Appendix 8

THE 33RD SESSION OF THE JOINT NORWEGIAN - RUSSIAN FISHERIES COMMISSION, ÅLESUND, NORWAY 25 - 29 OCTOBER 2004

REPORT OF THE WORKING GROUP ON SEALS

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Contents:

1. EXCHANGE OF INFORMATION AND SUMMARY OF SEAL CATCHES IN 2004

Norwegian catches were taken by four vessels in the Greenland Sea, whereas no Norwegian vessels operated in the southeastern Barents Sea in 2004.

For various reasons, the traditional Russian helicopter catch of harp seals could not be conducted in the White Sea in 2004. Difficult ice conditions and increased operational costs for the helicopters contributed to this. Also, and probably more important, a new (for sealing) resource tariff was imposed upon the sealing activities. The Working Group is very concerned about this situation, and **recommend** that Russian management authorites secures that profitable sealing can continue in the White Sea also in the future. Due to the extreme importance of sealing for the communities around the White Sea, it is desirable that the imposed resource tariff be appropriately reduced such that sealing can be resumed profitably in 2005. The Working Group appreciate this initiative.

The 2004 TACs given for Greenland Sea hooded seals was 5,600 one year old and older (1yr+) animals or an equivalent number of pups - if a harvest scenario including both 1yr+ animals and pups were chosen, one 1yr+ animal should be balanced by 1.5 pups. ICES had identified the sustainable catch level (that would stabilise the hooded seal population at present level) under a precautionary apporach as 5 600 animals for 2004 and coming years, however with no multiplier between 1+ animals and pups.

For the Greenland Sea harp seals, the 2004 TAC was set at 15,000 1yr+ animals or an equivalent number of pups (where one 1yr+ animal should be balanced by 2 pups). ICES had identified the sustainable catch level (that would stabilise this population at present level) as 8 200 1+ animals for 2004 and coming years. The 2004 TAC set for harp seals in the Barents Sea and White Sea was as recommended by ICES (i.e., a level that would stabilise the population at present level) for 2004 and coming years: 45,100 1yr+ animals or an equivalent number of pups where one 1yr+ animal should be balanced by 2.5 pups. Norway was allocated a quota of 10,000 1yr+ animals (with a similar equivalence between 1yr+ animals and pups).

Norwegian and Russian catches in 2004, including catches under permits for scientific purposes, are summarized in the table below:

Area/species	Norway	Russia	Sum
GREENLAND SEA			
Harp seals			
Pups	8288	0	8288
Older seals (1yr+)	1607	0	1607
Sum	9895	0	9895
Hooded seals			
Pups	4217[1]	0	4217
Older seals (1yr+)	664[1]	0	664
Sum	4881	0	4881
Area subtotal	14776	0	14776

BARENTS SEA / WHITE SEA			
Harp seals			
Pups	0	0	0
Older seals (1yr+)	33[2]	0	33
Sum	33	0	33
Area subtotal	33	0	33
TOTAL CATCHES	14809	0	14809

[1] Include 15 pups and 15 1+ animals taken under permit for scientific purposes
[2] Animals taken under permit for scientific purposes in June in the northwestern Barents Sea

2. EXCHANGE OF INFORMATION AND SUMMARY REPORTS OF RESEARCH ACTIVITIES IN 2004

2.1 Norwegian research

2.1.1 Estimation of pup production

From 14 March to 6 April 2002 aerial surveys were carried out in the Greenland Sea pack-ice (the West Ice), to assess the pup production of the Greenland Sea population of harp seals. One fixed-wing twin-engined aircraft was used for reconaissance flights and photographic strip transect surveys of the whelping patches once they had been located and identified. A helicopter assisted in the reconnaissance flights, and was used subsequently to fly visual strip transect surveys over the whelping patches. The helicopter was also used to collect data for estimating the distribution of births over time. Three harp seal breeding patches (A, B and C) were located and surveyed either visually and/or photographically. Results from the staging flights suggest that the majority of harp seal females in the Greenland Sea whelped between 16 and 21 March. The calculated temporal distribution of births were used to correct the estimates obtained for Patch B. No correction was considered necessary for Patch A. No staging was performed in Patch C; the estimate obtained for this patch may, therefore, be slightly negatively biased. The total estimate of pup production, including the visual survey of Patch A, both visual and photographic surveys of Patch B, and photographic survey of Patch C, was 98 600 (SE = 20 300), giving a coefficient of variation for the survey of 20.5%. This is an underestimate due to the presence of unestimated areas along transects during the photographich surveys. Adding the obtained Greenland Sea pup production estimate to recent estimates obtained using similar methods in the northwest Atlantic (in 1999) and in the Barents Sea / White Sea (in 2002), it appears that the entire North Atlantic harp seal pup production, as determined at the turn of the century, is of a magnitude of at least 1.4 million animals per year.

