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NINTH SPECIAL COMMISSION MEETING - DECEMBER 1976

Report of Special Meeting of Panel A (Seals)

Copenhagen, Denmark, 14 October 1976

1. Opening. The meeting was called to order by the Chairman of the Panel, Mr E. Lemche (Denmark), who welcomed participants to Denmark on behalf of the Danish Government. All Panel Member Governments were present (Appendix I).
2. Rapporteur. The Executive Secretary, Mr L.R. Day, was appointed Rapporteur.
3. Agenda. The Agenda was adopted as circulated (Appendix II).
4. Report of Scientific Advisers to Panel A (Seals). The Chairman drew attention to the Report of the Meeting of the Scientific Advisers (Appendix III) held 11 and 12 October 1976 in Copenhagen. The Panel agreed that the Chairman of Scientific Advisers to the Panel, Dr A.W. Mansfield (Canada), should present the portion of the Report of the Scientific Advisers on harp seal matters first for Panel discussion and then on hooded seal matters.
5. Consideration of Harp Seal Matters
 - (a) Scientific advice

The Chairman of Scientific Advisers reported that four assessments were considered as follows:

 - (1) an assessment by Winters (Canada) indicating a pup production of 310,000-340,000 with a sustainable yield of 215,000;
 - (2) a model by Benjaminsen (Norway) and Lett (Canada) indicating a pup production of 327,000 with a sustainable yield of 190,000;
 - (3) an assessment, incorporating new sampling data, by Benjaminsen and Øritsland (Norway) indicating a pup production of 315,000 with a sustainable yield of 210,000;
 - (4) Guelph models by Capstick *et al.* indicating, for three of the five models recommended for consideration by its authors, a pup production of 249,000-313,000 with a sustainable yield of 103,000-130,000 (113,000-140,000 if catch at Greenland and northern Canada included as in (1), (2), and (3) above.)

Regarding advice on management, the majority of Scientific Advisers agreed that the population level of 1+ seals producing maximum sustainable yield (MSY) was approximately 1.6 to 2.0 million with an MSY of 240,000-270,000 (assuming the same age composition of the catches as in recent years). All assessments, except the Guelph models, indicated that a TAC of 170,000 (including Greenland and northern Canada) would allow the population to increase to this level in 15-20 years, whereas the Guelph models indicated that catches above 130,000 (exclusive of Greenland and northern Canada) would cause a decline.

A recent increase was noted in harp seal catches by landmen, particularly in that part of the catch taken by small vessels (< 150 tons). Vessel numbers increased from 45 in 1972 to 180 in 1976.

With regard to harp seal-fish interactions, the Scientific Advisers noted that a wide spectrum of food is taken, comprising mostly small pelagic fish and crustaceans. The annual consumption may be 300,000-500,000 metric tons, there being insufficient data on energetics to specify food requirements precisely.

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The Scientific Advisers reported that, because of the complexity of the system involved, it would be many years before models of predictive value could be available.

Research recommended for 1977 on harp seals by the Scientific Advisers included:

- (1) complete aerial ultra-violet survey with good survey design and rigorous ground control;
- (2) detailed age and sex sampling of landmen's catches;
- (3) further study of natural mortality rates of immatures;
- (4) studies on age at maturity and pregnancy rates for both the Gulf and Front; and
- (5) studies of the sex ratio of catches at each age-class.

The delegate of Norway asked why the production and sustainable yield figures of the Guelph models were low compared to those from the other assessments. Dr Mansfield replied that the Guelph model was based on a projection forward from a population based on a pup production of 645,000 in 1951 obtained from the first aerial census which might not be correct. Also, hypothetical natural mortality rates used were higher for immature seals than those determined in the other assessments.

The delegates of Canada and Denmark, in commenting on the Report of the Scientific Advisers, congratulated the scientists on the progress being made in narrowing their differences regarding production, yield and allowable catches. They were pleased to note the close preparatory international cooperation among the scientists involved and felt that the work could be supported with confidence.

The Panel Members agreed that the policy of allowing slow increase of the stock to maximum sustainable yield (MSY) level should be the basis for the future work of the scientists in providing advice for management of the seal stocks.

The delegate of Canada referred to the excellent scientific cooperation in ICNAF and assured the Panel Members that such cooperation by Canadian scientists would continue regardless of the future management regime in the Northwest Atlantic area.

(b) Relationship between harp seals and fish populations

The Chairman drew attention to the Report of the Scientific Advisers which pointed out that, because of the complexity of the seal-fish interaction, it would be many years before predictive models could be produced. The delegate of Canada pointed out that, although major advances in the dynamics of fish populations were leading to better management, there were changes in rates of removal of fishes which could not be explained as the results of fishing; the seal-fish relationship could be one of the causes of such changes and should be part of a more extensive study of their interaction with other species such as the birds and whales in the ecosystem.

