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*REPORT OF THE WORKING GROUP ON
HARP AND HOODED SEALS IN THE GREENLAND SEA*

Copenhagen, 12 - 16 October 1987

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1 TERMS OF REFERENCE

At the 72nd Statutory Meeting of ICES in Copenhagen in 1984, it was decided to establish a Working Group on Harp and Hooded Seals in the Greenland Sea with the following terms of reference (C.Res.1984/2:4:18):

- i) assess the stock size and pup production of harp and hooded seals;
- ii) consider sustainable yields at present stock sizes and in the long term under varying options of age compositions in the catch;
- iii) consider effects of recent changes in the food supply and the possible interaction with other marine living resources in the area.
- iv) review the available data to assess the state of the stocks and give proposals for future research programmes;
- v) give advice on catch options for the sealing season (1986).

The possibility of coordination with NAFO should be investigated as appropriate.

With respect to the last item, it was recommended in the first report of the Working Group (Anon., 1987, p. 29), and subsequently endorsed by the Council (C.Res.1985/3:7), that NAFO "be invited to participate in a joint ICES/NAFO Working Group on Harp and Hooded Seals, with the terms of reference similar to those of the ICES Working Group on Harp and Hooded Seals in the Greenland Sea and those of the equivalent NAFO ad hoc Committee."

The Scientific Council of NAFO considered the matter at its meeting in September 1985 (NAFO SCS Doc. 85/27, p.9) and in June 1986 (NAFO SCS Doc. 86/24, p.12), expressing some reservations but concluding: "The Council, in declining the ICES invitation at this time, expressed an interest in the work of the ICES Working Group on Seals and agreed to keep the matter under review."

At the meeting of NAFO's Scientific Council in June 1987, the issue was referred to again, and the report (NAFO SCS Doc. 87/21,13) contains the following comments:

"The Council reviewed the long-standing invitation from ICES that there be a joint ICES/NAFO working group on seals. It was noted that consideration of a number of possible topics concerning seals would involve information from both the NAFO and ICES areas and that a joint working group would be an appropriate forum for such consideration. The Council was, however, of the opinion that, before accepting the invitation of ICES, it would be desirable to explore the mechanism for referring topics to the working group, particularly questions that might relate predominantly to the NAFO Area and/or to areas of coastal state jurisdiction."

2 MEETING ARRANGEMENTS

The Working Group, chaired by F.O. Kapel, and comprising scientists from Canada, Denmark, and Norway, met at ICES headquarters from 12 to 16 October 1987. A list of participants is given in Appendix I.

The Working Group reviewed the scientific information on harp and hooded seals in the Greenland Sea that has been made available since the first meeting, including the documents presented at this meeting. In addition, the Working Group received information on relevant research activities on harp and hooded seals in the Northwest Atlantic. The Agenda adopted for the meeting is given in Appendix II, and the papers referred to are listed in Appendix III.

The Working Group noted with satisfaction that the scientific reports of the Norwegian-Soviet Sealing Commission and the Joint Norwegian-Soviet Fisheries Commission had been released for use within the Working Group. The joint reports of the meetings 1975-1985, the Norwegian national reports for the seasons 1975-1986, and sections of the Soviet national report for 1977, 1980, 1984, 1985, and 1986 had been translated into English. The Working Group agreed that it would like to see translation carried out of the relevant sections of the Soviet reports for 1975, 1976, 1978, 1979, 1981, 1982, and 1983 as well as the joint report for 1986. Further reports should be translated as they become available.

3 SEAL STOCKS: STATUS AND MANAGEMENT

3.1 Hooded Seal (*Cystophora cristata*)

3.1.1 Recent information on catches and research activities

Norwegian and Soviet catches of hooded seals in the West Ice 1946-1987 are listed in Appendix IV, Table 1. Catches of hooded seals in the West Ice have increased in the period 1983-1987, but have not reached the 1980-1982 level, and the composition of the catch has changed. A summary of Norwegian and Soviet sealing effort directed at both hooded and harp seals is given in Appendix IV, Tables 3 and 4.