It is recommended that comprehensive aerial surveys needed 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, the 2002 surveys in the Greenland Sea (with subsequent laboratory analyses) included participation by Canadian and Russian scientific personell.

The most recent abundance estimate for harp seals in the northwest Atlantic is from 1999. For this reason, new surveys were carried out in March 2004 using an icegoing vessel ('Ann Harvey'), two helicopters and three fixed-wing aircrafts. Norwegian and Russian scientific personell participated in the field work.

2.1.2 Ecological role

To enable an assessment of the ecological role of harp and hooded seals throughout their distributional range of the Nordic Seas (Iceland, Norwegian, Greenland Seas), a project was initiated in 1999 by members of the NAMMCO Scientific Comittee. The project pays special attention to the period July-February (i.e., between moulting and breeding), which is known to be the most intensive feeding period for both harp and hooded seals. To provide data, seals were collected for scientific purposes on expeditions with R/V"Jan Mayen", conducted in the pack ice belt east of Greenland in September/October 1999 and 2002 (autumn), July/August in 2000 (summer), and February/March in 2001 (winter). Results from analyses of stomach and intestinal contents from captured seals revealed that the diet of both species in this particular habitat were comprised of relatively few prey taxa. Pelagic amphipods of the genus *Parathemisto* (most probably almost exclusively *P. libellula*), the squid *Gonatus fabricii,* the polar cod *Boreogadus saida,* the capelin *Mallotus villosus*, and sand eels *Ammodytes* spp were particularly important. Although their relative contribution to the diet varied both with species and sampling period/area, these five prey items constituted 63-99% of the observed diet biomass in both seal species, irrespective of sampling period.

During sampling in summer (July/August) in 2000 and winter (February/March) in 2001, harp and hooded seals were observed to co-occur in the sampling areas. This facilitated description and comparison of their diets. For hooded seals, *G. fabricii* and capelin were the dominant food items in winter 2001, but the summer 2000 diet comprised a mixture of this squid and polar cod. *Parathemisto* was most important for the harp seals during summer 2000, whereas in winter 2001 the contribution from krill and capelin were comparable to that of *Parathemisto*. Multivariate analyses revealed significant differences in the intestinal contents of hooded and harp seals, in areas where the two species' occurrence showed spatial overlap. Different foraging depths of the two seal species may have contributed to the observed differences in diets. Studies of diving behaviour of harp and hooded seals in the Greenland Sea have revealed that both species usually perform more shallow dives during summer than during winter, and that hooded seals dive to deeper waters than harp seals in both periods. Except for the youngest stages, which may occur in the upper water layers during summer, the major hooded seal prey *G. fabricii* has a typical mesopelagic distribution with occurrence mainly at depths greater than 400 m. This is in contrast to the distribution of the major food of harp seals: the observed krill and amphipod species are usually confined to the more upper water layers (< 200m depth).

Based on dorsal blubber cores collected in October 1995, fatty acid profiles and lipid biomarkers from 20 harp seals were used to investigate the foraging ecology of the species and the transfer of energy through the Franz Josef Land – Novaya Zemlya food chain. High level of the *Calanus* fatty acid trophic markers (FATMs) 20:1(n-9) (mean 14,6 %) and 22:1(n-11) (mean 6.5%), together with the typical dinoflagellate FATM 22:6(n-3) (mean 6.5%) and C18PUFA (mean

5.5%), were found in blubber samples. Based on analyses of the fatty acid profiles by principal component analysis, the importance of polar cod and the *Parathemisto libellula* in the diet of harp seals was confirmed. The high levels of 22:6(n-3), C18PUFA and C20 and C22 FATMs indicate that the harp seal lipids mainly originate from dinoflagellates consumed by *Calanus* copepods.

2.1.3 Sampling from harp seals taken as by-catch in gill nets

Biological data from 30 harp seals, taken as bycatch in March-April in gill-net fisheries in Finnmark, North Norway, were collected in 2003. Sampling included sex, age, condition and stomach contents, and the material is being analysed and will be reported jointly with similar material collected in the period 1992-2001. No sampling from bycatches were conducted in 2004.

2.2 Russian research

2.2.1 Estimation of pup production of harp seals in the White Sea

During the 1998-2003 meetings of the Joint ICES/NAFO Working Group on Harp and Hooded Seals (WGHARP), it was noticed and appreciated that Russian scientists had made substantial efforts to obtain reliable pup production estimates for the White and Barents Sea stock of harp seals. Estimates from 1998, 2000, 2002 have been used in models to assess stock status and to evaluate consequences of various catch options (on a ten year basis) for this stock. The applied methods with aerial counts of seals, using the "Arctica" AN-26 plane, equipped with video and photo facilities (including a camera capable to take pictures of seals in the IR-range), has been appreciated both by WGHARP and in Russian national marine mammal meetings. As it is now equipped, this plane is now a unique flying device for surveys of marine mammals in Russia.