The delegate of Denmark agreed that more knowledge of species interactions was needed. He recognized that, although the seal would be preferred to capelin in Greenland hunting districts, the situation may be different in the Newfoundland area.

The delegate of Canada pointed out that capelin harvesting was being approached very cautiously as its relationship in the seal-capelin-cod complex was virtually unknown. He suggested that an expanded program and sophisticated modelling was necessary and urged other countries to join in this type of study. Scientists from Canada and Denmark pointed out that this problem was recognized by fishery institutions and scientists throughout the world and that ICES papers on the subject of interspecies relationships had recommended an increase in studies on the subject in the North Atlantic as a whole.

(c) Conservation measures

The delegate of Canada again expressed his pleasure at the progress the scientists had made. As a preliminary view, he was prepared to accept a TAC (including Greenland and northern Canada) of up to 170,000 as it would allow for rebuilding the stock to the MSY level. He felt, however, that there could be further improvement to conservation by restricting capture of 1+ harp seals by the large vessels to a maximum of 2%. He acknowledged that there was a need for time for all to consider such a proposal and suggested Panel Members explore through correspondence and be prepared to make a decision at a short Panel Meeting to be held in conjunction with the Special Commission Meeting in December 1976.

The delegate of Denmark noted that the previous basis for management had been by seal pup unit and saw some good in restricting the catch of older seals in the Front. However, he would like to study the effect of such a measure on the Greenlanders' catch and on the hunting pattern.

The Chairman of the Greenland Provincial Council, Mr L. Chemnitz, addressed the Panel saying how happy he was to attend and to gain new knowledge and hear the views of others. He emphasized the great dependence of the Greenlanders on seals which were used for food, clothing, and the export of fur. He said that Greenlanders think it immoral to take seals for their fur only and, therefore, disliked seeing the ships taking

seal pups. He noted that there had been a decrease in the numbers of seals at Greenland over the last 10 years and that Greenlanders had no objection to the catch limitation proposal as they wanted to see the stocks rebuild as soon as possible.

The delegate of Norway pointed out that there were difficulties for everyone. He believed that a TAC of 170,000 was a conservative one and he could agree with it but only for the 1977 sealing season. He agreed that a decision should be delayed until the time of the Commission's December Meeting.

The delegate of Canada expressed his pleasure at the general agreement with the conservative approach of a 170,000-TAC and assured the Panel Members that improvement through the reduction in capture of older seals would help the Greenlanders. He pointed out that, with the decline in the Canadian finfish fisheries, seal hunting was becoming more important to the coastal communities. He assured the Panel Members that the use of seals for food was high and studies were underway to make even greater use of seals for protein.

The Chairman noted that the TAC of 170,000 would rebuild the stock level to MSY in 15 to 20 years, whereas the Greenlanders had said they would like to see restoration as soon as possible. He asked if the scientists could develop models showing restoration periods using various percentages of captures of 1+ seals. The Chairman of Scientific Advisers replied that the present model uses 80% pup capture and that other calculations could be made if required.

The delegate of Canada, noting the short time to the December Meeting and the need for further scientific examination of the conservation measures to be applied, suggested that Canada would submit a written proposal to Denmark and Norway including the scientific rationale respecting implications for the TAC and rebuilding of the seal stocks.

The Chairman agreed and suggested that new data could be put into the Benjaminsen and Lett model to provide new advice.

The Chairman of the Scientific Advisers pointed out that any change in the model of the pup to adult capture ratio would not change the TAC but would only give different times to attainment of the MSY.

The delegates of Denmark and Norway agreed that it would be difficult to have a Scientific Advisers Meeting to look at the problem and agreed that the scientists should be encouraged to develop new data which Canada would take into account in presenting its proposal with the scientific rationale to Denmark and Norway before the Panel Meeting in December 1976.

The delegate of Canada proposed using the same opening and closing dates and times for the hunt as set in 1976 (opening 0900 hrs GMT 12 March and closing at 2400 hrs GMT on 24 April) with the proviso that Canada and Norway might agree to delay the hunt in order that the proposed aerial photographic study of the Gulf and Front could be completed.

The delegates of Norway and Denmark agreed to the opening and closing dates and times for the hunt. The delegate of Norway stressed that after the closing time all killing must stop but, with the clear understanding, that previously killed seals could be taken on board the ships. The delegate of Canada supported this understanding.

