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REPORT OF THE JOINT ICES/NAFO WORKING GROUP ON

HARP AND HOODED SEALS

Copenhagen, 14-18 October 1991

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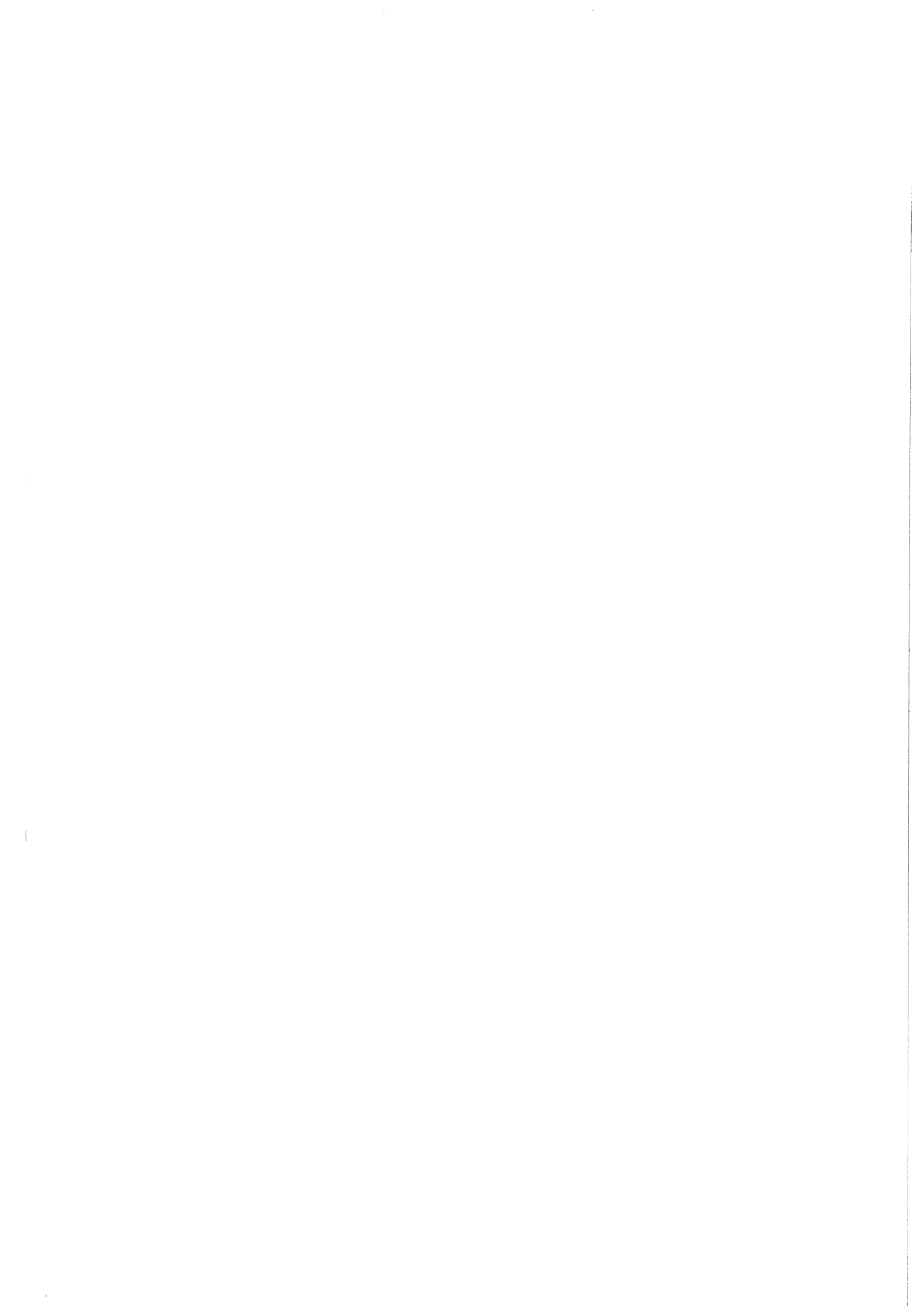
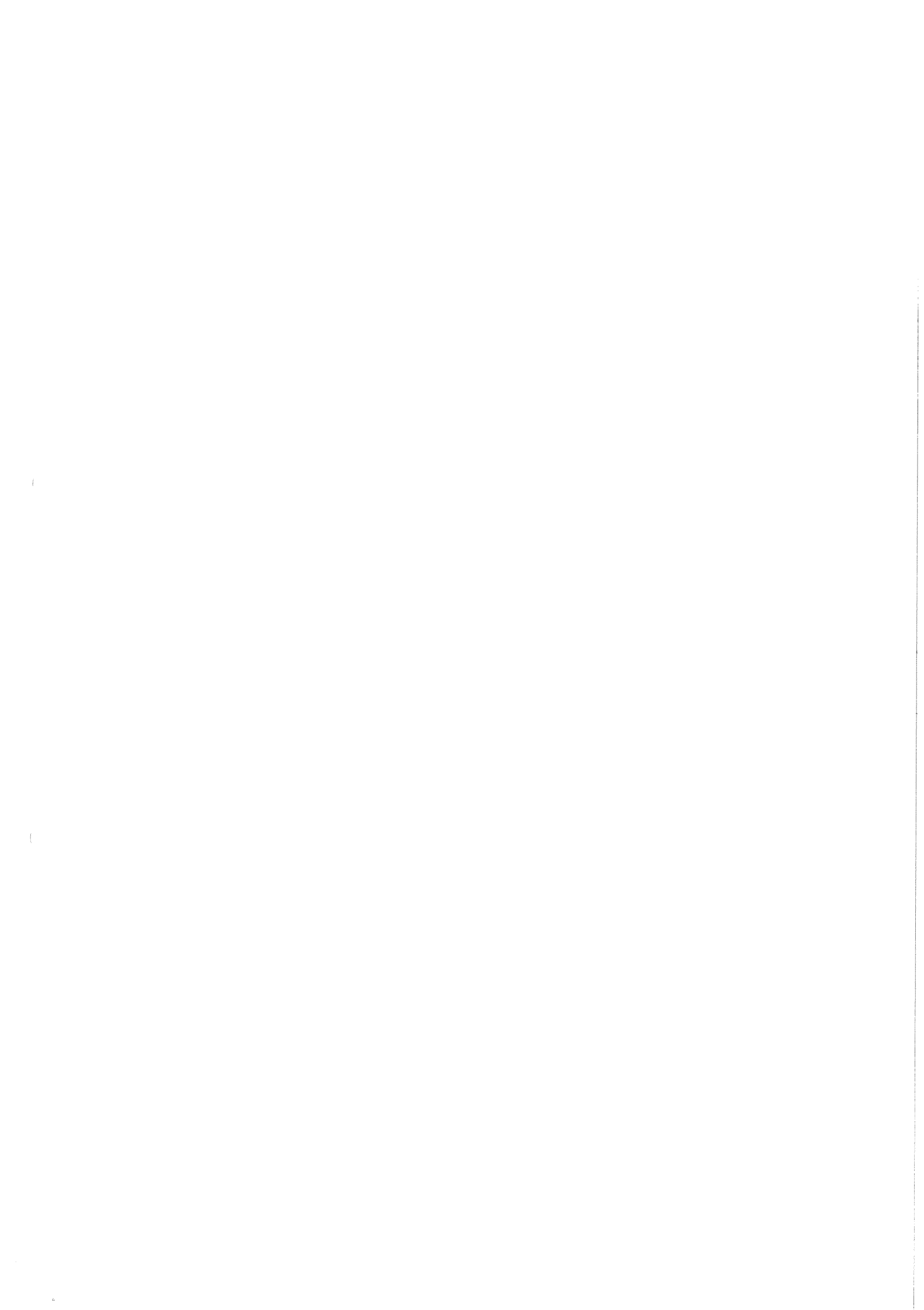


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1 TERMS OF REFERENCE

The Working Group on Harp and Hooded Seals in the Greenland Sea was established in 1984 (C.Res. 1984/2:4:18), and met in September 1985 and October 1987 (ICES Coop. Rep. 1948 and ICES C.M. 1988/Assess:8).

In 1988 the terms of reference were expanded to include harp seals in the White Sea and Barents Sea (C.Res. 1988/2:4:27), and the Working Group met in Bergen, 16-19 October 1989 (ICES C.M. 1990/Assess:8).

At the 77th Statutory Meeting, 1989, it was recommended that:

A Joint ICES/NAFO Working Group on Harp and Hooded Seals be established for the purpose of assessing the status of these stocks and providing related advice and information in the areas of both organizations. Contracting Parties to either organization or regulatory commissions who might desire advice on harp and/or hooded seals in a particular geographical area must refer their request to the organization (NAFO or ICES) having jurisdiction over or interest in that area. Advice based on reports of the Joint Working Group would be provided by ACFM in the case of questions pertaining to the official ICES Fishing Areas (FAO Area 27) and by NAFO Scientific Council in the case of questions pertaining to the legally-defined NAFO area. ICES will administrate the Joint Working Group in terms of convening meetings, formulating terms of reference, handling membership and chairman-ship, and processing, printing, and distributing Working Group reports." (C.Res. 1989/3:1).

At the 78th Statutory Meeting, 1990, a meeting of this Joint Working Group was scheduled for 14-18 October 1991, with the following terms of reference (C.Res. 1990/2:5:28):

- a) assess the stock size, distribution and pup production of harp and hooded seals in the Greenland Sea and in the NAFO area and of harp seals in the Barents Sea and White Sea;
- b) assess sustainable and replacement yields at present stock sizes and in the long term under varying options of age composition in the catch, and provide advice on catch options for the sealing season in 1992;
- c) assess effects of recent changes in the food supply and the possible interaction with other living marine resources in the area;
- d) review the available data used to assess the state of the stocks and give proposals for future-research programmes.

This resolution of calling a meeting followed a request by an ICES member nation (Norway) for advice on harp and hooded seals in the Northeast Atlantic; a similar request for advice on the Northwest Atlantic stocks has, however, not been forwarded through NAFO. Therefore, the Working Group shall not attempt to give advice for the western stocks of harp and hooded seals at the present meeting, but available scientific information on these stocks will be reviewed, as appropriate.

2 MEETING ARRANGEMENTS

The Working Group, chaired by F.O. Kapel, and comprising scientists from Canada, Denmark, Norway and the Soviet Union, met at the Greenland Fisheries Research Institute, Copenhagen, from 14 to 18 October 1991. A list of participants is given in Appendix I.

The Working Group reviewed available information on catches and relevant scientific information on harp and hooded seals, including documents presented at this meeting. The Agenda adopted for the meeting is shown in Appendix II, and the papers referred to are listed in Appendix III.

The present report was adopted 18 October, subject to editorial corrections.