A summary of Norwegian sealing regulations for the West Ice for 1985 to 1987 is given in Appendix V. It was noted that the opening data was changed from 22 March in previous years to 18 March in 1986 and 1987, and that the quota and allocations for 1987 were the same as in 1980-1982.

Norwegian and Soviet efforts to collect specimens for biological studies have been continued and samples were collected from breeding females for studies of age composition and reproduction in 1987. Norway tagged 1,441 hooded seal pups in 1986 and 36 in 1987. Soviet scientists carried out an aerial survey of one patch of breeding hoods in 1986.

3.1.2 Distribution and stock identity

The Working Group reviewed recent information on recaptures of seals tagged as pups at the West Ice (Øien and Øritsland, this meeting: SGS-11), the Davis Strait, and Newfoundland (Table 1). Two recoveries on the coast of Norway in 1987 from recent taggings in the West Ice from 1985 to 1986 confirm previous data indicating that young seals may disperse over large areas in their first years of life. To date, none of the 2,672 pups tagged in the West Ice since 1977 has been reported recaptured at Greenland (Øien and Øritsland, this meeting: SGS-11), and yet pups tagged at Newfoundland and in the Davis Strait during this same period have been recovered both in East and West Greenland as young of the year and older animals.

Table 1 Recoveries of hooded seals tagged at Newfoundland and in the Davis Strait (G. Stenson, unpublished).

Year tagged	Area tagged	No. tags	Recoveries								
			1984			1985			1986		
			F	W	E	F	W	E	F	W	E
1984	Front (Nfld)	415 ¹	-	-	-	-	-	2	-	-	1
1984	Davis St	1,465	-	5 ²	2	-	-	2	-	-	-
1985	Front (Nfld)	702	-	-	-	-	1	1	-	-	7

¹ Includes 15 pups sampled by research crew.

² Includes 1 pup sampled by research crew.

F = Front (Nfld).

W = West Greenland.

E = East Greenland.

Furthermore, age composition data from the Southeast Greenland hunt indicate that a significant proportion of the catch in some years is comprised of young of the year (Kapel, unpublished). Thus the lack of returns from East Greenland of seals tagged in the West Ice indicates the use of different areas by the North-west Atlantic and Greenland Sea populations.

3.1.3 Biological parameters

No new information on age-specific pregnancy rates or mortality rates was available to the Working Group. However, the Group is aware of recent biological collections (see Section 3.1.1 and Appendix VI, Table 1) which could be used to estimate vital rates in an age-structured analysis such as that developed by Jacobsen (1984).

3.1.4 Population assessment

Soviet scientists conducted a reconnaissance survey in 1984 and an aerial survey of West Ice whelping patches to assess stock size in 1986 and 1987. The 1984 survey was carried out on 22 and 24 March. On 22 March, a whelping patch of about 6,000 hooded seals and many seals in the water in the vicinity of the concentration were observed. Inclement weather hampered efforts to locate other concentrations (Anon., 1984). Of the most recent surveys, only summary results of the 1986 program were available to the Working Group. Six transects were flown over a single whelping concentration on 19 March 1986 resulting in an estimated pup production of approximately 25,000 pups (Anon., 1986). Soviet and Norwegian scientists observed at least one additional patch for which no estimate was attempted. The Working Group was encouraged by recent attempts to estimate pup production using aerial survey methods, but noted that further and more detailed information on survey design and estimation procedures must be made available before the reliability of these estimates could be evaluated. Reference to recent work on the Northwest Atlantic population (Bowen et al., 1987; Stenson and Myers, in press) may be useful in the design of future aerial survey attempts in the Jan Mayen area.

The Working Group, therefore, had no estimates of current pup production and stock size upon which to base a population assessment.