The Chairman, in reviewing the discussions, noted that tentative agreement had been reached on a TAC of 170,000 and the opening and closing dates and times for the hunt, and that further consideration would be given to reducing the take of 1+ seals. The Panel Members agreed to look forward to the Canadian proposal with its scientific rationale and to the allocation of a final agreed TAC at the December Meeting of the Panel.

6. Consideration of Hooded Seal Matters

(a) Scientific advice

The Chairman of the Scientific Advisers reported that an incomplete aerial photographic survey of the Davis Strait area showed approximately 5,000-10,000 animals. The Front hunt was intensive but the Norwegian catch per unit of effort had remained stable. There would thus seem no reason to recommend a change in the current TAC of 15,000. He stressed the need for population modelling as done for harp seals, an aerial photographic survey of Davis Strait and completion of analysis of Norwegian age data from moulters in Denmark Strait.

(b) Conservation measures

The delegate of Canada believed that the scientific basis for harp seal management was stronger than for hooded seals and that the future research and modelling proposed would give a much firmer basis for hooded seals next year. The delegate of Norway, in response to the Chairman's question, reported that completion of the Norwegian age data analysis depended on program priorities, funding and manpower. He could not promise completion for next year.

The delegate of Canada expressed concern regarding the 15,000 TAC level. He noted that there had been a recent increase in the West Greenland catches which had not been included in previous assessments. He looked forward to the development of a model which included data from Newfoundland, Greenland, and the northern areas combined. He preferred a lower TAC than 15,000 but would find the 15,000 more acceptable if, to improve the quality of the conservation, the numbers of breeding females taken would be reduced from the current 20% to less than 10%. He realized the suggestion was new and needed study before any decision was made. He further suggested that Canada would submit a proposal with attached scientific rationale which could form the basis for a decision at the December Meeting.

The delegate of Denmark questioned whether the increased catch at West Greenland was due to greater abundance or greater availability. He agreed that a model should be developed, taking into account all available data, and that efforts should be directed toward determining the relationship between the seal herds in the Denmark and Davis Straits, on the Front and at Jan Mayen Island. He agreed that, although the suggested TAC of 15,000 was based on the history of catches and might be a little high, the stable Norwegian catch per unit of effort indicated that the abundance was not affected. He looked forward to studying the Canadian proposal for lowering the percentage of breeding females taken in the hunt. He felt that the 1976 prohibition from killing whelping seals in Davis Strait from vessels over 50 gross tons should be retained for the 1977 season.

All Panel Members agreed that the regulation prohibiting the killing of whelping hooded seals in Davis Strait by vessels over 50 gross tons should be maintained for 1977.

The delegate of Canada suggested that the opening and closing dates and times for the 1977 hunt should be the same as for 1976 but he said there was considerable concern about the opening and closing times for the killing of hooded seals each day because of the shots that were missed due to the darkness at the times set in the 1976 regulations. The delegate of Norway agreed that the 1977 opening and closing dates should be as for 1976 (1000 hrs GMT on 22 March to 2400 hrs GMT on 24 April) and suggested that the prohibition to kill should be changed for vessels on the Front during the open season each day, from "between the hours of 2300 GMT and 1000 GMT up to 31 March..." to "between the hours of 2200 GMT and 0900 GMT up to 31 March..."

All Panel Members agreed to this suggestion and to leave the final decision on TAC and allocations, reduction of kill of breeding females and opening and closing dates and times for the season and daily hunting times to the December Meeting when the Canadian proposal with attached scientific rationale would have been circulated and studied.

7. Other Matters. The Panel noted that resolution (3) from the 1976 Annual Meeting (1976 Annual Meeting Proc. 14, Appendix III) provided for early implementation of the 1977 harp and hooded seal conservation proposals to be approved at the December 1976 Meeting of the Panel.

The Panel agreed to adopt the research plans proposed by the Scientific Advisers for harp and hooded seals for 1977. The delegate of Norway agreed that funds would be made available for Mr Benjaminsen (Norway) to meet with Mr Lett (Canada) in Canada during the summer of 1977, at a time and place to be agreed by correspondence, to develop a model of the hooded seal population. An invitation was extended to have a Danish scientist take part in the exercise.

8. Release of Research Documents. The Chairman of Scientific Advisers reported that, because of public interest in seal management, pertinent documents might be released to the public with prior approval of the author(s). Each document published would have a label reading, instead of "Restricted" as at present, "Not to be cited without prior reference to the author(s)". The Panel agreed that this was a valuable suggestion and could be helpful in preventing some of the misunderstandings which were occurring.