3 SEAL STOCKS; STATUS AND MANAGEMENT

3.1 Harp Seal (*Phoca groenlandica*) in the White Sea and Barents Sea

3.1.1 Catches, regulatory measures, and research

Norwegian and Soviet catches of harp seals in the White and Barents Seas 1946-1991 are listed in Appendix IV, Table 3. The combined Norwegian and Soviet catches in 1990 and 1991 were 41,979 and 41,980 animals, respectively, i.e., at a level comparable with the 1989 catches.

A summary of sealing regulations for the White and Barents Seas stock from 1979 to 1991 is given in Appendix V, Table 2.

In 1990 Norway started a 3 years project to continue studies of feeding habits of harp seals in the Barents Sea throughout the year (Haug *et al.*, 1991; Nilssen *et al.*, 1991a, b). Simultaneously with these ecology studies, material for studies of reproduction parameters are being

collected and analysed. Also, studies of harp seal energetics are continued.

Biological sampling and age analyses of Norwegian catches of moulting seals (Anon., this meeting, SEA-29), and stock assessment through simulation studies based on catch data and Soviet aerial survey estimates have continued (Ulltang, this meeting, SEA-27).

Studies of detoxification enzymes have been conducted, and samples for studies of contamination in harp seals have been collected. Norway has also continued biochemical studies of genetic variation in tissue enzymes in samples from the Greenland Sea and the Barents Sea (Meisfjord *et al.*, 1991). Also studies of fatty acid profiles have continued in the two areas. Studies of the feasibility of using satellite tracking have been initiated and will continue (Folkow & Blix, this meeting, SEA-24). Analyses of migrations from conventional tag recapture data have been updated (Øien and Øritsland, this meeting, SEA-33).

Soviet research on this stock in 1990 and 1991 included a continuation of the aerial reconnaissance surveys of breeding and moulting patches in the White Sea pack-ice between late February and June (Anon., this meeting, SEA-35 and SEA-39).

The Soviet tagging program, initiated in 1987 in cooperation with Norway, was continued in 1990 and 1991 when 3,646 and 4,161 seals were tagged, respectively (Timoshenko, this meeting, SEA-37; Anon, this meeting, SEA-35). As in previous years, Norwegian Rototags were used. Taggings are listed and recoveries are being recorded on datafile at the Institute of Marine Research, Bergen.

In both years, the Soviet Union collected material for studies of pelage type (from 1,343 and 1,473 seals, respectively), age composition (1,678 and 1,836 jaws, respectively) and reproduction (about 700 ovaries in 1990) (Anon., this meeting, SEA-35 and SEA-39).

3.1.2 Distribution and stock identity

The Working Group noted the apparent differences in age composition of recent catches from the moulting patches between the White Sea and Greenland Sea stocks (Anon., this meeting, SEA-29; Anon., this meeting, SEA-35; Anon. 1989). However, without further information concerning the sampling techniques and given the known age segregation of moulting harp seals, the Working Group could not evaluate the significance of this information.

Harp seal invasions of the magnitude observed in 1986-1988 to the Norwegian coast in winter (Haug *et al.*,

1991) have not been observed in 1990 and 1991 when only occasional visits of straggling herds, comparable to the observations made in 1989, were recorded (Appendix IV, Table 6).

From 1987 through 1991, 9,428 harp seals were tagged in the whelping patches in the White Sea. Recaptures have been made in the White and Barents Seas as well as along the Norwegian coast to Skagerrak (see 3.2.2.).

For results from biochemical genetic comparison between the White Sea and Greenland Sea stocks (see 3.2.2.).

3.1.3 Biological parameters

No new information was presented concerning biological parameters such as mortality, age at sexual maturity, or fertility rate.

Norway reported that both age data and biological material for estimation of reproductive parameters have been collected and are being processed for analyses and comparison with historical data. The Working Group acknowledged this and welcomed completed analyses as soon as possible.

No new information on mortality rates was reported, but the Soviet Union listed several possible factors that may have contributed to the apparent deficiency of young animals in catches taken from this stock in recent years: predation by polar bears (Potelov 1991), pollution in the White Sea nursery areas, and difficult weather and ice conditions (Anon., this meeting, SEA-35; Osipova *et al.*, this meeting, SEA-38).

3.1.4 Population size and pup production

At its last meeting, the Working Group concluded that detailed information concerning the techniques used was required in order to evaluate the Soviet aerial surveys of whelping females in the White Sea (Anon., 1990a). At this meeting, the Group was able to review some of the requested information for the 1988 survey (Timoshenko, this meeting, SEA-21). However, critical information necessary for determining the variance of the survey estimates were not available. The Working Group noted that although the general survey techniques used in 1988 were similar to earlier surveys, it could not be determined if the surveys were comparable because of possible changes in the female/pup ratios due to the different timing of the surveys. The Group concluded that until data on the precision of the estimates were presented and the possibility of changes in the female/pup ratios was examined, the validity of the Soviet surveys could still not be established.

Results of Soviet aerial surveys on the breeding grounds were summarized by the Working Group in its 1989 report (Anon., 1990). At this meeting results of simulations of stock size and pup production, calibrated to Soviet aerial survey estimates of female breeding population in 1980, 1985 and 1988 were reported, showing the size of extra natural mortality which would be required to explain the decline from 1985 to 1988 (Ulltang, this meeting, SEA-27). Simulations were calibrated to a) taking the aerial survey estimates at their face value, and b) correcting the survey estimates by a factor of 1.2 to take account of seals in the water at the moment of surveying. Without knowing whether the results of the surveys in the different years were comparable; or, if so, whether the correction factor applied was a likely value, the Working Group was unable to draw any conclusions from these simulations.

The Working Group also noted that the age compositions of recent samples from the moulting patches in the White Sea and Barents Sea suggest a decline in the proportion of young animals (Anon., this meeting, SEA-29; Anon., 1989). The significance of this apparent decline could not be evaluated because of the lack of information concerning the sampling techniques and the possibility of bias due to age and/or sex segregation of seals in the moulting patches.

3.1.5 Management advice

The Working Group was unable to calculate sustainable or replacement yield for the White Sea stock of harp seals.

However, in light of great uncertainties about the state of the stock, and the evidence from the aerial surveys suggesting a drastic decline in the numbers of breeding females, and supported by the apparent low number of young animals in age composition data from the moulting lairs (Anon., this meeting, SEA-29; Anon., this meeting, SEA-35), the Working Group reiterates its previous comments that a conservative approach should be adopted if catches from this stock are taken (Anon., 1990a).

3.2 Harp Seal in the Greenland Sea (Jan Mayen)

3.2.1 Catches, regulatory measures and research.

Norwegian and Soviet catches of harp seals in the Greenland Sea 1946-1991 are listed in Appendix IV, Table 2. In 1990 and 1991 both countries participated in the West Ice sealing (the Soviet Union did not participate in 1989). The total catches taken in 1990 and 1991 were 6,292 and 6,695 animals respectively. Of these, only 26

(1990) and 500 (1991) were reported to be pups which were taken solely for scientific purposes. At the meeting it was indicated that of the 1,328 1-year-old and older animals reported by the Soviet Union in 1991, approximately 100 were in fact pups (beaters).

Available information on Norwegian and Soviet sealing effort directed at both hooded and harp seals is given in Appendix IV, Tables 3 and 4.

A summary of sealing regulations for the Greenland Sea for 1985 through 1991 is given in Appendix V, Table 1.

After a pilot survey in 1990, Norway carried out in 1991 a transect survey on harp seal pups using fixed-wing aircraft and shipborne helicopter during the West Ice breeding season. Both years tagging of harp seal pups was conducted during the surveys, tagging 3,006 pups in 1990 and 3,328 pups in 1991.

Norway continued sampling for studies on the age composition in catches of moulting harp seals in 1990 and 1991 (Anon., this meeting, SEA-29). The data have been utilized to update the mark-recapture estimates of pup production, and for stock assessment by simulation studies (Øien and Øritsland, this meeting, SEA-33; Ulltang, this meeting, SEA-28).

The Norwegian research also included studies of detoxification enzymes, and samples for studies of contamination in harp seals have been collected. Stock identity studies are performed using the same methods as in the Barents Sea.

Soviet research in the Greenland Sea in 1990-91 included aerial and shipboard surveys of distribution and abundance of harp seals (Anon., this meeting, SEA-35 and SEA-39).

In addition, the Soviet Union continued sampling of material for studies of age composition, reproduction, pelage type, condition and feeding from 780 and 1,500 harp seals in 1990 and 1991, respectively (Anon., this meeting, SEA-35 and SEA-39).

3.2.2 Distribution and stock identity

Results from tagging experiments in the Greenland and White Seas were presented by Øien and Øritsland (this meeting, SEA-33) and Timoshenko (this meeting, SEA-37). Harp seal pups tagged in whelping patches in the Greenland Sea during the period 1968-1991 ($n=16,917$), have been recovered in coastal waters of Norway, Iceland, East and West Greenland in addition to recaptures from catch operations in the Greenland Sea. Most of the seals recaptured outside the Greenland Sea area were immatures drowned in fishing gear or caught in Greenland. However, there have also been recaptures of

adult seals at Newfoundland (one) and in the White Sea (one), although both after the breeding season.

Provisional results of marking experiments (see 3.1.2.) suggest that Greenland Sea harp seals, at least immatures, may share feeding grounds with Northwest Atlantic harps at Greenland and with White Sea harps in Norwegian waters. So far the tagging experiments have shown no evidence of mixing at breeding grounds.

A study of genetic variation among Northeast Atlantic harp seals (Meisjord *et al.*, 1991) did not reveal significant differences between samples from the Greenland Sea and the Southeastern Barents Sea, although a sample collected at Jan Mayen in 1989 differed from all the others. The Working Group noted that a possible exchange of genes between Greenland and White Sea harp seals could not be excluded, and that the degree of mixing could not be quantified.

3.2.3 Biological parameters

Age data and biological material obtained from previous Norwegian catches have now been worked up and are available for analyses. Furthermore, the Soviet Union has collected material relevant to the study of biological parameters both in 1990 and 1991, and analyses of this material are now in progress.

No new estimates were available on natural mortality, age at maturity, and fertility rates for this stock. The Working Group, therefore, based its stock assessments on values of biological parameters adopted for the Newfoundland harp seal population.

3.2.4 Population size and pup production

Øien and Øritsland (this meeting, SEA-33) presented updated mark-recapture estimates for the period 1977-1990, and addressed questions posed at the previous Working Group meeting concerning the validity of the underlying assumptions. Age readings, population closure, tag loss, non-reporting of recoveries and non-random sampling were considered and direction of potential biases described. The authors concluded that estimates based on the accumulated data for a cohort may be seriously biased by violating the randomness assumptions. The Working Group discussed possible mechanisms behind the violations such as non-random placements of tags and inadequate mixing, but did not adopt a specific estimate. It noted, however, that the mark-recapture estimates for the 1977 and 1978 cohorts remained consistent and that the visual estimate discussed below was within the range of the mark-recapture estimates.