Surveys with “Arctica” AN-26 on 18 and 21 March 2003 yielded a pup production estimate in the White Sea of 328,000. New surveys were conducted in the same areas on March 23 and 24 in 2004, again using the "Arctica" plane AN-26, fitted by video and the photo equipment, and also with IR-chamber. The plane was based in Arkhangelsk, and the photographing of pups were carried out by employees from PINRO and SevPINRO. Preliminary results from analysis of the photos, executed by PINRO employees, yielded pup production estimates of 243,400 (SE=52,400) and 233,600 (SE=48,300) (for 23 and 24 March, respectively. Further analyses of the photos are now being conducted by SevPINRO experts.

2.2.2 Estimation of number of harp seals on the White Sea moulting grounds

In April 2004, "Arctica" AN-26 was used to attempt to assess the number of harp seals on their moulting grounds in the White Sea. The techniques applied were similar t those used for the estimation of pup numbers. An aggregated number of 1,112,300 (SE=224,100).

2.2.3 Remote methods for the study of morphological parameters in harp seals

During earlier multispectral aerial surveys of harp seals on breeding grounds in the White Sea, it

has been possible to attempt contactless, remote registration of the sizes of adult animals and pups. The method has been based on the use of computer processing and analysis of digital pictures. The approach, if proven successful, may allow for future determination of the size spectrum, and maybe also the age structure, of the herd. Some preliminary results of this work was presented at the WGHARP meeting in 2003 (Arkhangelsk). In 2004 the work was continued, using the data received at the survey of seals on the moulting grounds.

2.2.4. Mortality of harp seal pups in the White Sea, June - July 2004

To study the reasons for and magnitude of harp seal pup mortality in the Dvina gulf of the White Sea during summer, an expedition was conducted. During the period 20 June to 1 July 2004, inspection of the entire coastal line of the Dvina gulf (about 180 km shore line) was carried out. A total of 27 dead animals (all about 4 months of age) were observed. The principal cause of death of the animals was their strong exhaustion and destruction in fishing nets, probably due to the fact that the moulted pups goes into the water in the rear parts of Dvina gulf. Nevertheless, collection of data, performed during spring and summer by fishermen, has not confirmed mass mortalities of harp seal pups during 2004. It is supposed, that the observed death rate of pups during their stay in the waters of the White Sea, corresponded with average long-term sizes.

2.3. Joint Norwegian-Russian work

2.3.1 Abundance estimation

On several occasions the Working Group has discussed the possibilities and undisputable advantages involved in exchange of scientists between the ”harp-and-hooded-seal-counting” countries during each others field work and subsequent analyses, discussions and presentations of results. This would ensure standardisation of both the field- and analytical methods involved. For this reason Norwegian scientists patrticipated in the 2000 aerial surveys in the White Sea, and have also taken part in the subsequent analyses and presentations of the data. Furthermore, one Russian expert has participated in the analyses of material collected during the Norwegian 2002 aerial surveys in the Greenland Sea. During the 2004 season, both Norwegian and Russian experts participated in harp seal surveys and some hooded seal research in the Northwest Atlantic.

2.3.2 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, a Norwegian survey was 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 harp seals were shot and sampled (stomachs, intestines, blubber cores). Additionally, samples of faeces were taken from the haul out sites on

the ice. Preliminary results from the analyses indicate that krill was the main food item for the seals.

2.3.3 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 (in Norway, Russia and other relevant countries such as Canada and Greenland), a joint workshop is planned to be arranged in Norway, preferably in 2005. In 2004 a Russian expert took part in Canadian experiments with age reading of harp and ringed seals based on transvere cuts of teeth.

3. STATUS OF STOCKS AND MANAGEMENT ADVICE FOR 2005

WGHARP met at SevPINRO, Arkhangelsk, Russia, 2-6 September 2003 to assess the stocks of Greenland Sea harp seals, White Sea / Barents Sea harp seals and Greenland Sea hooded seals. New information about pup production was available, and enabled WGHARP to perfrom modelling which provided ICES with sufficient information (at the ACFM meeting in Copenhagen, Denmark, 8-17 October 2003) to give advice 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 new population model that estimates the current total population size using the historical catch data and estimates of pup production. 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.