9. Approval of Report. The Panel agreed that the Executive Secretary would circulate copies of a draft of the Panel A Report to participants. Heads of delegations would collect suggestions for changes and send them to the Executive Secretary for preparation of a revised draft to be sent to heads of delegations before final approval at the December Meeting of the Panel.

10. Future Meetings. The Panel agreed that the Scientific Advisers meeting should be held in the autumn of 1977, perhaps at the time of the ICES meeting, but the final decision would be made at the December Meeting of the Panel.

The Panel agreed that its next meeting would be held beginning 0830 hrs on 1 December 1976 at the site of the Ninth Special Commission Meeting, Tenerife, Canary Islands.

11. Adjournment. There being no other business, the Panel adjourned at 1325 hrs, 14 October 1976.

NINTH SPECIAL COMMISSION MEETING - DECEMBER 1976

Special Meeting of Panel A (Seals)
Copenhagen, Denmark, 14 October 1976

List of Participants

(Head of Delegation underlined)

Chairman: Mr E. Lemche, Ministry for Greenland, Hausergade 3, DK-1128 Copenhagen K. Denmark

CANADA

Commissioners:

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Advisers:

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Mr T.V. Curran, Fisheries and Marine Service, Department of Fisheries and Environment, Goose Bay, Labrador
Mr F. Dopplinger, Department of Fisheries, Province of Newfoundland, St. John's, Nfld.
Mr C.G. Friend, Fisheries and Marine Service, Department of Fisheries and Environment, Information Branch, Ottawa, Ont.
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NORWAY

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Mr N. Bølset, Ministry of Foreign Affairs, Utenriksdepartementet, Oslo-Dep.

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Mr K. Kristoffersen, Norwegian Seamen's Association, Oslo

NINTH SPECIAL COMMISSION MEETING - DECEMBER 1976

Special Meeting of Panel A (Seals)
Copenhagen, Denmark, 14 October 1976

Agenda

1. Opening by the Chairman, Mr E. Lemche (Denmark)
2. Appointment of Rapporteur
3. Adoption of Agenda
4. Report of Meeting of Scientific Advisers, Copenhagen, 11 and 12 October 1976, by Chairman, Dr A.W. Mansfield (Canada)
5. Assessment of the relationship between seal and fish populations
6. Conservation requirements
 - (a) for harp seals
 - (b) for hooded seals
7. Research requirements
8. Approval of Panel Report
9. Date and place of next meeting of Panel A and Scientific Advisers
10. Other business
11. Adjournment

NINTH SPECIAL COMMISSION MEETING - DECEMBER 1976

Report of Scientific Advisers to Panel A (Seals)

Copenhagen, Denmark, 11 and 12 October 1976

1. The meeting was called to order by the Chairman, Dr A.W. Mansfield (Canada), with the following participants.

Canada - Dr A.W. Mansfield
Dr C.K. Capstick
Mr P.F. Lett
Dr A.W. May
Mr M.C. Mercer
Dr D.E. Sergeant
Dr G.H. Winters

Denmark - Mr Sv.Aa. Horsted
Mr F.O. Kapel

Norway - Mr T. Benjaminsen
Mr T. Øritsland

ICNAF - Mr L.R. Day

2. Rapporteur. Mr M.C. Mercer (Canada) was appointed Rapporteur.

3. Agenda. The agenda (Annex 1), as proposed by the Chairman, was adopted without revision. A list of pertinent documents (Annex 2) was presented by the Executive Secretary, Mr L.R. Day.

4. Harp Seals

(a) Results of research in 1976

Canada reported results of 1976 studies relating to estimation of selectivity in the shooting kill of moulting seals, age at sexual maturity, and age composition of seals taken in the shore-based fisheries (Res. Doc. 76/X/124). A planned aerial census of Front and Gulf herds by the University of Guelph, using ultra-violet photography, was not completed. Estimates of mortality, stock size and production were made, and various management strategies indicated (Res.Docs. 76/X/127, 76/X/130, and 76/X/132).

In addition to providing co-authorship of one of the above documents (Res.Doc. 76/X/130), Norway reported on field operations on the Front in 1976 (Res.Doc. 76/X/132) and also provided further unpublished estimates of mortality and production from age samples collected there in 1976.

Denmark provided unpublished catch and age composition data on harp seals in Northwest Greenland, 1972-75, which indicated an inverse correlation between catch of pups in the Gulf and Front areas and subsequent catches of beaters and bedlamers in Northwest Greenland in the following summer.