An estimate based on visual helicopter strip transects indicate a pup production of $50,500 \pm 16,000$ in the largest of four separate harp seal breeding patches recorded during the Norwegian West Ice survey in 1991 (Øritsland *et al.*, this meeting, SEA-23).

A second patch, covered by a Soviet shipboard transect survey, was estimated to contain 3,800 pups. The techniques used during this survey were not presented and data were not available to estimate the variance of this estimate. The other two breeding patches were roughly assessed to contain approximately 7 thousand and 12 thousand pups.

Three of the four breeding patches were also covered by aerial photographic surveys, and more precise estimates based on analyses of images from these surveys are expected to be available prior to the next meeting of the Working Group.

The new information from the Norwegian aerial surveys in 1991 and a review of mark-recapture estimates (Øien & Øritsland, this meeting, SEA-33) indicates that the 1989 assessment of the Greenland Sea harp seal stock underestimated present stock size and pup production. The 1989 assessment gave a pup production in 1991 of about 34,000 pups. In 1991, a visual survey estimate of the major breeding patch resulted in an estimate of $50,500 \pm 16,000$ pups. Taking into account that significant numbers of pups were also observed in the other breeding patches (indicating that total pup production could be of the order of 75,000 pups) the Working Group chose as an estimate of minimum pup production the point estimate of about 50,000 from the main breeding patch. It also chose to use a conservative value of natural mortality of $M = 0.11$, with natural mortality of age group 0 equal to $3M$ (0.33).

Utilizing the model given by Ulltang (1989a & b), stock and catch projections under these assumptions are shown for three alternative scenarios in the table below:

- a) no catch of pups;
- b) catch of pups only; and
- c) a ratio between pup catch and catch of 1-year-old and older seals approximately equal to the mean ratio during 1979-1988.

For all three scenarios, annual exploitation rates (catch/stock size) of pups (u_0) and older seals (u_{1+}) were selected to stabilize the population, although not necessarily at the 1991 level. Biological parameters other than natural mortality are unchanged from the 1989 assessment.

$$M = 0.11 \quad 1992 N_0 = 49,866 \quad N_{1+} = 231,914$$

Exploitation rates		Catches					
of Pups	of 1+	1992			Equilibrium		
u_0	u_{1+}	Pups	1+	Total	Pups	1+	Total
a) 0	0.046	0	10688	10688	0	10900	10900
b) 0.443	0	22091	0	22091	26000	0	26000
c) 0.225	0.025	11220	5798	17018	11800	5800	17600

As demonstrated in the 1989 report of the Working Group, a lower value of M (i.e. 0.10) would result in higher catches.

3.2.5 Management advice

The Working Group considers that the catches calculated above are reasonable minimum estimates of removal which would stabilize stock size. It did not try to calculate any "best" estimate since that should await the final analyses of the 1991 aerial survey data.

3.3 Harp Seal in the Northwest Atlantic (Newfoundland)

3.3.1 Catches, regulatory measures, and research

After the demise of the large vessel hunt in 1983, catches at Newfoundland declined rapidly from an annual average of 172,000 between 1978 and 1982 (Appendix IV, Table 6). After reaching a minimum of 19,035 in 1985, catches rose slightly. A peak of 94,046 was reached in 1988 although this may include an estimate for seals caught incidentally in fishing gear not included in other years. It was estimated that over 10,000 seals were caught along the west coast of Newfoundland in 1988. The average annual catch between 1983 and 1991 was 49,500.

Catches of harp seals in Greenland decreased from a level of about 20,000 in the early 1950s to about 6,000 in the late 1960s but increased again from the mid-1970s to a level of 14,000-19,000 in the early 1980s (Appendix IV, Table 9). For later years comparable figures for catches of harp seals in Greenland are not available (Kapel, this meeting, SEA-30).

The Royal Commission on Seals and Sealing in Canada (Anon., 1986) reviewed Canadian regulations pertaining to harp seals. A summary of the major management measures implemented are presented in Appendix V,

Table 3. Since 1988 large vessels (>19.8m) have been restricted from hunting, and commercial hunting of whitecoats has been banned. The current season for sealing by landmen is November 15 through May 15 of the following year.

Since 1985 biological samples have been collected for studies on harp seal age composition (4,306), feeding (3,210), reproductive parameters (825 females, 646 males) and morphometrics. Samples were collected by research personnel and through a program utilizing land-based collectors consisting of sealers and fishermen. Studies were also carried out to determine the optimum techniques for photographic surveys of harp seals. Work currently underway includes analyzing biological samples, monitoring incidental catches of seals in fishing gear, and updating a population model for harp seals in the Northwest Atlantic.

Surveys designed to estimate pup production of harp seals in the Northwest Atlantic were conducted during February-March 1990. The techniques used were presented to the Working Group. Reconnaissance and systematic aerial surveys were flown off the coast of Newfoundland (the 'Front') and in the Gulf of St. Lawrence. Pup production was estimated for three whelping concentrations at the Front using visual survey techniques. Photographic survey techniques were used to obtain estimates of production for two patches in the Gulf and for total production (including pups born outside of the concentrations) at the Front. Visual surveys were flown at an altitude of 46 m with a strip width of 30 m. Photographic imagery were obtained in the visible (conventional black and white) and ultra-violet spectrums at an altitude of 300 m. Individual frames of each film type were matched and used to correct film counts for missed or mis-identified pups. In 4 of the 5 patches, the proportion of pups in age-dependent developmental stages were determined by random cluster samples obtained at ice level. This information was used to correct the estimates for pups which were not present on the ice during the surveys.

Studies on harp seal feeding in Greenland have been continued (Angantyr and Kapel, 1991).

3.3.2 Distribution and stock identity

No information was presented to the Working Group on the distribution of harp seals in the Northwest Atlantic. New information on the relationship with stocks in the Northeast Atlantic is presented in 3.2.2.

3.3.3 Biological parameters

No data on biological parameters were presented to the Working Group. However, the Group was informed of studies underway to estimate reproductive parameters and mortality rates. Analyses of the data should be completed prior to the next meeting of the Working Group.

3.3.4 Other scientific information

It is expected that the results of recent harp seal surveys will be available to the Working Group at the next meeting.

3.4 Hooded Seal (*Cystophora cristata*) in the Greenland Sea (Jan Mayen)

3.4.1 Catches, regulatory measures and research

Norwegian and Soviet catches of hooded seals in the Greenland Sea 1946-1991 are listed in Appendix IV, Table 3. After a stop in the 1989 season, the Soviet Union again participated in the hooded seal hunt in the Greenland Sea in 1990 and 1991 when, respectively, a total of 1,236 and 2,542 animals were taken. These numbers are considerably higher than in the 1989 season (181), but considerably lower than during the 1986-1988 period when an average of 8,531 animals per year was taken. In 1990 and 1991 pups were taken only for scientific purposes (26 and 458, respectively).

Available information on Norwegian and Soviet sealing effort directed at hooded and harp seals are given in Appendix IV, Tables 3 and 4.

A summary of sealing regulations for the Greenland Sea for 1985 to 1991 is given in Appendix V, Table 1.

Norway has conducted studies of biochemical genetic variation in tissue enzymes of hooded seals (Sundt, this meeting, SEA-26), using samples from the Jan Mayen area and off Newfoundland. The Norwegian research

also included studies of detoxification enzymes, and samples for studies of contaminants have been collected.

As for harp seals, studies of the feasibility of using satellite tracking have been initiated and will continue (Folkow and Blix, this meeting, SEA-24). A study of distribution of hooded seals in Svalbard waters have been conducted (Giertz, this meeting, SEA-25).

Soviet research on hooded seal in the Greenland Sea included sampling of material for studies of age composition, reproduction, moulting and condition of about 800 and 2,000 specimens in 1990 and 1991, respectively (Anon., this meeting, SEA-35 and SEA-39)

As an item for future research on hooded seals, the Soviet scientists suggested a joint expedition to the Denmark Strait - Greenland Sea area in May-August 1992. In the absence of detailed information on the purpose, timing and operation area, other members of the Working Group were unable to evaluate the importance of such an international expedition at this meeting. It was suggested that the Soviet scientists could distribute a detailed project plan to other members, who would then comment on the proposal.

In March-June 1991, the Soviet Union carried out aerial and shipboard surveys of distribution of hooded seal in the Greenland Sea (Anon., this meeting, SEA-35).

3.4.2 Stock identity, distribution and migrations

The Working Group reviewed new information on recaptures of hooded seals tagged at the West Ice, the Denmark Strait, the Davis Strait and Newfoundland (Øien and Øritsland, this meeting, SEA-33; Kapel, this meeting, SEA-41). Recaptures of seals tagged as pups at Newfoundland and in the Davis Strait continue to appear in both West and East Greenland. There are, however, still no recaptures in Greenland of pups tagged at Jan Mayen. In a Soviet report of research activities in 1991 (Anon., this meeting, SEA-35), the Working Group was informed of a recapture in the Greenland Sea in June 1991 of a hooded seal reported to be tagged in Canadian waters.

From the taggings in the West Ice (Øien and Øritsland, this meeting, SEA-33) recoveries on the coast of Norway and north and southeast of Iceland confirm that young seals may disperse over large areas in their first years of life. Pilot studies of satellite tracking of hooded seals were performed in the West Ice in 1989 and 1990 (Folkow and Blix, this meeting, SEA-24). Although technical problems were met with and data were only obtained for short periods of time, the results gave clear indications that satellite tracking has the potential for giving information on the seasonal distribution and

movements, and possibly behaviour, of hooded seals. The observed migrations confirm previous information gained from traditional tagging in the same area.

A review of historical data (log-books etc.) demonstrated the summer distribution of hooded seals in the Svalbard area (Giertz, this meeting, SEA-25).

Biochemical genetic studies of hooded seal population structure in the North Atlantic are being conducted (Sundt, this meeting, SEA-26). No significant difference in allele frequencies between samples from Jan Mayen and Newfoundland has been demonstrated to date.

3.4.3 Biological parameters

No new estimate of biological parameters is available. However, all available samples collected by Norway in the Greenland Sea and the Denmark Strait in previous years are being worked up and will be ready for more detailed analyses during the forthcoming winter. Furthermore, Soviet scientists have collected biological material (including material for studies of reproduction) from 2,000 hooded seals in 1990 and 1991. Analyses of this material are now in progress.

3.4.4 Population size and pup production

Results from incomplete Soviet aerial surveys of hooded seal breeding patches in 1986 and 1987 and of moulting patches in 1988, were reported by Potelov (this meeting, SEA-40). However, the information provided was not sufficiently detailed to permit an evaluation of these results, and the Working Group was unable to comment on their validity.

There was no estimate of current pup production and stock size upon which to base a population assessment.

3.4.5 Management advice

For the reasons given in the previous section, the Working Group was unable to provide scientific advice on catch levels for the 1992 season.