There are several significant differences between the current model and the one used for the previous assessment (in 2000). The previous model used only two age classes (pups and 1+

animals), while the new model uses 20 age classes. Information about age composition in catches is available from age estimations from annual rings in canine teeth. Work carried out following the previous assessment, including discussions on and recommendations from the Workshop to Develop Improved Methods for Providing Harp and Hooded Seal Harvest Advice, indicated that the earlier model was less appropriate than a model with a full age structure. The same population dynamic model was used for all three of the northeast Atlantic populations, but with stock specific values of biological parameters. The inclusion of a full age structure into the model was an improvement from previously used estimation programs. In general the new model gives lower catch options than previous models. This is due to uncertainty in, in some cases also complete lack of, updated relevant data for the assessed stocks.

The advice given by ICES in 2003 was used by this Working Group on Seals to establish management advice for 2004 to the Joint Norwegian-Russian Fisheries Commission. In 2004, WGHARP only met by correspondence, and will not meet physically until 30 August – 3 September 2005, when a meeting is scheduled in St. John's, Newfoundland, Canada. For this reason, there is no new advice from ICES, and the Working Group **recommend** that the management advice given for 2004 is prolonged to apply also for the 2005 sealing season.

3.1. Greenland Sea

The Working Group **recommends** the following opening dates for the 2005 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 2005. 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 2005.

3.1.1 Hooded seals

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

The pup production and total population for 2003 was estimated using the model described above. Inputs to the model were:

Pup production estimate: Aerial surveys in 1997 resulted in estimates of pup production in the Greenland Sea of 23 762 pups (95% C.I. 14 819 to 32 705). This estimate is considered to be negatively biased since it was not corrected for the temporal distribution of births or for scattered pups. The actual number of pups produced in 1997 could, therefore, be larger.

Natural mortality: $M_{1+} = 0.12$.
Pup mortality: $M_0 = 3M_{1+}$.
Age at maturity ogive:
Estimated proportion of mature females (p) at ages 2-10, based upon data obtained from the NW Atlantic population

Age	2	3	4	5	6	7	8	9	10
P	0.029	0.262	0.504	0.734	0.802	0.802	0.850	0.908	1.00

Pregnancy rate for mature females: F=0.97

Based on this input, the model estimated the following 2003 abundance for Greenland Sea hooded seals: 120 000 (95% C.I. 65 000-175 000) 1+ animals with a pup production of 29 000 (95% C.I. 17 000-41 000).

The 1997 estimate of pup production is the only estimate available for the Greenland Sea hooded seal stock. The single estimate of pup production is over 6 years old and there are no estimates of reproductive rates for this stock. Therefore, any advice provided should be extremely cautious. One method of providing advice in such data poor situations is through the use of the Potential Biological Removals (PBR) approach. The Potential Biological Removal (PBR) has been defined as:

$$PBR=0.5 \cdot R_{Max} \cdot F_r \cdot N_{Min},$$

where R_{Max} is the maximum rate of increase for the population , F_r is a recovery factor with values between 0.1 and 1 and N_{Min} is the estimated population size using 20th percentile of the log-normal distribution. R_{Max} is set at a default of 0.12 for pinnipeds. It is appropriate to set the recovery factor (F_r) 0.75 given the time since the last survey and uncertainty in parameters used to determine the total abundance.

The PBR approach can be used when only a single estimate of abundance is available. This approach would be appropriate within the precautionary approach to marine resource management implemented by ICES.

Based on a request from the Joint Norwegian-Russian Fisheries Commission, 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 1999 – 2003)
- Sustainable catches.
- Two times the sustainable catches.

For the reasons outlined above, however, ICES rather recommend a PBR-based approach. A catch of 5 600 hooded seals in 2004 would sustain the population at present level. The Working Group **recommend** that this be used as a basis for the determination of a TAC for hooded seals

in the Greenland Sea also in 2005:
5,600 animals (irrespective of age).

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	58539	.104
1984	103250	.147
1985	111084	.199
1987	49970	.076
1988	58697	.184
1989	110614	.077
1990	55625	.077
1991	67271	.082
2002	98099	.204

Natural mortality: $M_{1+} = 0.12$.
Pup mortality: $M_0 = 3M_{1+}$.
Age at maturity ogive: p(3) = 0.058, p(4) = 0.292 p(5) = 0.554, p(6)=0.744, p(7)=0.861, p(8)=0.926, p(9)= 0.961, p(10)=0.980, p(11)=0.990, p(12)=0.995, p(13)=0.997, p(14)=0.999, p(15)=0.999
Pregnancy rate for mature females: F=0.833.

Based on this input, the model estimated the following 2003 abundance for Greenland Sea harp seals: 349 000 (95% C.I. 319 000-379 000) 1+ animals with a pup production of 68 000 (95% C.I. 62 000-74 000).

