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REPORT OF THE WORKING GROUP ON SEALS

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1. EXCHANGE OF INFORMATION AND SUMMARY OF SEAL CATCHES IN 2007

Norwegian catches were taken by four vessels in the Greenland Sea and one vessel in the southeastern Barents Sea. For logistical reasons, Russian seal vessels did not carry out hunting in the Greenland Sea in 2007. Russian hunting in the White Sea was conducted using helicopters, ice class vessel and small plastic boats (length less than 20 meters). For economical reasons, there was no Russian hunt of whitecoats in 2007, all pups taken were beaters.

Due to the uncertain status for Greenland Sea hooded seals, no animals of the species were permitted taken in the ordinary hunt operations in 2007. Only a few animals were taken for scientific purposes.

The 2007 TACs set for harp seals in the Greenland Sea and in the Barents Sea / White Sea were as recommended by ICES (i.e., levels that would stabilise the populations at present level). For the Greenland Sea harp seals, the 2007 TAC was set at 31,200 1yr+ animals or an equivalent number of pups (where one 1yr+ animal should be balanced by 2 pups). The 2007 TAC for the Barents Sea / White Sea harp seals was 78,200 1yr+ animals or an equivalent number of pups where one 1yr+ animal should be balanced by 2.5 pups. Based on an *ad hoc* decision, the Norwegian quota was increased from 10 000 to 15,000 1yr+ animals (with a similar equivalence between 1yr+ animals and pups) in 2007.

Norwegian and Russian catches in 2007, including catches under permits for scientific purposes, are summarized in the table below:

Area/species	Norway	Russia	Sum
GREENLAND SEA			
Harp seals			
Pups	6188	0	6188
Older seals (1yr+)	1640	0	1640
Sum	7828	0	7828
Hooded seals			
Pups	27[1]	0	27
Older seals (1yr+)	35[1]	0	35
Sum	62	0	62
Area subtotal	7890	0	7890
BARENTS SEA / WHITE SEA			
Harp seals			
Pups	242	5276[2]	5518
Older seals (1yr+)	5911	200[3]	6111
Sum	6153	5476	11629
Area subtotal	6153	5476	11629
TOTAL CATCHES	14043	5476	19519

[1] Animals taken under permit for scientific purposes in the Greenland Sea

[2] 5138 pups taken under permit for scientific purposes in the White Sea
[1] Animals taken under permit for scientific purposes in the White Sea

2. EXCHANGE OF INFORMATION AND SUMMARY REPORTS OF RESEARCH ACTIVITIES IN 2007

2.1 Norwegian research

2.1.1 Estimation of pup production

It is recommended that comprehensive aerial surveys, designed to provide estimates of current pup production, should be conducted periodically (c. every 5 year), and that efforts should be made to ensure comparability of survey results. Therefore, harp seal surveys in the White Sea in 2000, in the Greenland Sea in 2002 and in the Northwest Atlantic in 2004 included participation by scientific personell from Norway, Canada and Russia.

Knowledge of possible variations in the abundance of Greenland Sea hooded seals has been rather restricted. As judged both from catch per unit of effort analyses and mark-recapture pup production estimates, it has been assumed that the stock has increased ever since the early 1960s, but evidence of the level of increase has been rather imprecise. Aerial surveys to estimate the hooded seal pup production were attempted, however with rather little success, in the Greenland Sea both in 1959 and in 1994. More successful aerial surveys suggested a minimum pup production of c. 24 000 (s.e. = 4 600, cv = 19.0%) in 1997. New aerial surveys to assess the Greenland Sea hooded seal pup production were conducted in 2005. Using the same methodology as in the 1997 survey, the results from the 2005 survey suggested a current hooded seal pup production in the Greenland Sea of 15 200 (s.e. = 3 790, cv = 24.9%). The results seem to indicate that the 2005 pup production of hooded seals in the Greenland Sea is considerably lower than in 1997. Incorporating available pup production estimates into a population model indicates that Greenland Sea hooded seals underwent a substantial decrease in population abundance from the late 1940s and up to the early 1980s. In the most recent two decades, the stock appears to have stabilized at a low level, approximately 71 400 (95% C.I. 38 400-104 400) 1+ animals in 2006, which may be only 10-15% of the level observed 60 years ago. The low hooded seal pup production estimates is a matter of concern for ICES who has recommended that new surveys be conducted as sonn as possible.

Therefore, in the period 14 March to 3 April 2007 aerial surveys were performed in the Greenland Sea pack-ice (the West Ice), primarily to assess the pup production of the Greenland Sea population of hooded seals, alternatively also of harp seals if practicable possible. Two fixed-wing twin-engined aircrafts, stationed in Constable Pynt (East-Greenland), Akureyri (Iceland), and the Jan Mayen island, were used for reconnaissance flights and photographic surveys along transects over the whelping areas. A helicopter, operated from the applied expedition vessel (M/V"Nordsyssel") also flew reconnaissance flights, and was subsequently used for other purposes, such as monitoring the distribution of seal patches and age-staging of the pups.

The reconnaissance surveys were flown by the helicopter (14 – 24 March) and the fixed-wing aircrafts (21 march – 3 April) in an area along the eastern ice edge between 66°55'and 75°30'N. Obviously, the ice cover was narrow and the edge close to the Greenland coast in 2007, and all surveyed areas were overlaying the continental shelf (300 - 400 m depth). The reconnaissance surveys were adapted to the actual ice configuration, usually flown at altitudes ranging from 160 - 300 m. Repeated systematic east-west transects spacing10 nm (sometimes 5 nm apart) were flown from the eastern ice edge and usually 20-30 nautical miles (sometimes longer) over the drift ice to the west. The reconnaissance surveys detected no apparent hooded seal whelping concentrations, only scattered hooded seal families and, subsequently, solitary bluebacks over a relatively large area ranging from 72º00'N and 73º51'N. Scattered harp seal whelping was observed in the same area, whereas a more concentrated harp seal whelping patch was observed to the east of the scattered hooded seals between 73º00'N and 73º40'N.