3.5 Hooded Seal in the Northwest Atlantic (Newfoundland and Davis Strait)

3.5.1 Catches, regulatory measures, and research

Commercial hunting of hooded seals at the Front was reported as early as 1874. In early years there was little

distinction made between hooded and harp seals and they were hunted together. Following the shift to hunting for fur in the 1940s, the blueback became the most valuable of all the hair seal furs and hunting effort was increased. Before the implementation of quotas in 1974, catches varied greatly and ranged from less than 1,000 to over 25,000 animals per year (Appendix IV, Table 6). From 1974 through 1982, the average catch was 12,800 animals, mainly pups. Since then, larger proportions of older animals have been taken. From 1983 through 1990 catches varied greatly, ranging from 33 to 1,855 and averaging 663. The differences in annual catches were likely due to variability in the availability of hooded seals to the land-based hunters. For example, the large catch in 1987 followed a period of strong on-shore winds. This occurred again in 1991 when strong on-shore winds brought heavy pack-ice close to the coast of Newfoundland, and an estimated 11,925 hooded seals were caught.

In the Davis Strait breeding patch, catches have never been taken, apart from a scientific sampling program in 1984 (included in Appendix IV, Table 6).

In Greenland, catches of hooded seals decreased during the first half of the 20th century (to a level of 900-1,500 in the late 1950s) but began to increase in the early 1960s, reaching a level of about 6,000 in the early 1980s (Appendix IV, Table 8). On the validity of recent statistics for catches in Greenland, see 3.3.1 and Kapel (this meeting, SEA-30).

In the Denmark Strait moulting patch, Norwegian commercial sealing was terminated in 1960, after which only minor catches of hooded seals were taken by a Greenlandic vessel 1961-1967 (total 4,777 seals). Scientific catches by Norway occurred every second year between 1970 and 1978 (total 4,391 seals).

The Royal Commission on Seals and Sealing in Canada (Anon., 1986) reviewed Canadian regulations pertaining to hooded seals. A summary of the major management measures is presented in Appendix V, Table 3. Since 1988 large vessels (> 19.8m) have been restricted from hunting, and commercial hunting of bluebacks has been banned. The current season for sealing by landsmen is November 15 through May 15 of the following year.

Biological sampling of hooded seals in Canadian waters is described in 3.3.1. In addition, studies have been carried out to refine methods of determining age-dependent stage classifications of bluebacks, and to determine the migratory and diving patterns of free-ranging seals.

In March 1990, reconnaissance and systematic aerial surveys were flown in the Gulf of St. Lawrence and off the coast of Newfoundland-Labrador (the 'Front') to determine pup production of hooded seals in the Northwest Atlantic. Production was estimated for two whelp-

ing concentrations at the Front and one in the Gulf using photographic and/or visual survey techniques. An estimate of pup production outside of the whelping patches at the Front was obtained using low-density coverage photographic transects. The photographic techniques used are described in 3.3.1. Data on the proportion of pups in three age-dependent developmental stages (Bowen *et al.*, 1987, Stenson and Myers, 1988) obtained during the visual transects were used to correct the estimates for pups which were not present during the surveys of the whelping concentrations at the Front.

In 1991, visual survey techniques were used to obtain a second estimate of pup production of hooded seals in the Gulf of St. Lawrence. Data for correcting this estimate for the distribution of births were obtained.

3.5.2 Stock identity, distribution and migration

The Working Group was informed about satellite tracking studies being conducted in the Northwest Atlantic. On March 1991 three satellite linked time-depth-recorders were deployed on hooded seals in the Gulf of St. Lawrence. Two of the transmitters ceased transmitting shortly after deployment. The third, attached to an adult male captured on the whelping patch, continued to transmit for three months. During this period the animal migrated from the Gulf of St. Lawrence to southern Greenland. This pattern of movement is consistent with traditional tagging studies indicating that hooded seals from the Gulf move to the Denmark Strait for moulting.

3.5.3 Biological parameters

No new information on biological parameters were presented to the Working Group. The Group was informed of a current study on reproductive parameters.

3.5.4 Other scientific information

It is expected that the results of recent hooded seal surveys will be available to the Working Group at the next meeting.

4 ECOLOGY OF THE SEAL STOCKS

4.1 Feeding Biology and Energetics of Harp and Hooded Seals

Norway presented preliminary data on the diet of harp seals in the Barents Sea, during the period from late March through September (Nilssen *et al.*, 1991 b;

Nilssen and Haug, this meeting, SEA-32). From examinations of stomach samples, it appears that the harp seals sampled had not been feeding either in March/April or in the first half of June. Concurrent estimates of prey abundance using trawl gear in the areas where seals were captured in June, revealed virtually no presence of potential prey in the water column, whereas prawns (*Pandalus borealis*), capelin (*Mallotus villosus*) and polar cod (*Boreogadus saida*) were abundant in considerable amounts along the bottom. During investigations in September, trawling revealed large amounts of the amphipod *Parathemisto libellula* in the upper layers of the water column in the areas where harp seals occurred and were captured for stomach examinations. The fish fauna, mainly capelin and polar cod, was poor and occurred mainly along the bottom. In this period the seals were clearly feeding. They were very fat (contrary to the June seals which were very lean) and *P. libellula* was the prey item found most often in the seal stomachs. This amphipod also constituted most of the biomass of the harp seal diet in this period.

Norway also presented results from stomach analyses of invading harp seals taken as by-catch in gill nets on the coast of Norway during winter in 1986-1988 (Haug *et al.*, 1991, Nilssen *et al.*, 1991a). These results indicated opportunistic feeding on a variety of fish (in particular the gadoid species cod (*Gadus morhua*), saithe (*Pollachius virens*), haddock (*Melanogrammus aeglefinus*) and Norway pout (*Trisopterus esmarki*) and the pelagic shoaling species herring (*Clupea harengus*) and capelin.

The Soviet Union reported unpublished studies of stomach analyses of seals taken in the Greenland Sea: After moulting harp seals were stated to feed on *P. libellula* and krill (*Thysanoessa sp*) while hooded seals fed on the squid *Gonatus fabricii* in the period between breeding and moulting (April-May).

Canada presented results from a study using satellite-linked time-depth-recorders to determine movements and dive patterns of hooded seals (see 3.5.2). Preliminary results from a single adult male indicated that hooded seals are capable of diving to depths greater than 450 m and can remain underwater for more than 25 min. They also suggested that hooded seals may move great distances in short periods of time, for example travelling from eastern Newfoundland to Southern Greenland in two weeks or less.

A study of the diet of hooded seals in the Northwest Atlantic (Stenson *et al.*, this meeting, SEA-34) indicated that Greenland halibut (*Reinhardtius hippoglossoides*) was the most frequently occurring prey species in the 89 stomachs which contained food. Other commonly occurring prey included polar cod (*Boreogadus saida*), capelin, squid, herring and redfish (*Sebastes spp.*).

4.2 Possible Changes in Food Supply

There was no information on changes in food supply for harp and hooded seals presented at the meeting.

4.3 Possible Interactions between Seal Stocks, Other Marine Resources, and Man.

Studies of the effect of invading harp seals on local coastal fish stocks in North Norway suggest that in the presence of large numbers of seals, certain commercial fish species, such as cod, may change behaviour and disappear from the traditional fishing grounds (Nilssen *et al.*, 1991b). Harp seals were also observed to eat fish entangled in nets, and were reported to cause considerable damage to gill net catches by eating parts (usually the soft ventral parts) of the fish.

Basic information on the energy requirements, food selection, and distribution of harp seal are now being collected from many areas. For the time being, however, these investigations are in an early phase and have not yet provided sufficient data to determine the effect of seals on fish stocks or fisheries.

Although many of the prey species taken by hooded seals are commercially important, the extent of possible interactions between hooded seals and commercial fisheries could not be determined due to a lack of information concerning seal distributions and food requirements.

5 FUTURE RESEARCH

The Working Group discussed and identified research priorities and recommends that:

- 1) comprehensive aerial surveys, including associated stage determinations and visual surveys, should be conducted periodically to provide estimates of current pup production for harp and hooded seals;
- 2) further detailed information on design and techniques used for aerial surveys of harp seals in the White Sea should be made available to the Working Group;
- 3) tagging of harp seals in the White and Barents Seas should be continued, and mark-recapture studies, included testing of the underlying assumptions, should be conducted to provide independent estimates of pup production;
- 4) in order to develop a pup production estimate from the mark-recapture experiments, sampling

in harp seal moulting patches in the White and Barents Seas should be continued to determine age and sex composition of commercial catches. Efforts should be made to obtain random samples for age composition of the total population;

- 5) radio- and/or satellite tagging experiments should be continued to provide information on movements and bioenergetics of individual seals;
- 6) all possible methods should be utilized to determine stock identity of all stocks of harp and hooded seals;
- 7) all available age composition data and biological samples should be analysed and presented to the Working Group to allow assessment of biological parameters;
- 8) sampling of stomach contents for harp and hooded seals with concurrent estimates of possible prey abundance should be continued, particularly outside the whelping and moulting seasons;
- 9) studies of food consumption rates and energy requirements of seals under experimental conditions and/or in the field should be encouraged in order to improve the basis for modelling possible interactions between seals and other marine resources.

6 FUTURE ACTIVITIES OF THE WORKING GROUP

The Working Group noted again that it would be difficult to make thorough assessments of all stocks of harp and hooded seals at a five days meeting, and discussed ways of making its work more efficient. Among these are the possibility of requiring key assessment papers to be circulated well in advance of next meeting, and/or give priority to the stocks for which new analyses are available and could be successfully assessed.

Considering the importance of aerial surveys for assessing present pup production and stock size of harp and hooded seals, and noting the difficulties faced at this meeting in comparing and interpreting results from previous surveys, the Working Group recommends that:

a Special Working Group Meeting on methodology of aerial surveys be held in the third week of September 1992, and acknowledges the offer by the Soviet Union to convene this meeting in Archangelsk.

APPENDIX I

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APPENDIX II

AGENDA

1. Chairman's welcome and opening remarks.
2. Meeting arrangements:
 - 2.1. Meeting schedule and practical information.
 - 2.2. Appointment of rapporteur(s).
 - 2.3. Adoption of the Agenda.
 - 2.4. Review of documentation.
3. Status of stocks of harp and hooded seals:
 - 3.1. Harp seal (*Phoca groenlandica*) in the White Sea and Barents Sea ("Østisen").
 - 3.1.1. Catch and effort; current regulatory measures; research and data processing: Updating available information.
 - 3.1.2. Stock identity, distribution and migrations.
 - 3.1.3. Biological parameters.
 - 3.1.4. Population assessment.
 - 3.1.5. Management advice.
 - 3.2. Harp seal in the Greenland Sea (Jan Mayen, "Vestisen").
 - 3.2.1.-3.2.5. Subitems as for 3.1.
 - 3.3. Harp seal in the Northwest Atlantic (Newfoundland).
 - 3.3.1.-3.3.3. as for 3.1.
 - 3.3.4. Other scientific information.
 - 3.4. Hooded seal (*Cystophora cristata*) in the Greenland Sea (Jan Mayen, "Vestisen").
 - 3.4.1.-3.4.5. as for 3.1.
 - 3.5. Hooded seal in the Northwest Atlantic (Newfoundland and Davis Strait).
 - 3.5.1.-3.5.3. as for 3.1.
 - 3.5.4. Other scientific information.
4. Ecology of the seal stocks.
 - 4.1. Feeding biology and energetics of seals.
 - 4.2. Possible changes in food supply.
 - 4.3. Possible interactions between seal stocks, other marine resources, and man.
5. Future research needs.
6. Future activities of the Working Group.
7. Recommendations.
8. Other business.
9. Adoption of report.