(b) Mortality estimates

Estimates of total and natural mortalities were obtained in several ways:

- (1) In Res.Doc. 76/X/127 estimates of total mortality (Z) were derived from catch curves based on age composition data (sexes combined) for moulting seals of age-groups 5-13 for the years 1968-74. These were adjusted for instantaneous rates of change in recruitment (due to declining pup production) and changes with hunting mortality (F) with time. Instantaneous hunting mortalities were calculated separately by sex, combined and weighted by catch composition, and subtracted from Z to give $M = 0.115$ for both sexes combined. The mortality rate of immature seals was computed from cohort analysis and did not appear to be significantly different from that of adults.
- (2) In Res.Doc. 76/X/130 instantaneous total mortality rates were calculated using Paloheimo's linear formula (excluding 1-year-old seals), and hunting mortality (F) was derived from the halving of hunting effort following implementation of quota regulations in 1971. The estimate of natural mortality from the solution of appropriate equations was $M = 0.114$.
- (3) In Res.Doc. 76/X/132 hypothetical natural mortalities were applied to each age-group, with relatively high values for age-groups 0-2, and rapidly increasing values for age-groups 22 to 29. The

weighted average annual natural mortality was similar to that used in Res.Doc. 76/X/130. Mortality from the northern Canadian and Greenlandic hunt was considered as part of the natural mortality.

- (4) Unpublished data presented by Norway included age frequencies of moulting males in 1969-76. Mortality rates, calculated from catch curves for males in age-groups 2-12 corrected for changes in recruitment, gave a mean value of $M = 0.1058$.
- (c) Estimates of production in 1976 and sustainable yield in 1977
 - (1) In Res.Doc. 76/X/127 survival indices and a stock recruitment model were used to derive estimates of 310,000 to 340,000 with a sustainable yield of 215,000.
 - (2) In Res.Doc. 76/X/130 cohort analysis was used to derive a figure for the population in 1961. This population, projected forward to 1976, gave a pup production of 327,000, with a sustainable yield of 190,000 in 1977. These values were lower than those calculated in Res.Doc. 76/X/127, owing in part to the incorporation of random variation in natural mortality (M) and landsmen's catches.
 - (3) In tables of unpublished data presented by Norway, the mortality rate was used to estimate production of 346,000, or a more conservative estimate of 315,000 using functional regression. Sustainable yield from the latter estimate was 210,000.
 - (4) In Res.Doc. 76/X/132 a model, hereinafter called the Guelph model, was used to derive five population forecasts. These gave pup productions ranging from 193,000 to 321,000, with sustainable yields from 65,000 to 160,000 (exclusive of the aboriginal catch). Three of these, considered by the authors to be the most appropriate, gave productions ranging from 249,000 to 313,000 and sustainable yields from 103,000 to 130,000.

The Guelph model is based on:

- (i) a projection forward from a population based on a pup production of 645,000 in 1951, obtained from the first aerial census performed on harp seals in Canada;
- (ii) distribution of the bedlamer and adult catches in proportion to relative abundance in each age-group;
- (iii) hypothetical age-specific natural mortality rates, which are much higher in the immature age-classes than those described in the other Research Documents (76/X/127 and 76/X/130) and the unpublished Norwegian data. These are considered to be one of the principal factors in producing the low sustainable yields mentioned above.

(d) Advice on catch levels in 1977

A submission (Res.Doc. 76/X/133) suggested that management criteria, established by the International Whaling Commission (IWC) in 1974, be considered when formulating management policy for the harp seal population. The Scientific Advisers concluded that:

- (1) harp seal and large whale populations have quite different vital rates which would affect their recovery time;
- (2) the IWC-management regime was formulated as a response to widely different management objectives, some of which were not biologically based. It has no particular relevance to harp seal management;
- (3) there is no biological reason why a seal stock cannot be managed at a much lower level than that providing Maximum Sustainable Yield (MSY).

The Scientific Advisers' interpretation of the current management policy for the Northwest Atlantic harp seal stock is that the stock be allowed to rebuild towards MSY level. These objectives may require re-examination depending on the future assessment of relationships between seals and other marine life.

The majority of Scientific Advisers agreed that the MSY population size lay between 1.6 and 2.0 million seals, 1 year of age and older. The sustainable yields associated with this level of population were from 240,000 to 270,000, assuming the same proportion of adults to pups in catches as those currently observed. Furthermore, a Total Allowable Catch (TAC) of 170,000 (including aboriginal kill) would allow a continued increase towards attainment of MSY level in about 15 to 20 years. However, the population projections in the Guelph model considered appropriate by the authors indicate that levels of kill above 130,000 (excluding aboriginal kill) would cause a population decline.