Based on a request from the Joint Norwegian-Russian Fisheries Commission, ICES gave **catch options** for three different catch scenarios:

- Current catch level (average of the catches in the period 1999 – 2003)
- 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 2013 and 2003 is used.

					10 Year Projection
Option #	Catch level	Proportion of 1+ in catches	Pup catch	1+ catch	$N_{2013,1+}$ / $N_{2003,1+}$
1	Current	48% (current level)	1953	1819	1.16
2	Sustainable	48%	5990	5530	1.01
3	Sustainable	100%	0	8200	1.02
4	2 X sust.	48%	11981	11059	0.79
5	2 X sust.	100%	0	16400	0.81

While current catch level (option 1) will likely result in an increase in population size, ICES emphasized that a catch of 8,200 1+ animals (catch option 3), or an equivalent number of pups, in 2004 would sustaina 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 2005:
8,200 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 20-25% 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 20 April for Russian coastal catches and from 23 March to 20 April for Norwegian and Russian sealing ships. However, it is proposed that, in the case of difficult weather or ice conditions, the harvesting can be prolonged till 10 May. 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 2005.

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.

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	322 474	.089
2000	339 710	.095
2002	330 000	.200

Natural mortality: $M_{1+} = 0.09$.
Pup mortality: $M_0 = 5M_{1+}$ (fixed)
Age at maturity ogive: p(5) = 0.1, p(6) = 0.18, p(7) = 0.35, p(8)=0.6, p(9)=0.7, p(10)=0.94, p(11)= 1.0
Pregnancy rate: F=0.84.

The first (1998) pup production estimate is uncorrected, while the later ones have corrections applied. For 2000 there are two independent estimates for pup production.

Based on these input values, the model estimated the following 2003 abundance of harp seals in the White Sea: 1 829 000 (95% C.I. 1 651 000-2 006 000) 1+ animals with a pup production of 330 000 (95% C.I. 299 000-360 000).

Based on a request from the Joint Norwegian-Russian Fisheries Commission, ICES gave **catch options** for three different catch scenarios:

- Current catch level (average of the catches in the period 1999 – 2003)
- 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 2013 and 2003 is used.

					10 Year Projection
Option #	Catch level	Proportion of 1+ in catches	Pup catch	1+ catch	$N_{2013,1+}$ / $N_{2003,1+}$
1	Current	7% (current level)	37979	2992	1.16
2	Sustainable	7%	102 486	7 714	0.99
3	Sustainable	100%	0	45 100	1.03
4	2 X sust.	7%	204 972	15 428	0.71
5	2 X sust.	100%	0	90 200	0.80

While current catch level (option 1) will likely result in an increase in population size, ICES emphasized that a catch of 45,100 1+ animals (catch option 3), or an equivalent number of pups, in 2004 would sustain the population at the 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 2005:
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.
Catches 2X sustainable levels (options 4 and 5) will result in the population declining by approximately 20-25% in the next 10 years.

3.2.2 Other species

The Working Group agreed that commercial hunt of bearded seals should be banned in 2005, as in previous years, but it **recommend** to start catch under permit for scientific purposes to investigate results of long time protection.

3.4 Biological limits of yield

Biological limits of yield reflecting very low risk of collapse must be developed within a Precautionary Approach framework. ICES discussed a recent approach on the application of the Precautionary Approach (PA) and conservation reference points to the management of harp and hooded seals, originally developed to fit the harp seal stock in the Northwest Atlantic. Within this framework, conservation, precautionary and target reference points was identified and linked to specific actions to aid in managing the resource.

The availability of scientific information concerning the status of harp and hooded seals (abundance, reproductive and mortality rates) varies between stocks and species. Thus, the question of 'data rich' vs. 'data poor' is important, and a conceptual framework that applies to both harp and hooded seals should be established. There is an obvious lack of recent data on hooded seals in all areas. Therefore, in its intersessional work WGHARP has suggested to postpone any biological reference points discussion involving hooded seals until updated relevant information is available (i.e., after 2005 when there are plans for hooded seal surveys both in the northwest Atlantic and in the Greenland Sea). The primary focus in this first phase will therefore be harp seals.

The northwest Atlantic population of harp seals is the most data rich - the availability of data from this population is better than for both the White Sea population and the Greenland Sea population, although recent abundance estimates are available for both the latter. Development of a set of biological reference points for the northwest Atlantic harp seals appears quite feasible. WGHARP also feel that, under certain conditions, it might be possible also to develop biological reference points for the two remaining harp seal populations using the same framework as in the west. WGHARP intend to do this at the next meeting in St.John's, Newfoundland, Canada, in 2005. The Working Group look forward to see the results of this discussion.

