or 90% of the mature females produced offspring, respectively). All model runs indicated a population currently well below N30 (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).

Catch estimation: 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.

The Working Group recommends that this ICES advice is implemented in future managenment of hooded seals in the Greenland Sea: Removals should still be prohibited until more information about current stock status becomes available.

3.1.2 Harp seals

The assessment model trajectory suggests an increase in the Greenland Sea harp seal population abundance from the 1970s to the present (2017) abundance of 676 500 (95% C.I. 490.190-862.810) animals.

Catch estimation: 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.

The Working Group recommend that the advice from ICES be used as a basis for the

determination of a TAC for harp seals in the Greenland Sea in 2017:

- *If the management objective is to maintain the population at current level, a TAC of 21 500 1+ animals or an equivalent number of pups, is recommended.*
- *If the management objective is to reduce the population towards N_{70} over a 15-year period, a TAC of 26 000 1+ animals, or an equivalent number of pups, is recommended.*

In both harvest scenarios, one 1+ seal should be balanced by 2 pups.

3.2 The Barents Sea / White Sea

Current Russian regulations allows for seal hunting in the White Sea and southeastern Barents Sea from 20 March to 1 May. Both Parties **recommends** an extension of the hunting season which should include the entire period from 20 March to 15 May for the whole area. Exceptions from opening and closing dates should be made, if necessary, for scientific purposes.

The Working Group agreed that the ban on killing adult harp seal females in the breeding lairs should be maintained in 2017.

3.2.1. Harp seals

Russian aerial surveys of the White Sea harp seal pups were conducted in March in 1998 to 2013 using traditional strip transect methodology and multiple sensors. The results obtained may indicate a reduction in pup production after 2003:

YEAR	ESTIMATE	C.V.
1998	286 260	.150
2000	322 474	.098
	339 710	.105
2002	330 000	.103
2003	327 000	.125
2004	231 811	.190
	234 000	.205
2005	122 400	.162
2008	123 104	.199
2009	157 000	.108
2010	163 032	.198
2013	128.032	.237

As a result of the 2009 and 2010 surveys, regarded to be good by WGHARP, the Working Group feel that the reduced pup production observed since 2004 does not appear to be a result of poor

survey timing, poor counting of imagery, disappearance/mortality of pups prior to the survey or increased adult mortality. According to WGHARP, 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 its highest level in 1946 to the early 1960s, whereafter an increase has prevailed. Current level is 67% of the 1946 level.

Catch estimation: The last available information about the reproductive potential for the Barents Sea / White Sea harp seal population is based on data from 2006, i.e., more than 5 years old, and the population is considered to be "data poor". In such cases ICES usually recommend to consider the use the PBR approach to estimate catch quotas. 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.

Using the population assessment model, an equilibrium catch level of 10 090 1+ animals, or an equivalent number of pups (where one 1+ seal is balanced by 2 pups), was estimated for 2017 and subsequent years. This equilibrium catch is considerably lower than that estimated in previous assessments. The reason for this is the lower pregnancy rates assumed in the projections (an average of known values instead of the last measured rate), and this highlights the need for new samples. Such samples are best obtained from 1+ animals taken in commercial hunting in the harp seal moulting areas in the southeast Barents Sea. Despite the fact 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.

The Working Group suggest that the advice from ICES be used as a basis for the determination of a TAC for harp seals in the White Sea / Barents Sea in 2017: A TAC of 10 090 1+ animals, or an equivalent number of pups (where one 1+ seal should be balanced by 2 pups), is recommended.

3.2.2 Other species

The Working Group agreed that commercial hunt of bearded seals should be banned in 2017, as in previous years, but it **recommend** to start catch under permit for scientific purposes to investigate results of long time protection.