3.1.5 Management advice

Given the lack of information on current pup production and stock size of hooded seals in the West Ice, the Working Group was unable to calculate sustainable or replacement yield. With the information available to it, the Working Group was unable to provide scientific advice on catch levels for the 1988 sealing season.

The Working Group noted that the Norwegian-Soviet Sealing Commission (in recent years, the Joint Soviet-Norwegian Fishery Commission) had recommended quotas for the West Ice population of hooded seals since 1971. Although some of the reports of the scientific meetings of these Commissions were available to the Working Group, the reports do not contain the scientific basis for the establishment of these quotas.

3.2 Harp Seal (*Phoca groenlandica*)

3.2.1 Recent information on catches and research activities

Norwegian and Soviet catches of harp seals in the West Ice 1946-1987 are listed in Appendix IV, Table 2. In 1987, the Norwegian catch of harp seals increased to 11,444, similar to the pre-1983 level. A summary of Norwegian and Soviet sealing effort directed at both harp and hooded seals is given in Appendix IV, Tables 3 and 4.

A summary of Norwegian sealing regulations for the West Ice for 1985-1987 is given in Appendix V. In 1987, the opening date was changed from 22 to 18 March, and the Norwegian allocation was raised to the same level as in the period 1980-1982 (20,500).

Collection of material for biological studies has been continued and 2,139 pups were tagged by Norway in 1987. An age sample was collected from moulting harp seals by a Soviet ship after the sealing season in 1987.

3.2.2 Distribution and stock identity

Updated information on recoveries of harp seals marked as pups in the Jan Mayen area was reviewed. Most of the 34 recoveries outside the whelping and moulting patches in the Jan Mayen area are pups which have been recovered on the Norwegian coast, at Iceland, and at East Greenland in the first few months following weaning (Øien and Øritsland, this meeting: SGS-11). The Working Group noted, however, that inferences on the distribution and movements of young harp seals based on incidental and Inuit catches may not be representative of these age groups as a whole given the uneven geographic distribution of effort.

The Working Group received information that harp seals had invaded the Varangerfjord and the coast of eastern Finnmark, apparently from the east, during the spring cod (Gadus morhua) fishery each year from 1978-1984 (Øritsland, unpublished). There was no comparable influx of seals in 1985, but large numbers of harp seals were caught in fishing gear along the coast from western Finnmark to Trøndelag in the winter and spring of 1986 and south into the Skagerrak coast in 1987.

Up to 6,000 seals were recorded landed annually in eastern Finnmark from 1978 to 1984, comprising both sexes and a wide range of age groups. In 1986, several thousand, and in 1987, nearly 60,000 seals were recorded for fishing gear damage compensation along the Norwegian coast from January to April. In contrast to the wide range of ages of seals in the earlier invasions, those in 1986 and 1987 were mostly young animals, as indicated by body length measurements.

The causes and stock origin of the seals involved in the 1986 and 1987 invasions are uncertain. Recoveries in 1986 (n = 2) and 1987 (n = 4), during the months of the invasions, of harp seals tagged in the Jan Mayen area indicate that an unknown proportion of the influx came from the Greenland Sea. The Working Group also reviewed information on the body composition of a small sample of harp seals caught in fishing nets during the early part of the 1987 invasion. Mean blubber thickness in eighteen animals taken at Sunnmøre (n = 15) and Fredrikstad (n=3) in January was 1.8 cm \pm 0.5 (SD) (Markussen, unpublished data). Sculp weight was an average of 29.6 \pm 4.0% of total body weight in these same animals.

These values are below what might be normally expected for this time of year. The Working Group was aware of additional samples taken from seals during the invasion; however, these data were not available. Based on the data available, the Working Group concluded that it was premature to draw conclusions about the

cause of the invasion or the origin of the invading seals. The understanding of this situation could be improved by a documentation and synthesis of all sources of information. Should such an invasion take place in the future, every attempt should be made to obtain biological data from captured seals over the course of the influx and to obtain control samples from both the Greenland Sea and Barents Sea.