3.5 Prospects for future sealing activities

There are concerns over the current lack of ability on both the Norwegian and Russian side to fulfill given quotas on harp and hooded seals. 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. For this reason the workshop "Prospects for future sealing activities in the North Atlantic" was held at SevPINRO in Archangelsk, Russia in 2003. The Working Group has reviewed the main conclusions from the workshop and compared them with present status.

A primary conclusion from the workshop, which is also strongly supported by the Working Group, is that future sealing activities must be profitable. If sealing profitability increases, hunting levels are very likely to increase up to sustainable levels. It was agreed that 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 annually, 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 seals were surveyed in 2002, whereas the hooded seals in this area will be surveyed in 2005.

Regulation of the seal populations should be conducted as part of an ecosystem management. Nevertheless, the workshop agreed that 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. This is the most numerous seal species, and it is regarded as a predator of concern in assessments of both capelin and cod/haddock in the Barents Sea. In the report from the Basic Document Working Group,

necessary reasarch activities, to improve the basis for inclusion of harp seal predation in fish stock assessments and management, is identified. The Working Group notice that some of this work has already started (collection of diet data), and **recommend** that this work continues, and that necessary telemetric studies of the species are also started as soon as possible.

The workshop recommended that more long term strategy for management should be developed. The Working Group noted that ICES is currently working to develop biological reference points for harp and hooded seals. Most likely, such reference points can be developed for all harp seal populations at next years WGHARP meeting (Aug-Sep 2005). Reference points for hooded seals can not be estimated until new and updated abundance estimates are available from surveys in 2005. The Working Group **recommend** that these reference points be used in the long term strategy for management of harp and hooded seals.

Hunting methods and the logistics involved was an important issue for the workshop. Russia should change from helicopter-based to boat-based hunting, and the boats must be designed to facilitate participation in other fisheries outside the sealing season. Work in this direction is now in progress in Russia – most likely a combination of the present Canadian approach (with several small vessels) and the Norwegian approach (with at least one larger boat) will be the best solution. Increased profitability is necessary to make this change in sealing logistics and methodology feasible. This is also necessary to enable an urgent renewal of the Norwegian vessel fleet – this process is now in progress. Modernizing of the hunting logistics must take into account that the final design shall be for future sealing (where the whole seal is utilized) and not only for the more traditional pelt-blubber and, to a lesser extent, meat sealing. 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 empasize that sealing is restricted to a relatively short period during spring – new sealers must, therefore, be designed in such a way that they can be used also in other fisheries.

To assure self-sustained profitability in future sealing activities, the workshop concluded that it would be necessary to increase the profits of sealing by increasing the value of each seal. The Working Group does not see any ecological problems if only parts of the seal is used, i.e., that only pelts and blubber are taken, while the rest of the carcass is left on the ice to be recycled in the ecosystem. It is, however, 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. New products from sealing (e.g., omega-3 capsules based on seal blubber) is still at an experimental, and not at a large scale, stage. The Working Group **recommend** that development of new products must, therefore, occur in parallell with production of more traditional seal products (pelts, blubber, meat). The market situation for certain pelts (in particular bluebacks and beaters, whitecoats are at present uninteresting outside Russia) is improving. Nevertheless, marketing of both traditional and new products will be both necessary and important.

The workshop profoundly encouraged people from sealing nations to cooperate in the future, both on the scientific level (on one side to obtain safe and acceptable assessments and management of the seal stocks; on another side to develop new products), on the industrial level (initiate production of new products, secure sufficient marketing of both new and more traditional products), and among the hunters (renewal of hunting methods and logistics). The

Working Group **recommends** that workshops similar to the one in Arkhangelsk in 2003, with representatives of the sealing industry in the northern region, are arranged also in the future when some of the suggested changes starts to become visible. It should preferably be arranged in Russia.

4. RESEARCH PROGRAM FOR 2005+

4.1. Norwegian investigations

4.1.1 Collection of biological material from the commercial hunt

Biological material, to establish age distributions in catches as well as reproductive and nutritive status of the animals, will be collected from commercial catches both in the southeastern Barents Sea and in the Greenland Sea in the future. In 2005, however, all effort will be concentrated on hooded seal abundance estimation in the Greenland Sea, and no sampling will be performed from commercial vessels. Next sampling is planned in 2006.

Studies of the ecology of harp and hooded seal pups in the Barents Sea and Greenland Sea will be continued as well. The long term aim of these investigations is to get a better understanding of the underlaying mechanisms determining the recruitment success from year to year for the two species. Sampling is performed on commercial vessels – next effort will be in 2006.