(e) Recent trends in landsmen's catch

The Scientific Advisers noted a recent increase in the landings by landsmen, particularly in that part

of the catch taken by vessels of less than 150 tons (Fig. 1). Participation increased consistently from 45 vessels in 1972 to 180 in 1976. The Scientific Advisers also noted that the average level of annual catch over the period 1965-76 was 48,421.

(f) Future research on harp seals

The Scientific Advisers agreed on the following priorities in research in 1977:

- complete aerial photographic (ultra-violet) census of pups with refined survey design and rigorous ground control;
- detailed age and sex sampling of landsmen's fisheries;
- refined estimates of natural mortality, especially of juveniles;
- refined estimates of age at maturity and pregnancy rates in the Gulf and on the Front;
- refined estimates of sex ratio by age-classes.

The Scientific Advisers agreed that since age samples of moulting seals were necessary for the best scientific advice, and since quota catches by large vessels now rarely included moulting seals, scientific permits might be required for Canada and Norway to take a total of about 1,200 animals. This number would be needed to ensure a sufficient sample of 800 males.

5. Hooded Seals

(a) Results of research in 1976

Canada reported results of 1976 studies concerning aerial survey of breeding seals in Davis Strait, tagging and branding recoveries, and estimates of production and yield (Res.Doc. 76/X/126). Norway reported on field operations on the Front in 1976, during which a few hooded seals were tagged and a large number sampled for age (Res.Doc. 76/X/131). Recoveries in Newfoundland and on the west coast of Greenland of three hooded seals tagged in Denmark Strait in 1974 were also reported. Denmark provided preliminary data on catches of hooded seals in Greenland (Fig. 2) which suggest that the species has become more readily available in the last decade, especially in South Greenland.

(b) Mortality estimates

No new data were available.

(c) Estimates of production in 1976 and sustainable yield in 1977

- (1) Davis Strait. Whelping hooded seals were discovered in Davis Strait by aerial survey on 22 and 24 March 1976, close to where they had been located in March 1974. Incomplete, photographic estimates of the small patch seen on 22 March gave a count of 4,200 adult seals. On 24 March a patch of scattered seals was seen on more diffuse ice in the same general area, but it could not be determined if this was the same group seen previously. Visual estimates suggested a population size of between 5,000 and 10,000 adult seals.
- (2) The Front. A sample of 208 females, collected in 1976, was aged and combined with five years' similar data from Norway collected in 1967 and 1971-74, and 2 years' data collected in Canada in 1953 and 1966. The percentage of 5-year-old females in each sample was plotted against catch of young and gave an estimate of production of 23,000 from the functional regression. While there is some evidence that the hunt is intensive, it was noted that the catch per unit effort, as calculated for the Norwegian fleet for 1966-76, remained stable.

(d) Advice on catch levels in 1977

The Scientific Advisers considered that the new evidence did not provide a firm basis for altering for 1977 the TAC of 15,000 recommended for 1976 by the Scientific Advisers at their last meeting in Bergen in December 1975.

(e) Future research on hooded seals

The Scientific Advisers agreed on the following programs of research in 1977:

- the joint development of a population model, employing all available data;
- further aerial survey of whelping seals in Davis Strait.

The Scientific Advisers noted that Norway has a large age sample from the moulting patches in Denmark Strait which still needs to be analyzed. Although outside the ICNAF Area, Denmark Strait is thought to be the main moulting area for hooded seals from both the Front and Jan Mayen populations. The Scientific Advisers urge Norway to complete analyses of these data.

6. Assessment of the Relationship Between Seal and Fish Populations

Harp seals have a very wide food spectrum which comprises small pelagic fish, shrimps, and euphausiids. The most important fish by weight eaten in the Northwest Atlantic is capelin. At the current population level, annual consumption of capelin has been variously estimated to be of the order of 300,000 to 500,000 metric tons (Res.Doc. 76/X/125), most of which is taken about Newfoundland, but some also at West Greenland. A similar amount may also be eaten by the great whales. The dependence of a vast biomass of cod and many species of seabirds on capelin means that complex models will have to be constructed. The use of such models to predict changes in the level of one species from changes in the level of another will require the input of much biological and environmental data which may take many years to obtain.

7. Time and Place of Next Meeting

The Scientific Advisers stress the difficulty of providing analyses of new data from the current sealing season in time for the Annual Meeting of ICNAF. They, therefore, recommend that their next meeting take place in the fall of 1977.

8. Other Business

Release of research documents

Because of the general public interest in the subject of seal management, the Scientific Advisers agreed that pertinent documents should be released with prior approval of the authors. For this purpose the current "Restricted" label should be removed from the documents concerned and replaced by a legend "Not to be cited without prior reference to the author". This is the practice currently followed by ICES.