One aircraft was equipped with a Leica RC 30 camera with a motion compensation mechanism shooting AGFA Pan 400 black-and-white film. The second aircraft was fitted with a Vexcel Ultra Cam D digital camera, which provided multichannel images (Red Green Blue Infrared). On 27 March, a total of 19 photo transects, spacing 5 nautical miles, were flown using both aircrafts in the area between 72º 00'N / 18º 35' - 16º 49' W and 73º 30'N / 15º 40' - 13º W. The survey covered the entire area of scattered whelping hooded seals, including also scattered whelping harp seals in the northern parts of the covered area. The survey was conducted with low-density photographic effort where two photos were shot per 1 nm along each line, resulting in a total of 1136 photos. On 29 March, the area between 73º 03'N / 15º 42' - 14º 42' W and 73º 33'N / 15º 20' - 13º 50' W was covered using both aircrafts simultaneously in a high-density coverage of the concentrated patch of whelping harp seals. A total of 16 photo transects, spacing 2 nm, were flown with cameras operated to ensure about 80-90 % coverage of the area along each transect line, resulting in a total of 1987 photos shot. A second, smaller harp seal whelping concentration was covered in another high-density coverage on 3 April in the area between 71º 22'N / 17º 40' - 18º W and 71º 30'N / 17º 27' - 17º 46' W. Five photo transects, spacing 2 nm, were run with 80-90 % coverage of the area along each transect line, resulting in a total of 264 photos shot.

Only very few whelping hooded and harp seals were observed outside the surveyed whelping areas. The results from the aerial surveys are now being analysed and will be used to estimate the 2007 hooded and harp seal pup production in the West Ice. Subsequently, the status of the stocks will be assessed by fitting population models to the pup production estimates.

In previous hooded seal surveys the surveyed areas have traditionally consisted of two strata types: (1) whelping concentrations where both visual and photographic surveys were conducted with high-density coverage, and (2) scattered pups outside the whelping concentrations which were covered with low-density photographic surveys only. In the 2005 Greenland Sea survey hooded seal whelping occurred in three well defined concentrations, but it was not possible to run an additional low-density coverage survey of scattered pups outside these whelping concentrations. Owing to this, the total estimate presented is slightly negatively biased. In 2007, all pupping of hooded seals occurred scattered with no major patches of concentrated breeding.

This will increase the uncertainty in the estimate obtained – it remains to see how the new estimate compares with the 2005 estimate.

2.1.2 Feeding habits of harp and hooded seals

The feeding habits of Greenland Sea hooded seals throughout their distributional range of the Nordic Seas (Iceland, Norwegian, Greenland Seas) were studied in 1999-2003. The project paid special attention to the period July-February (i.e., between moulting and breeding), which is known to be the most intensive feeding period for hooded seals. Results from analyses of stomach and intestinal contents revealed that the diet was comprised of relatively few prey taxa. The squid *Gonatus fabricii* and polar cod *Boreogadus saida* were particularly important, whereas capelin *Mallotus villosus*, and sand eels *Ammodytes spp* contributed more occasionally.

During the surveys, also blubber and muscle tissues were secured from the captured animals. Similar samples were taken also from harp seals taken during the same surveys. The sampled tissues were used for analyses of fatty acid profiles and stable isotopes. The application of fatty acids analysis combined with stable isotopes in food web studies in marine ecosystems is an efficient tool, as it reflects dietary intake and assimilation over longer time periods than stomach content analysis. The use of fatty acid trophic markers (FATM) to trace the energy transfer from phytoplankton to top predators is based on the observation that primary and some secondary producers synthesize characteristic fatty acids and that this fatty acid signal is conservatively transferred through food chains. Stable isotopes reveal information about food carbon sources and trophic position of the species. The stable isotopes ratios of carbon and nitrogen ($\delta^{13}C$ and $\delta^{15}N$) in consumer proteins and fatty acid signature in consumer lipids both reflect those of their prey.Even if the two seal species showed considerable overlap in diet and occur at relatively similar trophic levels, the fatty acid profile indicated that the base of the food chain of harp and hooded seals was different. The fatty acids of harp seals originated from diatom based food chain, typically for high Arctic ice covered ecosystems. The fatty acids of hooded seals originate from dinoflagellate and the prymnesiophyte *Phaeocystis pouchetii* based food chain, which associates this species with more open Atlantic waters ecosystems.

2.1.3 Physiology/migrations, hooded seals

Both the University of Tromsø (UIT) and the Norwegian Polar Institute (NPI) have deployed satellite tags on young hooded seals in the Greenland Sea in 2007. UIT are also conducting various physiological studies of the species.

2.2 Russian research

2.2.1 New data on pup production of harp seals in the White Sea

During 1997-2005, 7 air surveys of harp seal pups production were carried out in the White Sea during whelping time. These surveys were made onboard research aircraft An-26 “Arktika” using

the same technology and methods, socalled multispectral methods. Results of surveys carried out in 1997-2003 were adopted and approved by the Joint ICES/NAFO WG on Harp and Hooded Seals (WGHARP, St. Johns, Newfoundland, Canada, 30 August-3 September 2005). These data were used for harp seals of the White Sea/Barents Sea population in stock abundance modeling calculation and definition of catch option with corresponding population trend for the next 10-years period.