4.1.2 Estimation of hooded seal pup production in the Greenland Sea

Last time hooded seal pup production was assessed in the Greenland Sea was in 1997. Since abundance estimates of hunted seal stocks should be obtained no less than every 5 year, Norway will conduct surveys to obtain data necessary for estimation of the abundance of hooded seals of the Greenland Sea stock in 2005. The methodological approach will be designed along the same lines as the recent (2002) Greenland Sea harp seal survey, i.e., to conduct aerial surveys of pups in the Greenland Sea pack-ice during the whelping period (March-April). A fixed-wing twin-engined aircraft (stationed in Scoresbysound, Greenland) will be used for reconaissance flights and photographic surveys along transects over the whelping patches once they have been located and identified. A helicopter, stationed on and operated from a research vessel, will assist in the reconnaissance flights, and subsequently fly visual transect surveys over the whelping patches. The helicopter will also be used for other purposes (stageing of pups and tagging). As part of the preparations, fuel to be used by the aeroplane was transported by ship to Scoresbysound during summer in 2004.

4.1.3 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 1999-2002. 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 2005.

4.1.4 Harp seals taken as by-catches in gillnets

Provided harp seals invade the coast of North Norway also during winter in 2005, biological samples will be secured from animals taken as bycatches in Norwegian gill net fisheries.

4.1.6 Seal physiology

On a research cruise to the Greenland Sea in March 2005, various physiological parameters of harp and hooded seals will be studied. Also, some experiments on how seals react to sonar sounds will be carried out.

4.2.Russian investigations

4.2.1 Harp seal pup production in the White Sea in 2005

Substantial practical experience in carrying out aerial surveys of harp seal pup production in the White Sea has accumulated in Russia. In 1997 – 2004, 7 aerial photographic surveys were conducted. The results have been reported on a regular basis to WGHARP, and published in Russia and abroad. In 2005, Russia plans to conduct a harp seal pup photography survey and to obtain new data for assessment of the stock. The methodological approach will be similar to previous surveys. Depending on the ice and other conditions, ground truthing necessary to adjust the aerial surveys parameters will also be conducted.

4.2.2. Studies of whelping harp seal in 2005

Biological material for determination of age structure in catches and the reproductive and feeding status of adult females will, if practically feasible, be collected during the 2005 commercial seal hunt. Collection of material on the morphology and ecology of harp seal pups will be continued in the White Sea. Basic attention will be given to such aspects as female breeding terms, time duration of pups in developmental stages, and the beginning of independent feeding. If ice conditions allow, tagging of pups with roto-tags will be conducted. Within the framework of the scientific program it is intended to collect biological samples from 500 adult females and 500 pups of any sex. It is also the intention to continue research on the feeding habits of the seals and their interactions with commercially important fish species.

4.2.3 Studies of harp seals in the 2005 moulting and feeding periods

In April - May 2005, studies of harp seal spring migrations in the White Sea and Barents Sea will be continued. In April 2004 full-scale surveys of the harp seals on their moulting grounds in the White Sea were conducted - in April - May 2005 this will be repeated

4.3. Joint Norwegian - Russian investigations

4.3.1 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. For various reasons it was not possible to initiate the project in 2003 as planned, so the first survey to address these questions took place in May/June 2004. The project is planned to run over a three-year period (2004-2006), and the next survey to address these questions will take place in June/July 2005. In the Norwegian area (NEZ) a chartered Norwegian coast guard vessel will be used, whereas a Russian vessel will be applied in REZ. If possible, there will be a mix of Norwegian and Russian scientific personell on both vessels. The boat-based survey may be supported with aerial reconnaissance surveys performed by a Russian aeroplane.

4.3.2 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 2005. 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 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 caried 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). Next step will be to secure funding in both countries – the plan is that expenses shall be shared on a 50/50 basis between Russia and Norway. If possible, first deployment of tags will be attempted conducted in 2005. The Working Group **recommends** that the experiment is started in 2005.

4.3.3 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 biological material. The Working Group **recommend** that Russian scientists are offered the possibility to participate in Norwegian research activities in 2005. If Russia can

realize scientific or commercial vessel trips in the White, Barents and Greenland Seas, invitation for participation of Norwegian scientists is desirable.

From the Russian side it has been suggested that Norwegian and Russian scientists coordinate their research on various biological aspects of the early life phase of seal pups in the White Sea / Barents Sea. Exchange of data and joint publication should be considered. In the period from 1986 to 1994, Russian scientists collected biological data on hooded seals of the Greenland Sea. Of particular current interest is material which describe the trends in maturity at average age (MAM) for hooded seals, and the Working Group strongly **recommend** that this material be analysed and published jointly.