APPENDIX III

REFERENCES

I. Working Documents Presented at the Meeting

- SEA-21 Timoshenko, Yu.K.: A method of aerial survey of harp seal breeding grounds in the White Sea.
- SEA-22 Anon.: Catches of harp and hooded seals in the Northeast Atlantic (Updated 19 Aug. 1991, Inst. Mar. Res., Bergen).
- SEA-23 Øritsland, T., Fagerheim, K.A. and Øien, N.: West Ice seal survey and tagging in 1991.
- SEA-24 Folkow, L.P. and Blix, A.S.: Satellite tracking of harp and hooded seals.
- SEA-25 Gjertz, I.: Distribution of hooded seals in Svalbard waters.
- SEA-26 Sundt, R.: Studies of biochemical genetic polymorphism in the hooded seal.
- SEA-27 Ulltang, Ø.: Simulations of development in stock size and pup production for harp seals in the Barents and White Seas ("East Ice"), 1967-1991, and corresponding stock projections.
- SEA-28 Ulltang, Ø.: Simulations of development in stock size and pup production for harp seals in the Greenland Sea ("West Ice") 1946-1991, and corresponding stock projections.
- SEA-29 Anon.: Age distributions in Norwegian catches of moulting harp seals in the Northeast Atlantic, updated to 1991 (Compiled by Inst. Mar. Res., Bergen).
- SEA-30 Kapel, F.O.: The decline and fall of the "Lists of Game"? - a note on the Greenland catch statistics for harp and hooded seals.
- SEA-31 Stenson, G. and Perry, E. A.: Catches of harp and hooded seals in the Northwest Atlantic (Canadian waters).
- SEA-32 Nilssen, K. T. and Haug, T.: Preliminary results from harp seal investigations in the Barents Sea 1991.
- SEA-33 Øien, N. and Øritsland, T.: Recaptures of harp seals (Phoca groenlandica) tagged as pups in the Greenland Sea. Pup production and dispersion patterns, with Addendum: Recaptures of hooded seals tagged in the Greenland Sea and of harp seals tagged in the White Sea.
- SEA-34 Stenson, G. B., Ni, I-H., Ross, S. A. and McKinnon, D.: Hooded seal, Cystophora cristata, feeding and interactions with commercial fisheries in Newfoundland.

- SEA-35 Anon.: Research and sealing activity in the North-East Atlantic, 1991. Report compiled by PINRO, Archangelsk, to the 20th session of the Joint Soviet-Norwegian Fishery Commission.
- SEA-36 Girshovich, E. S.: Utilization of meat raw material of White Sea population of Greenland Seals for creation medical preparations and reagents.
- SEA-37 Timoshenko, Y.K.: Harp seal tagging in the White Sea.
- SEA-38 Osipova, V.A. , Timoshenko, Y.K. , Churkina, M.G.: Marine mammals mortality in May-June, 1990 in the Duinsky Bay of the White Sea.
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APPENDIX IV

CATCHES OF HARP AND HOODED SEALS
INCLUDING CATCHES TAKEN ACCORDING TO SCIENTIFIC PERMITS

Table 1. Catches of hooded seals in the Greenland Sea ("West Ice"), 1946-1991, incl. catches for scientific purposes.

Year	Norwegian catches			Soviet catches			Total catches		
	pups	1 year and older	total	pups	1 year and older	total	pups	1 year and older	total
1946	8482	3083	11565	-	-	-	8482	3083	11565
1947	26059	12535	38594	-	-	-	26059	12535	38594
1948	23392	9371	32763	-	-	-	23392	9371	32763
1949	48698	7728	56426	-	-	-	48698	7728	56426
1950	49130	18568	67698	-	-	-	49130	18568	67698
1951	47487	35893	83380	-	-	-	47487	35893	83380
1952	18098	21864	39962	-	-	-	18098	21864	39962
1953	21864	4160	26024	-	-	-	21864	4160	26024
1954	53321	12680	66001	-	-	-	53321	12680	66001
1955	45266	11511	56777	+	+	a)	45266+	11511+	56777+
1956	31564	9224	40788	+	+	a)	31564+	9224+	40788+
1957	13238	8951	22189	+	+	a)	13238+	8951+	22189+
1958	38636	19906	58542	2861	3428	6289	41497	23334	64831
1959	22682	4536	27218	623	1246	1869	23305	5782	29087
1960	27572	5389	32961	641	642	1283	28213	6031	34244
1961	43681	29601	73282	3569	2169	5738	47250	31770	79020
1962	27183	18498	45681	2239	4900	7139	29422	23398	52820
1963	17958	4463	22421	2333	2993	5326	20291	7456	27747
1964	21987	6972	28959	1943	2435	4378	23930	9407	33337
1965	28154	10838	38992	633	1474	2107	28787	12312	41099
1966	33214	6762	39976	802	310	1112	34016	7072	41088
1967	21390	20351	41741	-	-	-	21390	20351	41741
1968	11795	2168	13963	-	-	-	11795	2168	13963
1969	15870	7057	22927	-	-	-	15870	7057	22927
1970	25208	12507	37715	-	-	-	25208	12507	37715
1971	19572	10678	30250	-	-	-	19572	10678	30250
1972	16052	4164	20216	-	-	-	16052	4164	20216
1973	22455	3994	26449	-	-	-	22455	3994	26449
1974	16595	9800	26395	-	-	-	16595	9800	26395
1975	18273	7683	25956	632	607	1239	18905	8290	27195
1976	4632	2271	6903	199	194	393	4831	2465	7296
1977	11626	3744	15370	2572	891	3463	14198	4635	18833
1978	13899	2144	16043	2457	536	2993	16356	2680	19036
1979	16147	4115	20262	2064	1219	3283	18211	5334	23545
1980	8375	1393	9768	1066	399	1465	9441	1792	11233
1981	10569	1169	11738	167	169	336	10736	1338	12074
1982	11069	2382	13451	1524	862	2386	12593	3244	15837
1983	0	86	86	419	107	526	419	193	612
1984	99	483	582	-	-	-	99	483	582
1985	254	84	338	1632	149	1781	1886	233	2119
1986	2738	161	2899	1072	799	1871	3810	960	4770
1987	6221	1573	7794	2890	953	3843	9111	2526	11637
1988	4873	1276	6149 ^{b)}	2162	876	3038	7035	2152	9187
1989	34	147	181	-	-	-	34	147	181
1990	26	397	423	0	813	813	26	1210	1236
1991	0	352	352	458	1732	2190	458	2084	2542

a) For 1955, 1956 and 1957 the USSR reports catches of hooded and harp seals at about 3900, 11600 and 12900, respectively. (Sov. Rep. 1975). These catches are not included.

b) including 1048 pups and 435 adults caught by one ship which was lost.

Table 2. Catches of harp seals in the Greenland Sea ("West Ice"), 1946-1991, including catches for scientific purposes.

Year	Norwegian catches			Soviet catches			Total catches		
	pups	1 year and older	total	pups	1 year and older	total	pups	1 year and older	total
1946	14795	1411	16206	-	-	-	14795	1411	16206
1947	28909	7534	36443	-	-	-	28909	7534	36443
1948	36076	23725	59801	-	-	-	26076	23725	59801
1949	29361	5168	34529	-	-	-	29361	5168	34529
1950	23887	9484	33371	-	-	-	23887	9484	33371
1951	39922	12851	52773	-	-	-	39922	12851	52773
1952	37348	7388	44736	-	-	-	37348	7388	44736
1953	27346	6550	33896	-	-	-	27346	6550	33896
1954	23845	5271	29116	-	-	-	23845	5271	29116
1955	23862	13564	37426	+	+	+a)	23862+	13564+	37426+
1956	8983	6894	15877	+	+	+a)	8983+	6894+	15877+
1957	4847	11801	16648	+	+	+a)	4847+	11801+	16648+
1958	24372	7713	32085	1384	445	1829	25756	8158	33914
1959	27812	2901	30713	3527	3264	6791	31339	6165	37504
1960	28421	1544	29965	831	2377	3208	29252	3921	33173
1961	16487	2755	19242	3532	4563	8095	20019	7318	27337
1962	25738	3126	28864	1636	788	2424	27374	3914	31288
1963	11808	3045	14853	1137	840	1977	12945	3885	16830
1964	2908	3060	5968	2763	1720	4483	5671	4780	10451
1965	20445	3727	24172	4693	1580	6273	25138	5307	30445
1966	23814	2210	26024	6	236	242	23820	2446	26266
1967	19708	1450	21158	-	-	-	19708	1450	21158
1968	20227	1103	21330	-	-	-	20227	1103	21330
1969	3992	1694	5686	-	-	-	3992	1694	5686
1970	16346	1750	18096	-	-	-	16346	1750	18096
1971	11149	0	11149	-	-	-	11149	0	11149
1972	15100	82	15182	-	-	-	15100	82	15182
1973	11858	0	11858	-	-	-	11858	0	11858
1974	14628	74	14702	-	-	-	14628	74	14702
1975	3742	1080	4822	239	0	239	3981	1080	5061
1976	7019	5249	12268	253	34	287	7272	5283	12555
1977	13305	1541	14846	2000	252	2252	15305	1793	17098
1978	14424	57	14481	2000	0	2000	16424	57	16481
1979	11947	889	12836	2424	0	2424	14371	889	15260
1980	2336	7647	9983	3000	539	3539	5336	8186	13522
1981	8932	2850	11782	3693	0	3693	12625	2850	15475
1982	6602	3090	9692	1961	243	2204	8563	3333	11896
1983	742	2576	3318	4263	0	4263	5005	2576	7581
1984	199	1779	1978	-	-	-	199	1779	1978
1985	532	25	557	3	6	9	535	31	566
1986	15	6	21	4490	250	4740	4505	256	4761
1987	7961	3483	11444	-	3300	3300	7961	6783	14744
1988	4493	5170	9663 ^{b)}	7000	500	7500	11493	5670	17163
1989	37	4392	4429	-	-	-	37	4392	4429
1990	26	5482	5508	0	784	784	26	6266	6292
1991	0	4867	4867	500	1328	1828	500	6195	6695

a) For 1955, 1956 and 1957 Soviet reports catches of harp and hooded seals at 3900, 11600 and 12900, respectively (Sov. Rep. 1975). These catches are not included.

b) including 1431 pups and one adult caught by one ship which was lost.