WGHARP was sufficiently concerned about biases resulting from the late and incomplete coverage of the surveys in 2004 (air survey results from 23 March was adopted for harp seal pups numbers calculation) to recommended that the 2004 results and estimate should not be used in the model. Therefore, WGHARP recommended to wait for the 2005 air survey results and estimates, which was flown earlier and covered the whole area. These recommendations were fulfilled. Calculations of harp seal pup production in 2005 yielded a final estimate of pup numbers of 122 400 (SE=19 900) including catch (14 000). This numbers is less in comparison with 2004, when the number of harp seal pups was estimated as 234 000 (SE=48 000).

Unfortunately, in 2006 and 2007 PINRO could not continue air surveys using multispectral methods as in previous years. However, in 2006 scientists tried to use data which was obtained during reconnaissance flights with aircraft and helicopter in preparing and carrying out of commercial harp seals catch during whelping (March). This resulted in an expert estimation of pup numbers, which was no more than 120 000.

In March 2007, under financial support of the International Fund for Animal Welfare (IFAW), the Council of Marine Mammals, GIPRORYBFLOT and the Institute of Problems of Ecology and Evolution of the Russian Academy of Sciences (IPEE RAS), conducted an airborne survey for harp seals in the White Sea. Data were presented at the joint meeting of Scientific Advisory Council on Marine Mammals of the Inter-Departmental Ichthyological Commission and Council of Marine Mammals in October 2007. Based on the multispectral airborne survey on the whelping grounds conducted from 14 to 17 March 2007 using the research aircraft L-410, data on pup production, some biological parameters of the seals, ice coverage and evidences of the effect of shipping on the whelping grounds were obtained. Harp seal pup production in the White Sea in 2007 was estimated at 158 600 ± 28 000 pups which may indicate a two-fold reduction in pup production in the area compared with the 2000-2003 data. The possible decrease in pup production of harp seals indicate the need to revise some of the methodological approaches used to evaluate the effect of climate change and human activities on marine mammals.

2.2.2 Biological data collection from harp seal pups and adults in the White Sea

In March- April 2007 observations on distribution of the harp seal whelping grounds were made from an aircraft and a sealer. Whelping grounds were formed on the ice along the Kola Peninsula. Dense aggregations were observed across settlements of Kashkarantsy, Kuzomen, Chapoma and in the area of the Sosnovets Island. The majority of females probably whelped in the area of Kashkarantsy and Kuzomen settlements, far more westerly than the main whelping grounds observed in previous years. It is assumed that most pups moved to waters of the White Sea Basin after lactation.

Distribution of the moulting grounds of the harp seals showed some peculiarities, presumably due to little ice coverage of the White Sea in 2007. The main moulting grounds were localized to the north of 66°N in the Basin and Gorlo. In the southern part of Voronka no extensive moulting aggregations were found.

Biological samples were taken from pups and adult harp seals. The material indicated that the period of pup stay in the White Sea and morphological parameters of harp seals corresponded to the long-term values. Data collected are used for monitoring of the state of pups and adults.

2.2.3 Monitoring of harp seal pup mortality in the White Sea in the spring-summer season

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Based on data from the report presented by the GIPRORYBFLOT institute at the joint meeting of Scientific Advisory Council on Marine Mammals of the Inter-Departmental Ichthyoplogical Commission and Council of Marine Mammals in October 2007, calculations were done to evaluate the effect of shipping routes on the whelping grounds of harp seals. It was observed that shipping routes crossed the dense harp seal whelping grounds, and estimations of pup mortality as a result of the shipping activity may constitute from 2 to 5 thousand pups.

Unusual ice coverage in the White Sea in March 2007 may also have caused higher mortality of pups:

- The area of the ice coverage in the White Sea has decreased substantially (resulting in only half the size of the long-term average);
- Due to little area covered by ice suitable for whelping, the density of the harp seal aggregations was very high, reaching 1500 harp seals per square kilometer;
- The period of ice presence in the White Sea has decreased considerably (70 days as compared with the usual 150 days), subsequently this reduced the possible period on ice for the pups;
- Thin ice was easily broken under the effect of strong winds.

2.2.4 Research on white whale biology in the White Sea

In 2007 no work to study white whale in the White Sea were carried out. Due to insufficient financing and prohibition to import to Russia foreign satellite tags, the research on tagging were not conducted.

2.3. Joint Norwegian-Russian work

2.3.1 Feeding habits of harp seals in open waters of the Barents Sea

In 2001 and 2002, Norwegian and Russian scientists performed an aerial survey to assess whether there was an overlap in distribution, and thus potential predation, between harp seals and capelin in the Barents Sea. This experiment is now being followed with boat-based surveys aimed to study pelagic feeding by harp seals in the Barents Sea during summer and autum. In May/June 2004, in June/July 2005, and in May/June 2006, Norwegian surveys were conducted, aimed to study the feeding habits of harp seals occurring in the open waters of the Barents Sea.

Very few seals were observed along the coast of Finnmark, and no seals were seen in the open, ice-free areas. In the nothwestern parts of the Barents Sea, however, very large numbers of seals were observed along the ice edge and 20-30 nautical miles south of this. In these areas, 33, 55 and 57 harp seals were shot and sampled (stomachs, intestines, blubber cores) in 2004, 2005 and 2006, respectively. Additionally, samples of faeces were taken from the haul out sites on the ice. Preliminary results from the analyses (which also included older material from 1996-1997) indicate that the summer consumption to a large extent was dominated by krill, whereas polar cod also contributed importantly. All sampling were performed in a period with low capelin abundance – this may have influenced the results. The total consumption increase throughout the summer, from a total of 165 thousand tons in May to 335, 435 and 820 thousand tons in June, July and August, respectively. The collected material is now being used to develop a revised model for annual harp seal consumption of food resources, fish resources such as capelin in particular, in the Barents Sea. Harp seal consumption will be implemented in assessment models for the Barents Sea resources.