Russian scientists also suggest to repeat previous (1970 – 1980) workshops, where experience of different countries scientists concerning the determination of seal age were exchanged. For this purpose, the use of teeth from seals of known age should be used. As a first step in this activity, one Russian expert were invited to stay in Norway (Tromsø) in January/February 2003 to study the age of harp seals taken in the Norwegian commercial hunt in recent years. The Working Group **recommend** that this sort of activities are continued.

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 2004:

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	250
Ringed seals	400	50
Bearded seals	300	50
Greenland Sea*		
Whelping grounds		
Adult breeding harp seal females	500**	100
Harp seal pups	500**	100
Adult breeding hooded seal females	500**	100
Hooded seal pups	500**	100
Outside breeding grounds		

Harp seals of any age and sex	0	100
Hooded seals of any age and sex	0	100
Ringed seals	10*	100
Bearded seals	10*	10

* If Greenland Sea quotas are allocated to Russia, these will be used for collection of biological samples
** Only possible if convenient vessel will be available

5. OTHER BUSINESS

5.1 White whale research

Taking into account the experience stored by Russian and Norwegian experts in studies of white whale abundance, distribution and migrations within the White and Barents Seas, the Working Group recommended in 2003 that Russian and Norwegian scientists unite efforts in developing the techniques for an investigations (including abundance estimation and studies of migration using satellite tags) of white whales in the White Sea. This advice has been followed, and in 2004 a joint Russian-Norwegian program aimed to study the ecology of white whales in the White Sea was developed. From the Russian side SevPINRO (Laboratory of Marine Mammals) and from Norwegian side the Norwegian Polar Institute will be engaged. In the course of program implementation it is planned to deploy 10-20 (depending on the total program budget) satellite-relay dive loggers to gather information on distribution and diving behaviour of white whale in the White Sea. These devices can provide remotely position information as well as a large array of data relating to diving behaviour of white whales. The program includes a number of sub projects:
- Distribution and diving behaviour determined through satellite tracking
- Contaminant levels in white whales in the White Sea
- Diet analyses of white whales -assessed through fatty-acid profiling
- Population discreteness of white whales in Svalbard and the White Sea
- Acoustic behaviour of belugas in Svalbard and the White Sea

The Working Group **recommends** that Russian and Norwegian scientists begin the implementation of the research program on white whales in the White Sea in 2005.

5.2 Studies of minke whale ecology

The northeast Atlantic stock of minke whales is known to consume a substantial amount of fish (including commercially important species such as capelin, herring and gadoids). To improve the data base needed to assess the impact of minke whales on the Barents Sea fish stocks, it was suggested at the 2001 meeting of the Joint Norwegian-Russian Fisheries Commission that a research program be developed. In response to this, a joint Norwegian-Russian research program to particularly study the ecology of minke whales in the REZ part of the Barents Sea was developed by professor Tore Haug (Norway) and drs Vladimir Potelov and Vladislav Svetochev (Russia). This would imply a take in REZ of 50 minke whales per year for scientific purposes

during the investigation period (2002-2005). Norway has approved such a program, and an application was sent to Russian authorities to permit two Norwegian whaling boats, each with a Norwegian/Russian scientific crew, to hunt a total of 50 minke whales in REZ in 2002. Russian authorities permitted the Norwegian vessels to go into the REZ, but unfortunately they were not allowed to hunt whales. The project therefore had to be cancelled in 2002. Similar procedures were followed in 2003 and 2004, but with the same results. The Working Group **recommends** that a new attempt to initiate the joint Norwegian-Russian research program on minke whale ecology in REZ is made, and that the program be designed to run over the period 2005-2008.

5.3 Joint whale and other surveys

Traditionally two Russian and two Norwegian research vessels have participated in the Barents Sea capelin survey in September each year. By placing whale observers onboard all four vessels one will gain data on the distribution and abundance on whales relative to the distribution of capelin and other potential prey species. Such data will be very valuable to obtain a further understanding of the role of whale species in the ecosystem. A first effort was done in 2004 when this survey was run as an ecosystem survey for the first time. Data colllected are being analysed. The Working Group **recommends** that this observer program is continued.

It is also suggested to continue the joint aerial investigations to study distribution and to perform an abundance evaluation of marine mammals and birds in the northern parts of the Barents Sea, including their overlap with fish species such as capelin and polar cod. The investigations will be carried out within the framework of annual surveys of pelagic fishes and have elements of ecosystem approach (September - October). The Working Group appreciate this activity, and also **recommend** that studies of diet of other seal species such as ringed seals, bearded seals and grey seals are undertaken to assess their impact on stocks of commercial fishes.

6. APPROVAL OF REPORT

The English version of the Working Group report was approved by the members on 28 October, 2004.