3.2.3 Biological parameters

Age compositions from breeding and moulting harp seals in the Jan Mayen area for 1982-1984 were presented, with an evaluation of the consistency of ages determined by a new reader compared with those of two experienced readers (Øien, this meeting: SGS-12). Based on these comparisons, the Working Group concluded that these new age compositions should be considered preliminary and thus should not be used until the samples can be re-examined.

Age compositions tabulated from reports of the Soviet-Norwegian Commissions for the period 1953-1981 (Appendix VI, Table 2) and the revised data from 1982 to 1984 should be incorporated into a comprehensive population analysis to be reviewed by the Working Group. Lacking such an analysis, the Working Group was not able to refine estimates of mortality rates in harp seals in the Greenland Sea.

3.2.4 Population assessment

Harp seal pups in the Jan Mayen area have been tagged on an opportunistic basis since 1951 to obtain data on distribution and migrations. However, in 1977-1978 and 1983-1985, sufficient numbers of pups were tagged to examine the possibility of using mark-recapture methods to estimate pup production (Øien and Øritsland, this meeting: SGS-11). Pups were marked at whelping patches in March using Roto tags. Due to sealing activities, it was not possible to avoid uneven tagging effort and thus the clumping of tags in the whelping concentrations. Thus, short-term recoveries (i.e., those in the whelping patch) were excluded from the analyses. Sufficient recoveries from moulting concentrations (long-term recaptures) in the Jan Mayen area were available to permit preliminary estimates of pup production for the 1977, 1978, and 1983 cohorts. Catches of age 1 and older animals from these cohorts were estimated using age compositions collected from the moulting areas in each year to 1984. The resulting estimates are given below:

Table 2 Estimates of pup production of harp seal in the Greenland Sea.

Cohort	M	m	C	N	PC	Production
1977	477	18	953	25,255	15,305	40,560
1978	478	11	836	36,328	16,424	52,752
1983	1,302	8	252	41,013	5,005	46,018

M = number effectively marked.

m = cumulative number of marked seals recovered for each cohort.

C = cumulative catch of age one and older seals for each cohort.

PC= pup catch at the whelping patch.

The Working Group agreed with the authors that the reliability of these estimates was uncertain as the underlying model assumptions have not been evaluated. It is likely that the estimates will need to be corrected to account for tag loss and the under-reporting of recovered tags. Although data were not available to the Working Group, experience with using Roto tags on harp seals in the Northwest Atlantic (Bowen and Sergeant, 1983) suggests that tag loss is unlikely to be a major source of error. Although it seems unlikely that significant numbers of tags are not returned by sealers aboard the large vessels hunting in moulting patches, this possibility should be investigated before the reliability of these estimates can be evaluated. Further, the Working Group felt there was a need to have more detailed information on the spatial and temporal pattern of recoveries, and the estimated catch at age in order to assess the reliability of the estimates and to enable calculation of appropriate confidence limits.

The Working Group noted that, in 1987, 2,139 pups were marked in an explicit attempt to estimate pup production using the Petersen mark-recapture estimator.

In the previous report of the Working Group, an unconfirmed reference was made to a 1984 Soviet aerial survey of harp seals in the Jan Mayen area. Based on translations of Soviet research reports available to the Working Group, it seems clear that this 1984 survey was conducted on hooded seals and not on harp seals.

3.2.5 Management advice

There is still no estimate of present pup production and stock size of the harp seals in the Greenland Sea. Therefore, the Working Group was unable to calculate sustainable or replacement yield. With the information available to it, the Working Group was unable to provide scientific advice on catch options for the 1988 sealing season.

For the reasons outlined in Section 3.1.5, the Working Group was unable to evaluate the scientific basis for the level of the previous catch quotas for this population.