2.3.2 Joint seal age estimations

Biological parameters (fertility, mortality, demography) are important input in models used for seal assessments. Data availability is, however, restricted, and it is important to eastablish routines for sampling. A substantial material of teeth (for ageing) has alredy been sampled, both by Norway and Russia, from commercial catches. This material is very useful, and some joint Norwegian-Russian age-reading experiments have been conducted on harp seal teeth. Age estimates of known age teeth (obtained from mark-recapture experiments) suggested differences between readers in both accuracy and precision, but these were not found to be statistically significant. Overall the study indicates that age estimates of harp seals should be treated as probability distributions rather than point estimates even in the youngest age classes. Adequate description of the probability distributions and the effects of having different readers can only be achieved by repeating the experiment with a much larger sample size. To obtain this, and to try to standardise reading between laboratories, a joint workshop was arranged in Bergen, Norway in November 2006. A total of 17 specialists from all Nordic countries, Russia, Canada and Holland participated.

2.3.3 Joint studies of life history parameters

Historical Norwegian and Russian data which describe the trends in fertility rate and maturity at average age (MAM) for hooded seals in the Greenland Sea have recently been subjected to joint Russian-Norwegian analyses. Age at maturity was determined by fitting Richards' curves to age specific proportions of mature females in scientific samples taken by Russian scientists in the Greenland Sea pack ice in May-June in the years 1990-94. Samples from the Denmark Strait (1956-60) and South Greenland (1970-71) previously analysed by the back calculation method were also included in the present analyses. Although there were annual difference in MAM among the Greenland Sea samples a common MAM of 4.8 years could be fit to all years . Similarly, a common MAM of 3.1 year could be fit to the two Northwest Atlantic samples. This represents a temporal and a stock specific split in the sample and it cannot be concluded which factor is more important. Ovulation rates of mature females ranged from 0.68 in May 1990 to 0.99 in June 1991 and 1992, but the average ovulation rate of 0.88 was similar to previous

estimates for Northwest Atlantic hooded seals. For breeding and moulting patch samples taken in the period 1986-1990, indirect measures of pregnancy rates derived from patterns of alternation in corpora formation between ovaries ranged from 0.74 to 0.97 and were significantly lower in 1987 and 1988 than in all other samples including the older data for the Northwest Atlantic stock ranging from 0.94 to 0.97.

2.3.4 Joint studies of harp seal stock identity

Tissue samples were collected from harp seal pups in the Greenland Sea (50 individuals, taken on Norwegian sealer) and in the White Sea (50 individuals, taken by Russian scientists) in 2005. Additional samples (50) were obtained from the Greenland Sea in 2007. Also, several samples were obtained from a harp seal breeding patch observed in southern Greenland in 2007. These samples will be compared with the Greenland Sea samples and with samples that are to be collected in the Northwest Atlantic in 2008. All samples will be subject to genetic analyses (DNA-based) to adress the question of stock identity of harp seals in the North Atlantic – analyses are already in progress.

2.3.5 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 on hot-spot feeding grounds (use of data from relevant Norwegian and Russian ecosystem surveys and Russian aerial surveys)
- identify relative composition of harp seal diets in areas and periods of particular intensive feeding (sampling of seals for diet studies in dedicated surveys and coast expeditions to selected hot-spot feeding areas)
- secure the availability of data necessary for estimation of population size of Northeast Atlantic harp seals (pup production, demography, natality/mortality, catch history)
- 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 assumed to start in 2007 with a tagging program for harp seals in the White Sea. This activity will give a necessary and important contribution to a better understanding of the temporal and spatial distribution of the seals, which is important input data when their total consumption of marine resources in the Barents Sea is to be assessed. It is important that animals of different sexes and ages are tagged. The program is assumed to run for 5 years, with 15 tags being deployed every spring (i.e., immediately after the moulting period).

First deployment of tags was planned to be conducted in the White Sea in May 2007. Tags are already provided. However, Russian authorities refused to permit the deployment. The reason given was that they could not allow availability of data which combined current information about position, depth, temperature and salinity. The tags planned to be applied, however, do not give information about oceanographic data. This has now been reported back to Russian authorities, and it is the intention to deploy the tags in 2008 provided permission is given.

As part of the joint program , marine mammals – harp seals included - were observed and recorded on the ecosystem surveys conducted in the Barents Sea in 2007.

3. STATUS OF STOCKS AND MANAGEMENT ADVICE FOR 2008

WGHARP met at the Department of Fisheries and Oceans (DFO), St.John's, Newfoundland, Canada, 30 August-3 September 2005, and in the ICES Headquarters, Copenhagen, Denmark, on 12-16 June 2006, to assess the stocks of Greenland Sea harp seals, White Sea / Barents Sea harp seals and Greenland Sea hooded seals. Updated information was available for all stocks to enable WGHARP to perfrom modelling which provided ICES with sufficient information to give advice (for harp seals in October 2005, for hooded seals in August 2006) on status and to identify catch options that would sustain the populations at present levels within a 10 year period.

Management agencies have requested advice on "sustainable" yields for these stocks. ICES notes that the use of "sustainable" in this context is not identical to its interpretation of "sustainable" applied in advice on fish and invertebrate stocks. "Sustainable catch" as used in the yield estimates for seals means the catch that is risk neutral with regard to maintaining the population at its current size within the next 10 year period.