4. RESEARCH PROGRAM FOR 2017+

4.1. Norwegian investigations

Secure that the stocks remain data rich:

- Analyze new (from 2014) data on fertility and condition for harp seals in the West Ice
- Collect new data on biological parameters for harp seals in the East Ice as soon as possible

Killing methods in Norwegian commercial sealing

- Analyze collected data on hunting methods (from 2013 and 2014), supplement with additional data from the 2017 hunt if possible

Focus on the difficult sock situation for hooded seals:

- Analyzes of collected biological material from the West Ice

Analyses of historical data from harp seals

- Applies to the East Ice: biological parameters and trophic level

Seal diets

- Analyzes of stable isotopes and fatty acids from harp seals and their prey in the Barents Sea
- Collect new autumn data from harp seals in the Arctic Ocean (north of Svalbard)

Tagging with satellite based tags, harp seals in the White Sea

- Maybe we finally can do this in 2017

Observations of marine mammals on the ecosystem surveys

- Continues in 2017 - the survey will be extended to include also the polar ocean

4.2. Russian investigations

Multispectral aerial surveys of harp seal whelping patches
Tagging with satellite based tags, harp seals in the White Sea
Marine mammals coastal research and observations including collection of biological samples;
Comprehensive aerial research surveys of marine mammals in the Barents and Kara Seas

- Planned to be carried out in 2017.

4.3. Joint Norwegian - Russian investigations

4.3.1 Joint Research program on harp Seal Ecology

Harp seals are the most important marine mammal top predators in the Barents Sea. To be able to assess the ecological role of harp seals by estimation of the relative contribution of various prey items to their total food consumption in the Barents Sea, more knowledge both of the spatial distribution of the seals over time, and of their food choice in areas identified as hot-spot feeding areas is urgently needed. For this reason, the Joint Norwegian-Russian Fisheries Commission has decided to initiate a joint research program on harp seal ecology aimed to:

- assess the spatial distribution of harp seals throughout the year (experiments with satellite-based tags)
- assess and quantify overlap between harp seals and potential prey organisms (ecosystem surveys)

- identify relative composition of harp seal diets in areas and periods of particular intensive feeding (seal diet studies in selected areas)
- secure the availability of data necessary for abundance estimation
- estimate the total consumption by harp seals in the Barents Sea (modelling)
- implement harp seal predation in assessment models for other relevant resources (modelling)

The program was adopted by the Joint Norwegian-Russian Fisheries Commission in 2006. Although both ecosystem surveys and abundance estimation of harp seals are in progress, the core activities of the program have not yet been properly started. The parties had planned to deploy satellite transmitters on harp seals in the White Sea in late May in 2007-2012. However, this proved impossible due to some limitations regarding deployment of telemetric tags in all years. Later, in 2013-2016, these limitations were removed, but lack of funding hampered the tagging of seals this year. In 2017 IMR is attempting to obtain funding (from the Norwegian Research Council) to carry out satellite tagging in the White Sea. During the planned tagging experiment, PINRO will provide the necessary logistics required for helicopter- or boat-based live catch of seals in April-May 2017. IMR will, as before, be responsible for the satellite tags, including providing all necessary technical details, as well as for providing experienced personnel and equipment for anaesthetizing seals and tag deployment. All data obtained from the tags will be available for both PINRO and IMR scientists. Both US and Russian transmitters can be used. The transmitters cannot collect geographically positioned temperature and salinity data.

After the 2017 tagging season future seal tagging will be decided upon following an evaluation of both the tagging methods and the obtained seal movement data set. Due to low pregnancy rates and decline in pup production it will be important to focus on harp seal ecology and demographics in the coming years.

4.3.2 Other issues

Life history parameters in seals

Russian scientists have participated in scientific work on Norwegian sealers during March-May both in the southeastern part of the Barents Sea and in the Greenland Sea. This type of Norwegian-Russian research cooperation is encouraged also in the future. This would enable coordinated and joint sampling of new biological material. If Russia will carry out vessel trips, invitation for participation of Norwegian scientists is desirable.

Reconnaissance of possible new harp and hooded seal breeding patches in the Greenland Sea

Substantial changes in extent and concentration of drift ice in the Greenland Sea may have triggered behavioral changes of such a magnitude as a relocation of breeding for at least parts of the seal populations. The Working Group **recommends** that this is further examined by using aerial surveys.