The Scientific Advisers also recommend to the Panel that the Commission should be asked to consider early release of the reports of meetings of the Panel, together with reports of the Scientific Advisers.

9. Approval of Report of Scientific Advisers

The Scientific Advisers met at the Ministry for Greenland, Hausergade 3, on 13 October, and approved the draft report. There being no other business, the Chairman adjourned the meeting.

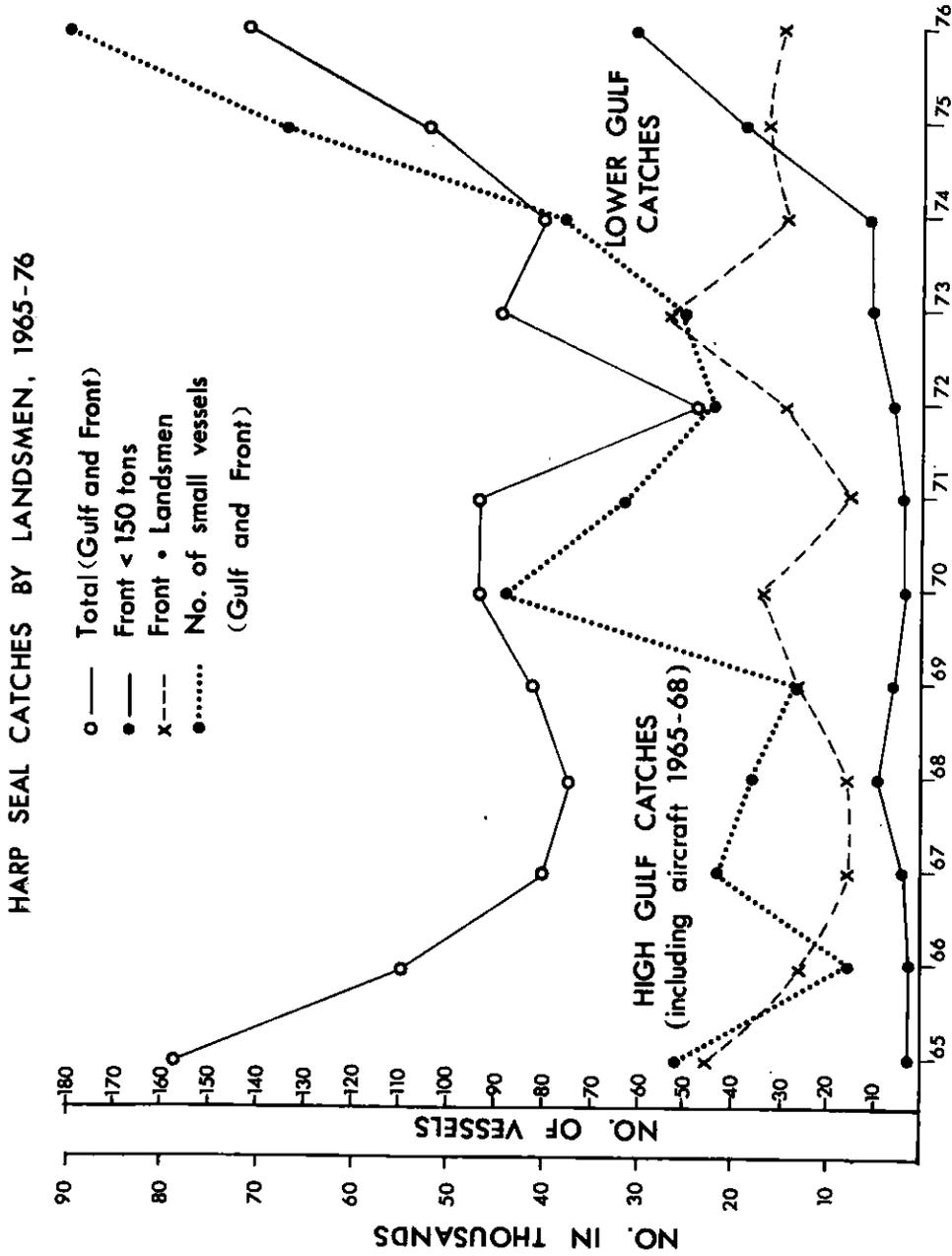


Fig. 1. Harp seal catches by landmen, 1965-1976.