Population assessments were based on a population model that estimates the current total population size. These estimates are then projected into the future to provide a future population size for which statistical uncertainty is provided for each set of catch options. Since the previous assessment (2003), the model used has been modified based upon recommendation from WGHARP. The major difference is that the model now estimates the biological parameters adult and pup mortalities (M_{1+} and M_0) and pregnancy rates (F) rather than using them as fixed input. The model estimates the current total population size using historical catch data and estimates of pup production. In principle, the model can also estimate biological parameters (M_{1+}, M_0 and F), but for the populations to which the model is applied there is not enough data to provide accurate estimates of M_{1+}, M_0 and F. To compensate for the lack of data, information from other similar populations are used as input to the model in the form of a prior distribution (mean and standard deviation) for each of the parameter. The same population dynamic model was used for all three seal populations in question, but with stock specific values of prior distributions for M_0, M_{1+} and F. The modifications implemented in the model was an improvement from previously used estimation programs. For harp seals, the modified model gives higher stock estimates and catch options than the previous model. These differences are primarily due to the change in the estimate of M_{1+} (which was fixed at value which is now regarded to have been to high) and the

inclusion of additional sources of uncertainty in the parameters.

The advice given by ICES in 2005 and 2006 was used by this Working Group on Seals to establish management advice for 2008 to the Joint Norwegian-Russian Fisheries Commission.

3.1. Greenland Sea

The Working Group **recommends** the following opening dates for the 2008 catch season: 1) Sucling pups, opening date of 18 March (0700 GMT) for catches of pups of both harp and hooded seals; 2) weaned pups, opening dates 20 March for hooded seals and 1 April for harp seals; 3) seals aged 1 yr and older (1yr+), opening date 22 March for hooded seals and between 1 and 10 April for harp seals. Adult hooded seal males should be permitted taken from 18 March. The Group recommends a closing date set at 30 June (2400 GMT) for harp seals and 10 July (2400 GMT) for hooded seals in 2008. Exceptions on opening and closing terms may be made in case of unfavourable weather or ice conditions. If, for any reason, catches of pups are not permitted, quotas can be filled by hunting moulting seals.

The Working Group agreed that the ban on killing adult females in the breeding lairs should be maintained for both harp and hooded seals in 2008.

3.1.1 Hooded seals

The Working Group noted the conclusion from ICES that recent removals have been below the recommended sustainable yields.

Results from a pup survey conducted in 2005 suggest that current pup production (15 200 pups, CV = 0.25) is lower than observed in a comparable 1997 survey (23 800 pups, CV = 0.19). Model explorations indicate a decrease in population abundance from the late 1940s and up to the early 1980s. In the most recent two decades, the stock appears to have stabilized at a low level which may be only 10-15% of the level observed 60 years ago. The modelling exercises included the two pup estimates as well as avialable information about age at maturity and estimates of natural mortality and natality. Based on these inputs the model estimated the following 2006 abundance for Greenland Sea hooded seals: 71 400 (95% C.I. 38 400-104 400) 1+ animals with a pup production of 16 900 (95% C.I. 10 200-23 600).

Catch estimation: ICES was requested to give options (with indication of medium term consequences) for three different catch scenarios:

- Current catch level (average of the catches in the period 2001 – 2005)
- Maintenance catches (defined as the fixed annual catches that stabilizes the future 1+ population)
- Two times the maintenance catches.

ICES still regard the Greenland Sea stock of hooded seals as data poor. Due to the restricted

availability of data, ICES is not in the position to estimate future 1+ populations and can therefore not estimate sustainable catches. Instead, the concept of the Potential Biological Removal level (PBR) was used to calculate catch limits. The PBR approach identifies the maximum allowable removals that will ensure that the risk of the population falling below a certain lower limit is only 5% and that would allow a stock that dropped below this limit to recover. Using the PBR approach, the catch limit was calculated at 2,189 animals. However, ICES concludes that even harvesting at the PBR level could result in a continued stock decline or a lack of recovery. ICES therefore, concludes that the harvesting should not be permitted with the exception of catches for scientific purposes from 2007 on.

The Working Group **recommend** that this ICES advice is implemented in future managenment of hooded seals in the Greenland Sea: Removals should be stopped until more information about current stock status becomes available. As recommended by ICES, new surveys of pup production and updating of information on reproductive rates and health status were conducted for hooded seals in the Greenland Sea in 2007. The data are now being analyzed, and the results will be presented at the next WGHARP meeting in Tromsø, Norway, in August 2008.

3.1.2 Harp seals

The Working Group noted the conclusion by ICES that recent removals have been below the recommended sustainable yields, and that prolongation of current catch level will likely result in an increase in population size.

The model solves for a constant exploitation which stabilise the 1+ population. Inputs to the model were:

Pup production estimates from previous tag-recapture experiments (1983-1991) and from recent (2002) aerial surveys:

Year	Pup production estimates	c.v.
1983	58 539	.104
1984	103 250	.147
1985	111 084	.199
1987	49 970	.076
1988	58 697	.184
1989	110 614	.077
1990	55 625	.077
1991	67 271	.082
2002	98 500	.179

As well as these pup estimates the model includes age at maturity and estimates of natural

mortality and natality. Based on these inputs the model estimated the following 2005 abundance for Greenland Sea harp seals: 618 000 (95% C.I. 413 000-823 000) 1+ animals with a pup production of 106 000 (95% C.I. 71 000-141 000).

Catch estimation: Based on a request from Norway, ICES gave catch options for three different catch scenarios:

- Current catch level (average of the catches in the period 2001 – 2005)
- Sustainable catches.
- Two times the sustainable catches.

The sustainable catches are defined as the (fixed) annual catches that stabilise the future 1+ population. The catch options are further expanded using different proportions of pups and 1+ animals in the catches.

As a measure of the future development of the estimated population, the ratio between the size of the 1+ population in 2015 and 2005 is used.