4 INTERACTION BETWEEN SEALS, OTHER MARINE RESOURCES, AND COMMERCIAL FISHING

4.1 Feeding Biology

No new information on the feeding biology of harp or hooded seals in the Greenland Sea was presented to the Working Group. However, the status of historical samples and new collections from 1985 to 1987, including samples from seals caught during the 1986 and 1987 invasions, were briefly reviewed. In addition, the Working Group was informed of ongoing studies on harp seal feeding in Greenland, the Barents Sea, and the Northwest Atlantic.

4.2 Energetics

The Working Group heard a presentation on current research to better define the energetic requirements of seals, including experiments on the rate of food passage and the rate and components of energy use during periods of fasting in harbour seals. No new information was available to the Working Group on the energy requirements of the harp and hooded seal populations in the Greenland Sea.

4.3 Interaction with Commercial Fishing

The invasion of harp seals into the coast of Norway in 1986 and 1987 undoubtedly had a disruptive effect on inshore spring fisheries. However, the Working Group did not have access to data or analyses to permit an evaluation of either the magnitude or significance of this interaction, although it understands that further information could be brought to bear on this matter.

5 FUTURE RESEARCH

The Working Group identified priorities and recommends that:

- 1) aerial surveys be conducted to provide estimates of current pup production for harp and hooded seals;
- 2) mark-recapture studies be continued to provide an independent estimate of harp seal pup production;
- 3) further efforts be made to fit age-structured population models to catch-at-age data as a method of estimating historic population trends of both species, incorporating all relevant information on vital rates;
- 4) sampling in harp seal moulting patches be continued on an annual basis to determine the age and sex composition of catches;
- 5) data be collected on seasonal and geographic patterns of diet composition in harp and hooded seals, including studies on activity to enable better estimates of energy requirements of these populations to be made.

6 FUTURE ACTIVITIES OF THE WORKING GROUP

At its first meeting, the Working Group concluded that calculation of sustainable or replacement yields for harp and hooded seals in the Greenland Sea was not possible because a significant portion of the historical data base was not available to the Working Group and because no estimate of current stock size or pup production was available (Anon., 1987). In addition, it was concluded that the available data base was insufficient for an evaluation of the possible interaction between seals and other living resources in the area.

Since that time, a major part of the historical data base has been made available to the Working Group, but comprehensive analyses of this material were not carried out prior to the present meeting and could not be made during the meeting. Further, estimates of current stock size or pup production were not available, or were of a preliminary nature. Finally, little new information was available on the issue of interaction with other living resources.

The Working Group considers that significant progress is needed in respect to one or more of the priority research activities recommended in Section 5 before meeting again.

The Working Group still considers that exchange of research results from studies of all stocks of harp and hooded seals in the North Atlantic would be beneficial for assessing the status of any stock and giving management advice, and that one way of achieving this would be the establishment of a Joint ICES/NAFO Working Group on Harp and Hooded Seals (C.Res.1985/3:7).

APPENDIX I

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APPENDIX II

AGENDA

1. Chairman's welcome and opening remarks.
2. Appointment of rapporteur(s).
3. Adoption of Agenda.
4. Arrangements for the meeting.
5. Documentation.
6. Information on harp and hooded seal research in the Northwest Atlantic.
7. Status of seal stocks in the Greenland Sea.
 - 7.1 Hooded seal (Cystophora cristata)
 - 7.1.1 Catch and effort: Updating available information.
 - 7.1.2 Current regulatory measures.
 - 7.1.3 Status of research and data processing.
 - 7.1.4 Stock identity, distribution and migrations.
 - 7.1.5 Biological parameters.
 - 7.1.6 Population assessment.
 - 7.1.7 Management advice.
 - 7.2 Harp seal (Phoca groenlandica)
 - 7.2.1 - 7.2.7 sub-items as for hooded seal.
8. Ecology of the seal stocks.
 - 8.1 Variation in the physical environment.
 - 8.2 Feeding biology and energetics of seals.
 - 8.3 Relations between seal stocks, other marine resources, and man.
9. Future research.
10. Publications.
11. Future activities of the Working Group.
12. Recommendations.
13. Other business.
14. Adoption of report.