Table 3. Norwegian sealing effort in the Greenland Sea ("West Ice") 1946-1991.

Year	Number of trips/boats		Crew number		Average duration of trips (days)	Average tonnage		Average Horse-power
	Total	Average	Total	Average		Gross	Net	
1946	16		247	15	47	116	44	151
1947	33		574	17	39	122	43	206
1948	51		788	16	46	118	42	199
1949	44		689	16	45	119	41	206
1950	41		642	16	39	118	41	215
1951	56		922	17	40	129	49	250
1952	48		803	17	42	136	48	273
1953	38		657	17	45	152	52	309
1954	40		675	17	36	144	49	282
1955	45		744	17	37	137	47	271
1956	43		708	16	49	140	48	287
1957	40		662	17	48	142	48	301
1958	42		685	16	47	137	46	295
1959	45		736	16	55	134	46	264
1960	44		719	16	51	132	46	263
1961	40		646	16	37	137	47	302
1962	42		683	16	45	135	46	302
1963	43		714	17	53	139	49	320
1964	36		599	16	52	144	48	356
1965	38		617	16	49	144	50	407
1966	31		498	16	44	140	48	417
1967	25		404	16	38	146	49	484
1968	23		343	15	42	162	55	553
1969	20		316	16	49	157	52	519
1970	19		290	15	38	156	58	528
1971	18		242	13	23	154	51	548
1972	20		256	13	42	165	56	551
1973	16		202	13	37	164	55	526
1974	16		200	13	42	163	55	561
1975	15		188	12	39	163	54	573
1976	15		188	13	51	174	61	650
1977	13		156	12	43	174	61	642
1978	11		132	12	42	198	73	773
1979	10		130	13	46	224	84	910
1980	9		115	13	52	266	107	1034
1981	7		91	13	52	281	119	1070
1982	6		84	14	36	334	134	1348
1983	2		.	(10)	39	352	144	1325
1984	2		.	(10)	41	237	86	970
1985	1		11	11	37	178	72	940
1986	2		.	.	.	.	.	.
1987	5		.	.	.	.	.	.
1988	7(6) ^a		.	.	.	.	.	.
1989	3		.	.	.	.	.	.
1990	3		41	14	.	.	.	.
1991	2		26	13	.	.	.	.

Note: ^{a)} one ship lost

Table 4. Soviet sealing effort in the Greenland Sea ("West Ice"), 1958-1991¹.

Year	Number of vessels	Average crew number	Average duration of trips (days)	Average tonnage		Horse-power
				Gross	Netdl	
1958	7	23	.	140	2)	
1959	7	23	.	200		
1960	5	23	22	200		
"	2	23	42	200		
1961	7(8) 3)	23	42	200		
1962	6(7)	23	46	200		
1963	7(8)	23	47	200		
1964	7(8)	23	46	200		
1965	7	23	46	200		
1966	4	23	46	200		
... 4)						
1975	1	.	45	.		
1976	2	.	24	.		
1977	3	68	16	1.971	597	3.300
1978	3	.	22	.		
1979	2	.	24	.		
1980	2	.	21	.		
1981	2	.	17	.		
1982	2	.	22	.		
1983	2	.	.	.		
1984	-	-	-	-		
1985	2	.	16	.		
1986	2	.	(11)	.		
1987	2	.	(23)	.		
1988	3	.	.	.		
1989	-	-	-	-		
1990	.	.	.	.
1991	.	.	.	.

- Notes: 1) Information extracted from the Soviet reports to the Norwegian Soviet Sealing Commission.
 2) Most probably an error for 200.
 3) The numbers in parentheses include one vessel operating as support and repair ship.
 4) Soviet vessels did not participate in the hunt 1967-1974.

Table 5. Catches of harp seals in the White and Barents Seas ("East Ice"), 1946-1991.

Year	Norwegian catches a)			Soviet catches			Total catches		
	pups	1 year and older	total	pups	1 year and older	total	pups	1 year and older	total
1946			10935	47983	26156	74139			85074
1947			27543	123270	31085	154355			181898
1948			29765	72041	65799	137840			167605
1949			30678	108017	65460	173477			204155
1950			26366	98844	87924	186768			213134
1951			35371	76087	105406	181493			216864
1952			19418	65973	53251	119224			138642
1953	710	11734	12444	34873	42765	77638	35583	54499	90082
1954	835	10813	11648	70664	79765	150429	71499	90578	162077
1955	-	19068	19068	48353	46127	94470	48353	65195	113538
1956	3775	21380	22183	36200	29125	65325	39975	50505	87508
1957	151	22183	22334	64691	39185	103876	64842	61368	126210
1958	2733	12396	15129	84395	27997	112992	87128	40393	128121
1959	2257	6286	8543	48257	47982	96239	50514	54268	104782
1960	2474	8222	10694	60579	28736	89315	63053	36958	100009
1961	2903	8254	11157	41827	51676	93503	44730	59930	104660
1962	1325	6981	8306	67633	39327	106960	68958	46308	115266
1963	405	12944	13349	54861	7603	62464	55266	20547	75813
1964	3109	11477	14556	47008	15771	62779	50117	27248	77335
1965	4537	1899	6436	20135	0	20135	24672	1899	26571
1966	1932	10319	12251	20012	196	20208	21944	10515	32459
1967	9648	2004	11652	20000	0	20000	29648	2004	31652
1968	11960	3150	15110	20000	0	20000	31960	3150	35110
1969			11938	21588	593	22181			34119
1970			12964	24328	1262	25590			38554
1971	7028	1596	8624	26666	1002	27668	33694	2598	36292
1972	4229	8209	12438	30635	500	31135	34864	8709	43573
1973	5657	6661	12318	29950	813	30763	35607	7474	43081
1974	2323	5054	7377	29006	500	29506	31329	5554	36883
1975	2255	8692	10947	29000	500	29500	31255	9192	40447
1976	6742	6375	13117	29050	498	29548	35792	6873	42665
1977	3429	2783	6212 ^{b)}	34007	1488	35495	37436	4271	41707
1978	1693	3109	4802	30548	994	31542	32241	4103	36344
1979	1326	12205	13531	34000	1000	35000	35326	13205	48531
1980	13894	1308	15202 ^{c)}	34500	2000	36500	48394	3308	51702
1981	2304	15161	17465 ^{c)}	39700	3866	43566	42004	19027	61031
1982	6090	11366	17456	48504	10000	58504	54594	21366	75960
1983	431	17658	18089	54000	10000	64000	54431	27658	82089
1984	2091	6785	8876	58153	6942	65095	60244	13727	73971
1985	348	18659	19007	52000	9043	61043	52348	27702	80050
1986	12859	6158	19017	53000	8132	61132	65859	14290	80149
1987	12	18988	19000	42400	3397	45797	42412	22385	64797
1988	18	16580	16598	51990	2501	54401	51918	19081	70999
1989	0	9413	9413	30989	2475	33464	30989	11888	42877
1990	0	9522	9522	30500	1957	32457	30500	11479	41979
1991	0	9500	9500	30500	1980	32480	30500	11480	41980

a) Incidental catches of harp seals in fishing gear on Norwegian and Murman coasts are not included (see Table 6).

b) Approx. 1300 harp seals (unspecified age) caught by one ship lost are not included.

c) An additional 250-300 animals were shot but lost as they drifted into Soviet territorial waters.

Table 6. Incidental catches and death of harp seals at the Norwegian and Murman coasts . Norwegian data are recorded catches, since 1991 recorded for compensation under regulations for damage to fishing gear.

Year	Norwegian coast	Murman coast	Total
1978	.	.	.
1979	2023	1114	3137
1980	3311		
1981	2013		
1982	517		
1983	855		
1984	1236		
1985	1225		
1986	4409		
1987	56222		
1988	21538		
1989	314		
1990	368		
1991	-		

Table 7. Catches of moulting hooded seals in the Denmark Strait, 1945-1978.

Year	Norway, sealing	Greenland, sealing ^a	Norway, scient. sampling
1945	3,275	-	-
1946	17,767	-	-
1947	16,080	-	-
1948	16,170	-	-
1949	1,494	-	-
1950	17,742	-	-
1951	47,607	-	-
1952	16,910	-	-
1953	2,907	-	-
1954	18,292	-	-
1955	10,230	-	-
1956	12,840	-	-
1957	21,425	-	-
1958	14,950	-	-
1959	6,480	414	-
1960	7,930	0 ^b	-
1961	-	773	-
1962	-	967	-
1963	-	813	-
1964	-	360	-
1965	-	-	-
1966	-	782	-
1967	-	358	-
1968	-	-	-
1969	-	-	-
1970	-	-	797
1971	-	-	-
1972	-	-	869
1973	-	-	-
1974	-	-	1,201
1975	-	-	-
1976	-	-	323
1977	-	-	-
1978	-	-	1.201

^a Performed by KGH (Royal Greenland Trade Department) on behalf of the local inhabitants of Ammassalik, Southeast Greenland.

^b The vessel was lost 23 June on its first trip that year; previous information on a catch of 773 seals is thus in error (probably confused with 1961-catch).

Table 8. Catches of hooded seals in West and East Greenland, 1954-1987.

Year	West Greenland			East Greenland				Total Greenland
	N	NW-S	Total	SE	KGH ^c	NE	TOTAL	
1954	-	1,097	1,097	201	-	-	201	1,298
1955	1	971	972	343	-	1	344	1,316
1956	-	593	593	261	-	3	264	857
1957	5	792	797	410	-	2	412	1,209
1958	-	846	846	361	-	4	365	1,211
1959	2	778	780	312	414	8	734	1,514
1960	3	962	965	327	-	4	331	1,296
1961	14	659	673	346	803	2	1,151	1,824
1962	3	542	545	324	988	2	1,314	1,859
1963	7	885	892	314	813	2	1,129	2,021
1964	3	2,182	2,185	550	366	2	918	3,103
1965	3	1,819	1,822	308	-	2	310	2,132
1966	8	1,813	1,821	304	748	-	1,052	2,873
1967	18	1,590	1,608	357	371	1	729	2,337
1968	12	1,380	1,392	640	20	1	661	2,053
1969	5	1,817	1,822	410	-	1	411	2,233
1970	3	1,409	1,412	704	-	9	713	2,125
1971	2	1,632	1,634	744	-	-	744	2,378
1972	1	2,382	2,383	1,825	-	2	1,827	4,210
1973	16	2,638	2,654	673	-	4	677	3,331
1974	61 ^a	2,740	2,801	1,205	-	13	1,218	4,019
1975	143 ^a	3,536	3,679	1,027	-	58 ^a	1,085	4,764
1976	108 ^a	4,122	4,230	811	-	22 ^a	833	5,063
1977	102	3,649	3,751	2,226	-	32 ^a	2,258	6,009
1978	73	3,562	3,635	2,752	-	17	2,769	6,404
1979	152 ^a	3,460	3,612	2,289	-	15	2,304	5,916
1980	113 ^a	3,666	3,779	2,616	-	21	2,637	6,416
1981	101 ^a	3,644	3,745	2,424	-	28 ^a	2,452	6,197
1982	128 ^a	4,270	4,398	2,035	-	16 ^a	2,051	6,449
1983	79 ^a	4,076	4,155	1,321	-	9 ^a	1,330	5,485
1984	79	3,285	3,364	1,328	-	17	1,345	4,709
1985	51	3,137	3,188	3,689	-	6	3,695	6,883
1986	...	2,796 ^b	2,796 ^b	3,050 ^b	-	- ^b	3,050 ^b	5,846 ^b
1987	...	2,333 ^b	2,333 ^b	2,472 ^b	-	3 ^b	2,475 ^b	4.808 ^b
1988 ^d								

^a Only in these years do the figures for this region include estimates for non-reported catches.