					10 Year Projection
Option #	Catch level	Proportion of 1+ in catches	Pup catch	1+ catch	$N_{2015,1+}$ / $N_{2005,1+}$
1	Current	25.6% (current level)	3 303	1 138	1.51 (1.18-1.83)
2	Sustainable	25.6%	36 688	12 624	1.01 (0-61-1.41)
3	Sustainable	100%	0	31 194	1.05 (0.66-1.44)
4	2 X sust.	25.6%	73 376	25 248	0.45 (0.00-0.97)
5	2 X sust.	100%	0	62 388	0.55 (0.06-1.03)

While current catch level (option 1) will likely result in an increase in population size, ICES emphasized that a catch of 31 194 1+ animals (catch option 3), or an equivalent number of pups, in 2006 and subsequent years would sustain the population at present level within a 10 year period. The Working Group **recommend** that this be used as a basis for the determination of a TAC for harp seals in the Greenland Sea also in 2008: **31 200 1+ animals or an equivalent number of pups. If a harvest scenario including both 1+ animals and pups is chosen, one 1+ seal should be balanced by 2 pups.**

Catches 2X sustainable levels will result in the population declining by approximately 45-55% in the next 10 years.

3.2 The Barents Sea / White Sea

The Working Group **recommends** the following terms concerning opening and closing dates and areas of the catches: From 28 February to 15 May for Russian coastal and vessel catches and from 23 March to 15 May for Norwegian sealing ships. Exceptions from opening and closing

dates should be made, if necessary, for scientific purposes. The Norwegian participants in the Working Group suggest to prolong dates of harvesting to 1 July, and to determine the operational areas for the Norwegian catch activities to be the southeastern Barents Sea to the east of 20°E.

The Working Group agreed that the ban on killing adult harp seal females in the breeding lairs should be maintained in 2008.

3.2.1. Harp seal.

The Working Group noted the conclusion by ICES that recent removals have been below the recommended sustainable yields, that prolongation of current catch level will likely result in an increase in population size, and that there is some evidence that densities may be so high that biological processes like rate of maturation may be showing density dependent effects. There are reports that pup mortality rates may vary substantially in the White Sea region, and that in recent years these rates have been very high. For this reason, the 2005 abundance of White Sea harp seals was estimated under the assumption that the ratio between the natural mortality of pups and adults was 5 instead of 3.

The model solves for a constant exploitation which stabilise the 1+ population. Inputs to the model were:

Pup production estimates (from Russian aerial surveys):

Year	Pup production estimate	c.v.
1998	286 260	.073
2000	325 643	.111
2000	339 710	.095
2002	330 000	.103
2003	327 000	.125

For 2000 there are two independent estimates for pup production.

As well as these pup estimates the model includes age at maturity and estimates of natural mortality and natality. Based on these inputs the model estimated the following 2005 abundance of harp seals in the White Sea: 2 065 000 (95% C.I. 1 497 000-2 633 000) 1+ animals with a pup production of 361 000 (95% C.I. 299 000-423 000).

Catch estimation: Based on a request from Norway, ICES gave catch options for three different catch scenarios:

- Current catch level (average of the catches in the period 2001 – 2005)
- Sustainable catches.
- Two times the sustainable catches.

The sustainable catches are defined as the (fixed) annual catches that stabilise the future 1+ population. The catch options are further expanded using different proportions of pups and 1+ animals in the catches.

As a measure of the future development of the estimated population, the ratio between the size of the 1+ population in 2015 and 2005 is used.

					10 Year Projection
Option #	Catch level	Proportion of 1+ in catches	Pup catch	1+ catch	$N_{2015,1+}$ / $N_{2005,1+}$
1	Current	11.5% (current level)	25 945	3 371	1.35 (0.91-1.78)
2	Sustainable	11.5%	153 878	19 995	0.98 (0.57-1.39)
3	Sustainable	100%	0	78 198	1.04 (0.62-1.50)
4	2 X sust.	11.5%	307 756	39 990	0.53 (0.12-0.93)
5	2 X sust.	100%	0	156 396	0.67 (0.24-1.10)

While current catch level (option 1) will likely result in an increase in population size, ICES emphasized that a catch of 78 198 1+ animals (catch option 3), or an equivalent number of pups, in 2006 and subsequent years would sustain the population at the present level within a 10 year period. Catches 2X sustainable levels (options 4 and 5) will result in the population declining by approximately 53-67% in the next 10 years.

Russian aeroplane surveys of White Sea harp seal pups were conducted also in March 2004 and 2005 using traditional strip transect methodology and multiple sensors. The results obtained may indicate a reduction in pup production as compared with the results obtained in similar surveys in 1998-2003. Surveys flown with helicopters in March 2006 and fixed-wing aircraft in March 2007 apparently confirm the possible reductions in pup production. Severe reductions in both period and extension of ice cover in the White Sea in recent years may have contributed to the possible reductions in pup production in the area. The Working Group strongly **recommend** that new aerial surveys must be conducted in the area in 2008 to investigate whether this possible reduction in pup production still prevail.

The possible reductions in pup production for harp seals in the White Sea is a matter of concern. For this reason the Russian part has suggested to preliminary reduce the TAC to 45 100 1+ animals, which is below the sustainable level suggested by ICES. The Norwegian party emphasized the need to consider the harp seal quotas in an ecosystem perspective which would require a more complete use of the quotas given by ICES. A more complete use of harp seal quotas in the White Sea will also promote Russian-Norwegian cooperation in the Barents and White Seas and, in particular, contribute to development of Russian vessel-based and land-based hunting.