APPENDIX III

REFERENCES1. Working Documents Presented at the Meeting

- SGS-10 Norwegian and Soviet catches of harp and hooded seals in the West Ice, 1946-1987, and catches of moulting hooded seals in the Denmark Strait, 1945-1978.
- SGS-11 Øien, N. and Øritsland, T. Markings and recaptures of harp and hooded seals in the West Ice.
- SGS-12 Øien, N. Age compositions in 1982 to 1984 samples from breeding and moulting harp seals in the West Ice, with an evaluation of the age determinations.

2. Other References

- Anon. 1984. Soviet research on seals and catch of seal in the Northeastern Atlantic in 1984. Report by VNIRO and PINRO, Moscow 1984.
- Anon. 1986. Soviet Research on seals and catch of seal in the Northeastern Atlantic in 1986. Report by VNIRO and PINRO, Moscow 1986.
- Anon. 1987. Reports of the ICES Working Group on Seals in the Baltic and of the Working Group on Harp and Hooded Seals in the Greenland Sea. ICES Coop. Res. Rep. 148.
- Bowen, W.D. and Sergeant, D.E. 1983. Mark-recapture estimates of harp and seal pup (Phoca groenlandica) production in the northwest Atlantic. Can. J. Fish. Aquat. Sci. 40:728-742.
- Bowen, W.D., Myers, R.A. and Hay, K. 1987. Abundance estimation of a dispersed, dynamic population: hooded seals (Cystophora cristata) in the northwest Atlantic. Can. J. Fish. Aquat. Sci. 44:282-295.
- Jacobsen, N.O. 1984. Estimates of pup production, age at first parturition and natural mortality for hooded seals in the West Ice. Fisk. Dir. Skr. Ser. HavUnders. 17:483-98.
- Stenson, G.B., and Myers, R.A. (in press). Accuracy and pup classifications and its effect on population estimates in the hooded seal (Cystophora cristata). Can. J. Fish. Aquat. Sci.

APPENDIX IV

CATCHES OF HARP AND HOODED SEALS IN THE WEST ICE,
INCLUDING CATCHES TAKEN ACCORDING TO SCIENTIFIC PERMITSTable 1 Catches of hooded seals in the West Ice, 1946-1985,
including catches for scientific research.

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	67598	-	-	-	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+ a)
1956	31564	9224	40788	+	+	a)	31564+	9224+	40788+ a)
1957	13238	8951	22189	+	+	a)	13238+	8951+	22189+ a)
1958	38636	19906	58542	2861	3428	6299	41497	23344	64841
1959	22682	4536	27218	623	1246	1869	23305	5782	29087
1960	27572	5383	32951	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	0	7794	7794	-	-	-	-	-	-

a) For 1955, 1956, and 1957 Soviet reports catches of hooded and harp seals at about 3900, 11600, and 12900, respectively (Sov. Rep. 1975).

Table 2 Catches of harp seals in the West Ice, 1946-1985, 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	-	-	-	36076	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+ a)
1956	8983	6894	15877	+	+	a)	8983+	6894+	15877+ a)
1957	4847	11801	16648	+	+	a)	4847+	11801+	16648+ a)
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	5243	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	989	12936	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	13	2	15	4490	250	4740	4503	252	4755
1987	7961	3483	11444	-	-	-	-	-	-

a) For 1955, 1956, and 1957 Soviet reports catches of harp and hooded seals at about 3900, 11600, and 12900, respectively (Sov. Rep. 1975).

Table 3 Norwegian sealing effort in the West Ice, 1946-1985.