^b These provisional figures do not include estimates for non-reported catches as for the previous years.

^c Royal Greenland Trade Department special vessel catch expeditions in the Denmark Strait, 1959-68.

^d For 1988 and following years, comparable catch statistics are not available.

Table 9. Catches of harp seals in West and East Greenland, 1954-1987.

Year	N	West Greenland		East Greenland			Total Greenland
		NW-S	Total	SE	NE	Total	
1954	...	18,912	18,912	475	32	507	19,419
1955	...	15,445	15,445	178	45	223	15,668
1956	...	10,883	10,883	180	5	185	11,068
1957	...	12,817	12,817	133	40	173	12,990
1958	...	16,705	16,705	360	30	390	17,095
1959	...	8,844	8,844	168	7	175	9,019
1960	...	15,979	15,979	350	16	365	16,244
1961	173 ^a	11,713	11,886	219	13 ^a	232	12,118
1962	63 ^a	8,331	8,394	211	10 ^a	221	8,615
1963	120 ^a	9,883	10,003	215	20 ^a	235	10,238
1964	67	9,073	9,140	125	7	132	9,272
1965	109	9,142	9,251	76	2	78	9,329
1966	65	6,964	7,029	55	6	61	7,090
1967	90	4,125	4,215	54	10	64	4,279
1968	117	6,909	7,026	180	4	184	7,210
1969	63	6,320	6,383	110	9	119	6,502
1970	150	6,028	6,178	182	15	197	6,375
1971	53	5,487	5,540	63	5	68	5,608
1972	49	5,903	5,952	84	6	90	6,042
1973	84	9,078	9,162	100	38 ^a	138	9,300
1974	327 ^a	6,746	7,073	144	27	171	7,244
1975	208 ^a	5,745	5,953	125	68 ^a	193	6,146
1976	332 ^a	7,455	7,787	260	27	287	8,074
1977	644 ^a	9,294	9,938	72	21	93	10,031
1978	282	10,258	10,540	408	30	438	10,978
1979	543 ^a	12,231	12,774	171	18	189	12,963
1980	352 ^a	11,918	12,270	308	45 ^a	353	12,623
1981	184 ^a	13,421	13,605	427	49 ^a	476	14,081
1982	335 ^a	16,909	17,244	267	50 ^a	317	17,561
1983	407 ^a	18,332	18,739	357	57 ^a	414	19,153
1984	409 ^a	17,258	17,667	525	61 ^a	586	18,253
1985	421 ^a	18,024	18,445	534	56 ^a	590	19,035
1986	...	13,932 ^b	13,932 ^b	533 ^b	37 ^b	570 ^b	14,502 ^b
1987	...	16,053 ^b	16,053 ^b	1060 ^b	15 ^b	1075 ^b	17,128 ^b
1988 ^c							

^a Only in these years do the figures for this region include estimates for non-reported catches.

^b These provisional figures do not include estimates for non-reported catches as for the previous years.

^c For 1988 and following years, comparable catch statistics are not available.

Table 10. Harp seal catches, including research catches, in southeastern Canada ("Gulf" and "Front"), 1946-1991.

Year	Large Vessel Catch				Landsmen Catch ²				Total Catches			
	0	1+	UNK	Total	0	1+	UNK	Total	0	1+	UNK	Total
1946	36161	17709	0	53870	36839	11853	0	48692	73000	29562	0	102562
1947	67513	64446	0	131959	34781	9769	0	44550	102294	74215	0	176509
1948	88052	83670	0	171722	48617	10675	0	59292	136669	94345	0	231014
1949	167469	55324	0	222793	59702	14216	0	73918	227171	69540	0	296711
1950	182086	47664	0	229750	43683	9649	0	53332	225769	57313	0	283082
1951	247956	113083	0	361039	70670	23876	0	94546	318626	136959	0	455585
1952	172185	98378	0	270563	25878	10667	0	36545	198063	109045	0	307108
1953	147090	66811	0	213901	50885	8100	0	58985	197975	74911	0	272886
1954	125353	83939	0	209292	49681	5443	0	55124	175034	89382	0	264416
1955	231700	75671	0	307371	20597	5401	0	25998	252297	81072	0	333369 ³
1956	299745	42585	0	342330	41652	5428	0	47080	341397	48013	0	389410
1957	137721	76437	0	214158	27777	3605	0	31382	165498	80042	0	245540
1958	80430	137227	0	217657	60566	19563	0	80129	140996	156790	0	297786
1959	227212	77304	0	304516	11620	3998	0	15618	238832	81302	0	320134
1960	131649	114534	0	246183	24519	6648	0	31167	156168	121182	0	277350
1961	154286	13170	0	167456	14533	5877	0	20410	168819	19047	0	187866
1962	164625	99513	0	264138	42463	13388	0	55851	207088	112901	0	319989
1963	207818	57094	0	264912	62601	14529	0	77130	270419	71623	0	342042
1964	210089	60348	0	270437	56293	14933	0	71226	266382	75281	0	341663
1965	121398	33757	0	155155	61360	17738	0	79098	182758	51495	0	234253
1966	209145	59364	0	268509	42590	12640	0	55230	251735	72004	0	323739
1967	252837	41361	0	294198	24913	15245	0	40158	277750	56606	0	334356
1968	125236	30328	0	155564	31222	5910	0	37132	156458	36238	0	192696
1969	202685	44940	0	247625	30655	10532	0	41187	233340	55472	0	288812
1970	184192	26225	0	210417	33239	13839	0	47078	217431	40064	0	257495
1971	169426	14343	0	183769	41153	6044	0	47197	210579	20387	0	230966
1972	104109	1646	0	105755	12701	11427	0	24128	116810	13073	0	129883
1973	69303	15156	0	84459	29032	10341	0	39373	98335	25497	0	123832
1974	85387	21828	0	107215	29438	10982	0	40420	114825	32810	0	147635
1975	109832	10992	0	120824	30806	22733	0	53539	140638	33725	0	174363
1976	93939	4576	0	98515	38146	28341	0	66487	132085	32917	0	165002
1977	92904	2048	0	94952	34078	26113	0	60191	126982	28161	0	155143
1978	63669	3523	0	67192	52521	42010	0	94531	116190	45533	0	161723
1979	96926	449	0	97375	35532	27634	0	63166	132458	28083	0	160541
1980	91577	1563	0	93140	40844	35542	0	76386	132421	37105	0	169526
1981 ⁴	89049	1211	0	90260	89345	22564	0	111909	178394	23775	0	202169
1982	100568	1655	0	102223	44706	19810	0	64516	145274	21465	0	166739
1983	9529	1021	0	10550	40529	6810	0	47339	50058	7831	0	57889
1984 ⁵	95	549	0	644	23745	6528	0	30273	23840	7077	0	30917
1985 ⁵	0	1	0	1	13334	5700	0	19034	13334	5701	0	19035
1986	0	0	0	0	21888	4046	0	25934	21888	4046	0	25934
1987 ⁶	2671	90	2	2763	30986	10266	20	41272	33657	10356	22	44035
1988 ⁶	0	0	0	0	66950	13493	13603	94046	66950	13493	13603	94046
1989 ⁶	0	0	0	0	53879	5504	5691	65074	53879	5504	5691	65074
1990 ⁷	44	44	0	88	33144	22087	2903	58134	33188	22131	2903	58222
1991 ⁸	0	0	0	0	38898	5431	6491	50820	38898	5431	6491	50820

¹ All values are from NAFO except where noted.

² Landsmen values include catches by small vessels (< 150 gr tons) and aircraft.

³ Addition error in NAFO Statistics Bulletin corrected.

⁴ NAFO values revised to include complete Quebec catch (Bowen, W.D. 1982. Age structure of northwest Atlantic harp seal catches, 1952-80. NAFO Sci. Coun. Studies, 3: 53-65).

⁵ Large vessel catches represent research catches and may differ from NAFO values.

⁶ Total catch may differ from NAFO value. Maritime and Quebec catches from R. Simon (pers. comm.).

⁷ Preliminary values. Large vessel catch represents research catch.

⁸ Preliminary values.

Table 11. Published values for harp seal catches in the Canadian Arctic, 1952-1984.

Year	Bowen ¹			D.E.S. ² Total	Roff & Bowen ³			NAFO ⁴	Stewart et al. ⁵		
	0	1+	Total		0	1+	Total		N Que	Baffin	N Lab
1952	60	1724	1784								
1953	60	1724	1784								
1954	60	1724	1784								
1955	60	1724	1784								
1956	60	1724	1784								
1957	60	1724	1784								
1958	60	1724	1784								
1959	60	1724	1784								
1960	60	1724	1784								
1961	60	1724	1784								
1962	60	1724	1784								
1963	60	1724	1784								
1964	60	1724	1784								
1965	60	1724	1784								
1966	60	1724	1784								
1967	60	1724	1784								
1968	60	1724	1784								
1969	60	1724	1784								
1970	60	1724	1784								
1971	60	1724	1784								
1972	60	1724	1784								
1973	60	1724	1784								
1974	60	1724	1784	1117							
1975	60	1724	1784	2513							
1976	60	1724	1784	2017					272		
1977	60	1724	1784	1508				1508	306		
1978	60	1724	1784			72	2057	2129	2129	44	
1979	60	1724	1784			128	3492	3620	3707	87	
1980	60	1724	1784			215	6135	6350	6459	52	2062
1981						158	4514	4672	4672	6263	20775
1982						166	4715	4881	4268	5849	1226
1983									1287	2433	86
1984											288

¹ Bowen, W.D. 1982. Age structure of northwest Atlantic harp seal catches, 1952-80. NAFO Sci. Coun. Studies, 3: 53-65. Mean catch of 1768 for years 1962 - 1971 from Smith and Taylor (1977) and values for years 1974-1977 reported by Sergeant.

² Sergeant (pers. comm.) as cited in Bowen (1982).

³ Roff, D.A. and W.D. Bowen. 1986. Further analysis of population trends in the northwest Atlantic harp seal (*Phoca groenlandica*) from 1967 to 1985. Can. J. Fish. Aquatic. Sci., 43: 553-564.