Reconnaissance of possible new harp seal breeding patches outside the White Sea

Possibilities to account for the reduced harp seal pup production in the White Sea since 2004 include a shift in contemporary pupping to areas outside of the traditional areas. During the late 1980s or early 1990s, some reports of harp seal pups being observed in Svalbard were received. Therefore, the Working Group conclude that it is important that areas in the northern and southeastern Barents Sea and Kara Sea (south western part) be searched during future aerial reconnaissance surveys.

Comparison of methods used in pup production estimation

The Parties plan to continue work on comparison of methods used in pup production estimation, including both reading of images and subsequent calculations of the aerial survey data. This will continue the successful work started in 2009, and should include participation from Canada and Greenland.

4.4. Necessary research takes

For completion of the proposed Norwegian and Russian research programs, the following numbers of seals are planned to be caught under special permits for scientific purposes in 2017:

Area/species/category	Russia	Norway
Barents Sea / White Sea		
Whelping grounds		
Adult breeding harp seal females	170	0
Harp seal pups	30	0
Outside breeding period		
Harp seals of any age and sex	20	500
Greenland Sea		
Whelping grounds		
Adult breeding harp seal females	0	0
Harp seal pups	0	0
Adult breeding hooded seal females	0	50
Hooded seal pups	0	50
Outside breeding grounds		
Harp seals of any age and sex	0	200
Hooded seals of any age and sex	0	0

5. OTHER ISSUES

5.1 Sighting surveys of whales

Norway will conduct comprehensive line transect sighting surveys for minke whales (and other whales) in the Barents Sea (including the REZ) in 2017. These surveys are included in a six-year cycle (2014-2019) of sighting surveys which will result in new, updated whale estimates for the Northeast Atlantic area in 2020. It is of utmost importance that Russian authorities give permission to operate in the REZ for the rented Norwegian vessel that will do the survey, and both Parties strongly **recommend** that this happens. One Russian observer will be invited to participate in the survey.

5.2 Observations of marine mammals on the ecosystem surveys

The PINRO and IMR scientists acknowledge the importance of ecosystem surveys in the research of the ecology of marine mammals in the Barents Sea. The PINRO and IMR scientists emphasize

the need of two observers per ship (as defined in the survey protocol) and agreed on the necessity to continue aerial observation of marine mammals and environmental conditions from Russian research aircraft, which was carried out annually from 2003-2005 as part of ES. Aerial surveys are particularly efficient for obtaining high quality results from a large area over a short time period.

5.3 Joint research program on grey seals

In Norway grey seal pup production surveys aimed to cover all the breeding colonies along the entire coast were conducted in 2006-2008 using boat based as well as aerial surveys. New pup production surveys were initiated in 2013, starting with coverage of the northmost parts of Norway (Finnmark and Troms). The surveys continued in 2014-2015, and will be finished in 2016. There are large breeding colonies of grey seals located on the Murman Coast in Russia. Previous tagging experiments have shown that there is exchange of seals between these colonies and feeding areas in North Norway. Abundance estimation, using pup counts, in the Russian colonies has not been performed since 1991. For this reason, both Parties **recommend** that the Russian grey seal breeding colonies at the Murman Coast should be covered again. Ideally each colony should be visited three times (minimum twice) during the breeding period. The Parties discussed possibilities of multispectral surveys carried out by PINRO using a smaller aircraft. Norwegian participation in the grey seal surveys in Russia is highly recommended by both Parties. Traditionally the Russian grey seal colonies have been surveyed by Murmansk Marine Biological Institute (MMBI), and continued cooperation with MMBI is encouraged.

The parties agreed that this task can be most effectively solved within the frames of a future joint research program, preferably developed within the frames of the JRNFC. In addition to abundance estimation, also other important issues should be addressed:

- Stock identity: Do the Murman Coast grey seal colonies constitute isolated stocks, or are they part of the stock distributed in North Norway north of Vesterålen? This question can be addressed using genetic analyses.
- Spatial distribution and habitat use, e.g., what are the feeding areas for the Russian grey seals? Could be addressed by using satellite tags.
- Feeding habits and conflicts with fisheries and fish farming (diet studies).

6. APPROVAL OF REPORT

The English version of the Working Group report was approved by the members on 18 October 2016.