Year	Number of trips	Average duration of trips (days)	Average tonnage		Average horsepower	Average crew number
			Gross	Net		
1946	16	47	116	44	151	15
1947	33	39	122	43	206	17
1948	51	46	118	42	199	16
1949	44	45	119	41	206	16
1950	41	39	118	41	215	16
1951	36	40	123	49	250	17
1952	48	42	136	48	273	17
1953	38	45	152	52	309	17
1954	40	36	144	49	282	17
1955	45	37	137	47	271	17
1956	43	49	140	48	287	16
1957	40	48	142	48	301	17
1958	42	47	137	46	295	16
1959	45	55	134	46	264	16
1960	44	51	132	46	263	16
1961	40	37	137	47	302	16
1962	42	45	135	46	302	16
1963	43	53	139	49	320	17
1964	36	52	144	48	356	16
1965	38	49	144	50	407	16
1966	31	44	140	48	417	16
1967	25	38	146	49	484	16
1968	23	42	162	55	553	15
1969	20	49	157	52	519	16
1970	19	38	156	58	528	15
1971	18	23	154	51	548	13
1972	20	42	165	56	551	13
1973	16	37	164	55	526	13
1974	16	42	163	55	561	13
1975	15	39	163	54	573	12
1976	15	51	174	61	650	13
1977	13	43	174	61	642	12
1978	11	42	198	73	773	12
1979	10	46	224	84	910	13
1980	3	52	266	107	1034	13
1981	7	52	281	119	1070	13
1982	6	36	334	134	1348	14
1983	2	39	352	144	1325	10
1984	2	41	237	86	970	10
1985	1	37	178	72	940	9
1986	2					
1987	5					

Table 4 Soviet sealing in the Jan Mayen Area ("West Ice")¹⁾

Year	Number of vessels	Average duration of trips (days)	Average tonnage		HP	Average crew number
			Gross	Nett		
1958	7	.	140 ²⁾			23
1959	7	.	200			23
1960	5	22	200			23
	2	42	200			23
1961	7(8) ³⁾	42	200			23
1962	4(7)	46	200			23
1963	7(8)	47	200			23
1964	7(8)	46	200			23
1965	7	46	200			23
1966	4	46	200			23
...	4)					
1975	1	45	.			.
1976	2	24	.			.
1977	3	16	1.971	597	3.300	68
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						

- 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.

APPENDIX V

Summaries of Norwegian sealing regulations for the West Ice, 1985-1987.

Season	Opening date	Closing date	Quotas						Other Regulations ¹	
			Total	Pups	Females	Males	Norway	USSR		
<u>Hooded Seals</u>										
1985	22 March	5 May	(20,000) ²	(20,000) ²	3		unlim.	8,000 ⁴	3,300	Breeding females protected ³
1986	18 March	5 May	9,300	9,300	3		unlim.	6,000	3,300	Breeding females protected ³
1987	18 March	5 May	20,000	20,000	3		unlim.	16,700	3,300	Breeding females protected ³
<u>Harp Seals</u>										
1985	10 April	5 May	(25,000) ²	(25,000) ²	5	5		7,000	4,500	1 year+ protected ⁵
1986	22 March	5 May	11,500	11,500	5	5		7,000	4,500	1 year+ protected ⁵
1987	18 March	5 May	25,000	25,000	5	5		20,500	4,500	1 year+ protected ⁵

¹ 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 Two pups deducted from quota for each female taken for safety reasons.

⁴ Adult males only.

⁵ Pup quota may be filled by 1 year+ after 10 April.

APPENDIX VI

Table 1 Age samples of hooded seals at Jan Mayen and Denmark Strait.