⁴ Anon. 1985. Provisional report of the Scientific Council. NAFO. SCS Doc. 85/I/2. Values include catches in the Northwest Territories and northern Quebec.

⁵ Stewart, R.E.A., P. Richards, M.C.S. Kingsley and J.J. Houston. 1986. Seals and sealing in Canada's northern and Arctic regions. Fish. Aquat. Sci. Tech. Rep. No. 1463.

Table 12. Hooded seal catches, including research catches, in southeastern Canada ("Gulf" and "Front"), 1946-1991.

Year	Large Vessel Catches				Landsmen Catches ²				Total Catches			
	0	1+	UNK	Total	0	1+	UNK	Total	0	1+	UNK	Total
1946	4839	591	0	5430	332	143	0	475	5171	734	0	5905
1947	1509	2638	0	4147	342	146	0	488	1851	2784	0	4635
1948	8157	7040	0	15197	420	180	0	600	8577	7220	0	15797
1949	4532	681	0	5213	489	210	0	699	5021	891	0	5912
1950	1106	154	0	1260	560	240	0	800	1666	394	0	2060
1951	9675	2681	0	12356	786	267	0	1053	10461	2948	0	13409
1952	1278	209	0	1487	161	39	0	200	1439	248	0	1687
1953	3217	1569	0	4786	499	281	0	780	3716	1850	0	5566
1954	1800	981	0	2781	838	73	0	911	2638	1054	0	3692
1955	3772	1424	0	5196	184	125	0	309	3956	1549	0	5505
1956	6623	7233	0	13856	24	21	0	45	6647	7254	0	13901
1957	79	58	0	137	30	14	0	44	109	72	0	181
1958	4391	3642	0	8033	321	214	0	535	4712	3856	0	8568
1959	4154	569	0	4723	62	42	0	104	4216	611	0	4827
1960	2959	1667	0	4626	91	61	0	152	3050	1728	0	4778
1961	1592	207	0	1799	680	112	0	792	2272	319	0	2591
1962	765	84	0	849	302	81	0	383	1067	165	0	1232
1963	4472	1650	0	6122	160	12	0	172	4632	1662	0	6294
1964	3955	6104	0	10059	644	198	0	842	4599	6302	0	10901
1965	2052	734	0	2786	817	593	0	1410	2869	1327	0	4196
1966	15364	8339	0	23703	1387	446	0	1833	16751	8785	0	25536
1967	8340	6310	0	14650	40	130	0	170	8380	6440	0	14820
1968	1196	525	0	1721	12	10	122	144	1208	535	122	1865
1969	8630	9444	0	18074	191	78	0	269	8821	9522	0	18343
1970	3883	1481	0	5364	1437	389	0	1826	5320	1870	0	7190
1971	7987	6875	0	14862	54	30	0	84	8041	6905	0	14946
1972	6820	5636	0	12456	108	36	0	144	6928	5672	0	12600
1973	4499	1930	0	6429	103	35	0	138	4602	1965	0	6567
1974	5984	3990	0	9974	7	18	0	25	5991	4008	0	9999
1975	7459	7805	0	15264	187	160	0	347	7646	7965	0	15611
1976	6065	5718	0	11783	475	127	0	602	6540	5845	0	12385
1977	7967	2922	0	10889	1003	201	0	1204	8970	3123	0	12093
1978	7730	2029	0	9759	236	509	0	745	7966	2538	0	10504
1979	11817	2876	0	14693	131	301	0	432	11948	3177	0	15125
1980	9712	1547	0	11259	1441	416	0	1857	11153	1963	0	13116
1981	7372	1897	0	9269	3289	1118	0	4407	10661	3015	0	13676
1982	4899	1987	0	6886	2858	649	0	3507	7757	2636	0	10393
1983	0	0	0	0	0	128	0	128	0	128	0	128
1984 ³	206	187	0	388	0	56	0	56	206	243	0	449
1985 ³	215	220	0	435	5	344	0	349	220	564	0	784
1986	0	0	0	0	21	12	0	33	21	12	0	33
1987	124	4	250	378	1197	280	0	1477	1321	284	250	1855
1988	0	0	0	0	828	80	0	908	828	80	0	908
1989	0	0	0	0	102	260	5	367	102	260	5	367
1990 ⁴	41	46	0	87					480	299	0	779
1991 ⁵												11925

¹ All values are from NAFO except where noted.

² Landsmen values include catches by small vessels (< 150 gr tons) and aircraft.

³ Large vessel catches represent research catches and may differ from NAFO values.

⁴ Preliminary values. Large vessel catch represents research catch.

⁵ Preliminary values.

APPENDIX V

SUMMARIES OF SEALING REGULATIONS

Table 1. Summaries of Norwegian sealing regulations for the Greenland Sea ("West Ice"), 1985-1991.

Season	Opening date	Closing date	Quotas ¹		-		Allocations	
			Total	Pups	Fem.	Males	Norway	USSR
Hooded Seals								
1985	22 March	5 May	(20,000) ²	(20,000) ²	0 ³	unlim.	8,000 ⁴	3,300
1986	18 March	5 May	9,300	9,300	0 ³	unlim.	6,000	3,300
1987	18 March	5 May	20,000	20,000	0 ³	unlim.	16,700	3,300
1988	18 March	5 May	(20,000) ²	(20,000) ²	0 ³	unlim.	16,700	5,000
1989	18 March	5 May	30,000		0 ³	incl.	23,100	6,900
1990	26 March	30 June	27,500	0	0	incl.	19,500	8,000
1991	26 March	30 June	9,000	0	0	incl.	1,000	8,000
Harp Seals								
1985	10 April	5 May	(25,000) ²	(25,000) ²	0 ⁵	0 ⁵	7,000	4,500
1986	22 March	5 May	11,500	11,500	0 ⁵	0 ⁵	7,000	4,500
1987	18 March	5 May	25,000	25,000	0 ⁵	0 ⁵	20,500	4,500
1988	10 April	5 May	28,000		0 ^{5,6}	0 ^{5,6}	21,000	7,000
1989	18 March	5 May	16,000	-	0 ⁵	0 ⁵	12,000	9,000
1990	10 April	20 May	7,200	0	0 ⁵	0 ⁵	5,400	1,800
1991	10 April	31 May	7,200	0	0 ⁵	0 ⁵	5,400	1,800

¹ Other regulations include: Prescriptions for date for departure Norwegian port ; only one trip per season ; licensing ; killing methods; and inspection.

² Basis for allocation of USSR quota.

³ Breeding females protected ; two pups deducted from quota for each female taken for safety reasons.

⁴ Adult males only.

⁵ 1 year+ seals protected until 9 April; pup quota may be filled by 1 year+ after 10 April.

⁶ Any age or sex group.

Table 2. Summary of sealing regulations for the White and Barents Seas ("East Ice"), 1979-1991.¹

Season	<u>Opening dates</u>		Closing date	<u>Quotas - Allocations</u>		
	Soviet sealers	Norwegian vessels		Total	USSR	Norway
Harp seals²						
1979-80	1 March	23 March	30 April ³	50,000 ⁴	34,000	16,000
1981	-	-	-	60,000	42,500	17,500
1982	-	-	-	75,000	57,500	17,500
1983	-	-	-	82,000	64,000	18,000
1984	-	-	-	80,000	62,000	18,000
1985-86	-	-	-	80,000	61,000	19,000
1987	-	-	20 April ³	80,000	61,000	19,000
1988	-	-	-	70,000	53,400	16,600
1989-91	-	-	-	40,000	30,500	9,500

¹ Quotas and other regulations prior to 1979 are reviewed by Benjaminsen, 1979.

² Hooded, bearded and ringed seals protected from catches by ships.

³ The closing date may be postponed until 10 May if necessitated by weather or ice conditions.

⁴ Breeding females protected (all years).

Table 3a. Major management measures implemented for harp seals in Canadian waters (1960 - 1991).

1961	Opening and closing dates set for the Gulf of the St. Lawrence and Front areas.
1964	First licensing of sealing vessels and aircraft. Quota of 50,000 set for southern Gulf (effective 1965).
1965	Prohibition on killing adult seals in breeding or nursery areas. Introduction of licensing of sealers. Introduction of regulations defining killing methods.
1966	Amendments to licensing. Gulf quota areas extended. Rigid definition of killing methods.
1971	TAC for large vessels set at 200,000 and an allowance of 45,000 for landsmen.
1972 - 1975	TAC reduced to 150,000, including 120,000 for large vessel and 30,000 (unregulated) for landsmen. Large vessel hunt in the Gulf prohibited.
1976	TAC was reduced to 127,000.
1977	TAC increased to 170,000 for Canadian waters, including an allowance of 10,000 for northern native peoples and a quota of 63,000 for landsmen (includes various suballocations throughout the Gulf of St. Lawrence and northeastern Newfoundland). Adults limited to 5% of total large vessel catch.
1978 - 1979	TAC held at 170,000 for Canadian waters. An additional allowance of 10,000 for the northern native peoples (mainly Greenland).
1980	TAC remained at 170,000 for Canadian waters including an allowance of 1,800 for the Canadian Arctic. Greenland was allocated additional 10,000.
1981	TAC remained at 170,000 for Canadian waters including 1,800 for the Canadian Arctic. An additional allowance of 13,000 for Greenland.
1982 - 1987	TAC increased to 186,000 for Canadian waters including increased allowance to northern native people of 11,000. Greenland catch anticipated at 13,000.
1988 - 1991	TAC remained unchanged. Ban on commercial hunting of white coats and hunting on large (>65 ft) vessels.

Table 3b. Major management measures implemented for hooded seals in Canadian waters (1960 - 1991).

1964	Hunting of hooded seals banned in the Gulf area (below 50°N), effective 1965.
1966	ICNAF assumed responsibility for management advice for northwest Atlantic .
1968	Open season defined (12 March - 15 April).
1974 - 1975	TAC set at 15,000 for Canadian waters. Opening and closing dates set (20 March - 24 April).
1976	TAC held at 15,000 for Canadian waters. Opening delayed to 22 March. Shooting banned between 23:00 and 10:00 GMT from opening until 31 March and between 24:00 and 09:00 GMT thereafter (to limit loss of wounded animals).
1977	TAC maintained at 15,000 for Canadian waters. Shooting of animals in water prohibited (to reduce loss due to sinking). Number of adult females limited to 10% of total catch.
1978	TAC remained at 15,000 for Canadian waters. Limited number of adult females to 7.5% of total catch.
1979 - 1982	TAC maintained at 15,000. Catch of adult females reduced to 5% of total catch.
1983	TAC reduced to 12,000 for Canadian waters. Previous conservation measures retained.
1984 - 1987	TAC reduced to 2,340 for Canadian waters and previous conservation measures retained.
1988 - 1990	TAC maintained at 2,340 for Canadian waters. Hunting from large vessels (>65 ft) banned. Commercial hunt for bluebacks banned.
1991	TAC increased to 15,000.