Nevertehless, with reference to current uncertainty associated with the stock status, The Working Group **recommend** that the TAC suggested by the Russian part be used as a basis for the determination of a TAC for harp seals in the White Sea / Barents Sea in 2008:

45 100 1+ animals or an equivalent number of pups. If a harvest scenario including both 1+ animals and pups is chosen, one 1+ seal should be balanced by 2.5 pups.

The Russian part suggested that the Norwegian share of this TAC should be 10 000 1+ animals.

3.2.2 Other species

The Working Group agreed that commercial hunt of bearded seals should be banned in 2008, as in previous years, but it **recommend** to start catch under permit for scientific purposes to investigate results of long time protection.

4. PROSPECTS FOR FUTURE SEALING ACTIVITIES

There are concerns over the current lack of ability on both the Norwegian and Russian side to fulfill given seal quotas. Also, the multispecies perspective of seal management is a matter of concern in the two countries. The main problem for the sealing industry in the last 2-3 decades has been the market situation. Protest activities initiated by several Non-governmental Organisations in the 1970s destroyed many of the old markets for traditional seal products which were primarily the skins. The results have been reduced profitability which subsequently resulted in reduction in available harvest capacity (e.g., the availability of ice-going vessels) and effort. With the present reduced logistic harvest capacity in Norway and Russia it is impossible to take out catches that would stabilise the stocks at their present levels. Unless sealing again becomes profitable, it is likely that this situation will prevail.

It is the opinion of the Working Group that future sealing activities must be profitable. If sealing profitability increases, hunting levels are very likely to increase. This calls for availabilty of updated information about stock status (abundance, productivity and catch statistics), such that catch options can be defined on the best possible basis. Under the precautionary approach, ICES (and NAFO) will not give harvest advice unless such updated information is available. Hunting nations must secure that the stocks are monitored and assessed using accepted methods at regular intervals (no less than every 5 year). The Working Group feels that both countries now contribute acceptably to this in that Russian scientists estimates the abundance of White Sea harp seals regularly, last time in 2007, whereas Norway aims to estimate Greenland Sea harp and hooded seals regularly, preferably with no more than 5 years between each survey. Greenland Sea harp and hooded seals were surveyed in 2007.

Regulation of the seal populations should be conducted as part of an ecosystem management. Nevertheless, seals must be harvested as resources, and not as a pest. Thus, seal resources should be exploited according to the same principles as any other living marine resources. In an ecosystem context, harp seals are most important. Given the uncertain situation for the hooded seal stock, the Working Group **recommend** that sealing activities in the Northeast Atlantic focus on harp seals in the coming years.

The Working Group appreciated Russian efforts to change from helicopter-based to boat-based hunting in the White Sea. The Russian part informed the Working Group that the catches in 2007 were carried out partly with helicopter and partly with a vessel. Unfortunately, the helicopter part of the hunt was severely hampered by bad weather and ice conditions, so most of the 2007 catches in the White Sea were taken in the boat-based operations which included one large vessel and three smaller catcher boats with outboard motors. Plans for the 2008 season include both helicopter-based (mainly to take whitecoats) and boat-based (mainly targeting beaters) hunt. Although all hunters in the White Sea were Russians, the boat based activities occurs as a cooperative project between the authorities of the Arkhangelsk oblast and the Norwegian company GC Rieber Skinn AS. The latter company has also established a daughter company in Arkhangelsk, GC Rieber Skinn Pomor'e Lic.

As a further development of the Norwegian-Russian efforts to develop the seal harvesting in the White Sea, the Norwegian company Polardrift AS plan to establish a company in Russia, aiming to hunt seals with their own sealing vessel MS"Kvitungen". The vessel will operate under Russian flag, primarily with Russian crew, and in close cooperation with GC Rieber Skinn Pomor'e. The company has applied to Russian authorities for permission to start this activity in the 2008 season, and the Working Group **recommend** that Russian authorites give priority to a quick and serious consideration of the application.

Increased profitability is necessary to enable an urgent renewal of the Norwegian vessel fleet. As for the new Russian fleet, also new Norwegian sealing vessels must be designed in such a way that they can be used for other purposes outside the sealing season. Until sealing again become self-sustained and profitable, Norwegian fisheries organisations and authorities will have to find solutions that secure the existence of an effective and competent seal-fleet.

To assure self-sustained profitability in future sealing activities, the Working Group concluded that it would be necessary to increase the profits of sealing by increasing the value of each seal. It is preferable that the whole animal is utilized, and that effort is spent to develop methods to make new products of the parts of the seal that is otherwise discarded. When seal meat is taken for human consumption, the production lines onboard the vessels must meet the usual standards for food production. The Working Group **recommend** that Norway and Russia cooperate closely in the necessary development of future sealing. This cooperation may include such elements as the joint use of Norwegian vessels in the White Sea, development of joint industry for seal products etc.

In September 2003, the workshop "Prospects for future sealing activities in the North Atlantic" was held at SevPINRO in Archangelsk, Russia with participation from Canada, Greenland, Norway and Russia. The meeting was very succesful, and in retrospect this Working Group recommended that similar workshops, with representatives of the sealing industry in the northern region, should be arranged on a more regular basis in the future. The Working Group now feels the time mature for a new workshop, and **recommend** that it should be arranged in Tromsø, Norway in August 2008. Preferably, the workshop should be arranged back to back with WGHARP which will meet in Tromsø 19-22 August 2008. That would secure participation of scientists at the workshop. Again the workshop should be an arena where experts involved in the various aspects and branches of sealing can meet. This must primarily be a meeting for people

from all levels of the sealing industry, including participants with knowledge of both the sealing itself, the products and their application, and the market prospects. Themes addressed should primarily focus on market prospects for traditional products (skins), but also the possibility to introduce "new" products (meat- or blubber-based) on the markets should be assessed. Participation also from other seal hunting nations must be secured, in particular Canada and Greenland. To ensure input about the resource bases and management, also participants from management authorities and science is needed.