Year	S o v i e t D a t a			N o r w e g i a n D a t a					
	Jan Mayen			Jan Mayen			Denmark Strait		
	♂♂	♀♀	Total	♂♂	♀♀	Total ^{a)}	♂♂	♀♀	Total ^{a)}
1954				.	.	164			
1955							.	.	145
1956							.	.	729
1957				.	.	97	.	.	1264
1958	121	58	179	108	79	496	.	.	3098
1959	60	12	72	(hooded & harp 800)			.	.	c.1300
1960	102	52	154				.	.	1381
1961	211	194	405						
1962	790	599	1389	.	.	789	252	140	393
1963	216	347	563	.	.	776	167	109	276
1964	282	259	541	.	.	29	141	161	308
1965	540	308	848						
1966	70	55	125				228	155	383
1967	-	-	-				202	155	358
1968	-	-	-	.	.	58			
1969	-	-	-	.	.	87			
1970	-	-	-				452	339	791
1971	-	-	-	40	13	112	-	-	-
1972	-	-	-	56	126	182	482	376	858
1973	-	-	-	72	242	458	-	-	-
1973(Dutch)	55		55						
1974	-	-	-	127	190	217	707	494	1101
1975(Dutch)	259		259						
1975	153	219	372	311	793	1104	- ^b	- ^b	-
1976	84	88	172	60	117	177	212 ^b	108 ^b	320
1977	206	247	453	372	618	990	- ^b	- ^b	-
1978	164	202	366	367	510	877	677 ^b	523 ^b	1200
1979	.	.	.	1107 ^b	470	1577	-	-	-
1980	97	172	269	330 ^b	248	578	-	-	-
1981	17	27	44	612 ^b	54	666	-	-	-
1982	322	203	525	1579 ^b	371	1950	-	-	-
1983	.	.	.	26 ^b	-	26	-	-	-
1984	-	-	-	341 ^b	119 ^b	460	-	-	-
1985	85	46	131	49 ^b	20 ^b	69	-	-	-
1986	189	243	432	-	36 ^b	36	-	-	-
1987									

a) Totals include specimens of unknown sex.

b) Sample not analyzed, or not presented in the reports.

Data extracted from Rasmussen (1960), Jacobsen (1984), and the national reports to the Norwegian-Soviet Sealing Commission.

Table 2 Age samples of harp seals at Jan Mayen.

Preliminary Survey

Year	S o v i e t D a t a				N o r w e g i a n D a t a					
	Whelping		Moulting a)		Whelping		Moulting a)			
	♀♀ ++	Total	♂♂ ++	♀♀ ++	Total	♀♀ ++	♂♂ ++	♀♀ ++	Total b)	
1953							.	.	166	
1954							.	.	798	
1955							.	.	478	
1956							.	.	34	
1957										
1958						.	95			
1959			55	31	86	.	106			
1960			50	111	161					
1961			133	210	343					
1962			334	370	704	.	706			
1963			159	20	179	.	1.037			
1964			363	53	416	.	.	.	3	
1965	197	197	102	35	137	.	.	.	165	
1966	-	-	-	-	-					
1967	-	-	-	-	-					
1968	-	-	-	-	-	41	41	42	15	76
1969	-	-	-	-	-			.	.	27
1970	-	-	-	-	-					
1971	-	-	-	-	-					
1972	-	-	-	-	-			.	.	77
1973	-	-	-	-	-					
1974	-	-	-	-	-					
1975										
1976	30	30				39	39	-	17	17
1977	252	252				265	265	865	316	1.181
1978								15	15	33
1979								66	104	176
1980								993	222	1.215
								+523	+256	+779 c)
1981								+942	+226	+1.168
								+55	+10	+65 c)
1982	217	217						1.502	857	2.359 c)
1983								1.801	616	2.417 c)
1984								1.142	604	1.746 c)
1985								9	16	25 c)
1986	248	248						-	2	2 c)
1987										

a) For some of the early samples it is not stated whether they are whelping or moulting animals, or both.

b) Some totals include specimens of unknown sex.

c) Sample not analyzed, or not presented in the reports.

Data extracted from Rasmussen (1957), and the national reports to the Norwegian-Soviet Sealing Commission.