5. RESEARCH PROGRAM FOR 2008+

5.1. Norwegian investigations

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

Data for pup production estimation were obtained from both harp and hooded seals in the Greenland Sea in March/April 2007. Analyses of these data will be an important Norwegian activity in 2008 – the plan is that results shall be presented for and used by WGHARP at the meeting in Tromsø in August 2008.

5.1.2 Collection of biological material from the commercial and local hunt and dedicated surveys

Biological material, to establish age distributions in catches as well as health, reproductive and nutritive status of the animals, will be collected from commercial catches of harp seals both in the southeastern Barents Sea and in the Greenland Sea in 2008. In the Greenland Sea, samples will also be obtained also from local Greenland hunters and from seals sampled for scientific purposes in a dedicated research cruise in June/July.

5.1.3 Ecology of harp and hooded seals in the Greenland Sea

A project aimed to provide the data necessary for an assessment of the ecological role of Greenland Sea harp and hooded seals throughout their distributional area of the Nordic Seas (Iceland, Norwegian, Greenland Seas) was conducted in 1999-2003. The field work is now completed, some results are published, and it is the intention that the data shall be subjected to further analyses and prepared for publication in 2008.

5.1.4 Harp seals taken as by-catches in gillnets

Provided harp seals invade the coast of North Norway also during winter in 2008, biological samples will be secured from animals taken as bycatches in Norwegian gill net fisheries.

5.1.5 Seal physiology and tagging

On research cruises to the Greenland Sea in March/April 2008, various physiological parameters of harp and hooded seals will be studied. Also, some satellite based tags will be deployed on hooded seals in the area.

5.2.Russian investigations

5.2.1 Russian research on the White Sea/Barents Sea harp seal population

Plans to carry out annual accounting multispectral aerial surveys with aim to use these data for determination of population size by modelling, and in Joint Norwegian-Russian Research Program on Harp Seal Ecology. This research will be carried out under recommendations of ICES WGHARP and JRNFC 36 session.

Research on harp seal reproductive biology is planned to be carried out in the White and the Barents Seas. The final aim is study of harp seal biological data (mortality, maturity, birth rate, morphological and physiological indexes, etc.). During springtime work will be continued on pup mortality estimation in the White Sea. Plans to continue research on harp seal feeding in the White and the Barents Seas during spring and summer times. This research will be carried out under the program and recommendation of WGHARP and JRNFC 36 session.

5.3. Joint Norwegian - Russian investigations

5.3.1 Feeding habits of harp seals in open waters of the Barents Sea

In 2001 and 2002, Norwegian and Russian scientists performed an aerial survey to assess whether there was an overlap in distribution, and thus potential predation, between harp seals and capelin in the Barents Sea. This experiment was followed with boat-based surveys aimed to study pelagic feeding by harp seals in the Barents Sea during summer and autum in (2004-2006), and the results from these investigations are now being analysed and prepared for presentation/publication.

5.3.2 Tagging of Barents Sea / White Sea harp seals with satellite tags

The successsful joint Norwegian-Russian 1996 project (and a similar project during harp seal breeding in 1995) with tagging of harp seals with satellite transmitters in the White Sea is planned to be continued with final analyses of data and joint publication of results in 2006/2007. The Working Group **recommends** that satellite tagging experiments with harp seals in the White Sea are continued jointly between Norwegian and Russian scientists with the purpose to study distribution, migrations and daily activity of the seals. This activity is part of the joint research program, and will give an important contribution to a better understanding of the temporal and spatial distribution of the seals, which is important input data when their total consumption of marine resources in the Barents Sea is to be assessed. It is important that animals of different sexes and ages are tagged. In 2004 a joint research program (written by Drs Arne Bjørge, Mette Mauritzen and Vladislav Svetochev) that ensures a proper design on the experiment, has been

developed. The program describes the background for the project, the types of equipment to be used, how the field work will be carried out, and the total costs. The program is assumed to run for 5 years, with 15 tags being deployed every spring (i.e., immediately after the moulting period). First deployment of tags will be conducted in the White Sea in 2008. It is important that both young immature seals and adults are tagged each year.

5.3.3 Life history parameters in seals

Upon request, forwarded during meetings of the Joint Norwegian-Russian Fisheries Commission, one Russian scientist was invited to participate in scientific work on Norwegian sealers during March-April in 1997-1999 in the southeastern part of the Barents Sea, and in 2000 in the Greenland Sea. This Norwegian-Russian research cooperation is encouraged, e.g., by extending an invitation to Russian scientists to participate on Norwegian sealers in the southeastern Barents Sea and/or in the Greenland Sea also in the future. This would enable coordinated and joint sampling of new biological material. The Working Group **recommend** that Russian scientists are offered the possibility to participate in Norwegian research activities in 2008. If Russia can realize scientific or commercial vessel trips in the White, Barents and Greenland Seas, invitation for participation of Norwegian scientists is desirable.

5.4. 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 2008:

Area/species/category	Russia	Norway
Barents Sea / White Sea		
Whelping grounds		
Adult breeding harp seal females	500	0
Harp seal pups	500	0
Outside breeding period		
Harp seals of any age and sex	2300	0
Greenland Sea*		
Whelping grounds		
Adult breeding harp seal females	0	100
Harp seal pups	0	100
Adult breeding hooded seal females	0	100

Hooded seal pups	0	100
Outside breeding grounds		
Harp seals of any age and sex	0	100
Hooded seals of any age and sex	0	200

6. APPROVAL OF REPORT

The English version of the Working Group report was approved by the members on 25 October 2007.