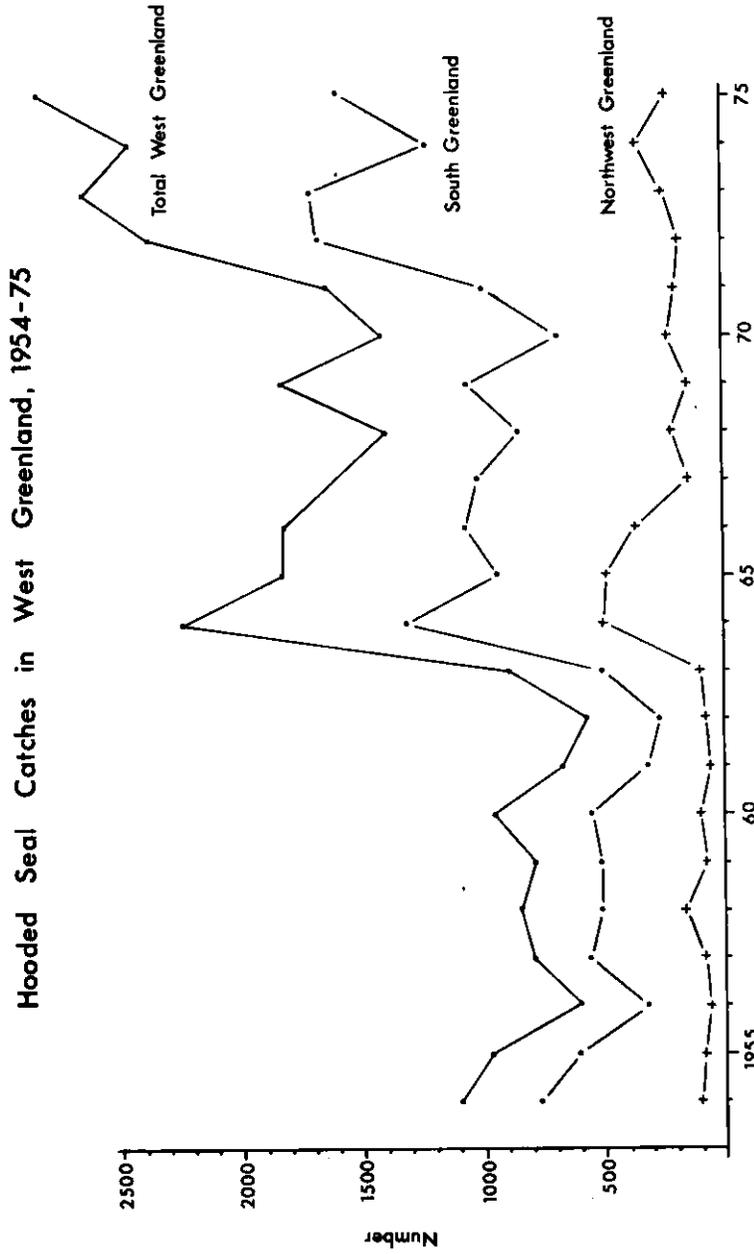


Fig. 2. Catch of hooded seals in West Greenland, and in two important regions within that area, 1954-1975.

NINTH SPECIAL COMMISSION MEETING - DECEMBER 1976

Special Meeting of Scientific Advisers to Panel A (Seals)
Copenhagen, Denmark, 11 and 12 October 1976

Agenda

1. Opening by the Chairman, Dr A.W. Mansfield (Canada)
2. Appointment of Rapporteur
3. Adoption of Agenda
4. Harp seals
 - (a) Population status
 - (b) Recommendations for Total Allowable Catch in 1977
 - (c) Future research
5. Hooded seals
 - (a) Population status
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6. Assessment of the relationship between seal and fish populations
7. Time and place of next meeting
8. Other business
9. Approval of Report of Scientific Advisers
10. Adjournment

Serial No. 4020
(B.g.6)

ICNAF Summ.Doc. 76/XII/47
Appendix III
Annex 2

NINTH SPECIAL COMMISSION MEETING - DECEMBER 1976

Special Meeting of Scientific Advisers to Panel A (Seals)
Copenhagen, Denmark, 11 and 12 October 1976

List of Pertinent Documents

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76/X/131	4017*	The sealing season and Norwegian seal investigations off Newfoundland-Labrador in 1976	B. Bergflødt
76/X/132	4018*	Population forecasts for Northwest Atlantic harp seals, <i>Pagophilus groenlandicus</i>	C.K. Capstick, D.M. Lavigne & K. Ronald
76/X/133	4019*	The present status of western Atlantic harp seals: a management consideration	D.M. Lavigne

<u>Working Paper No.</u>	<u>Title</u>	<u>Author</u>
76/X/1 (76/X/120*)	Age-group frequencies, mortality and production estimates for Northwest Atlantic harp seals updated from samples collected off Newfoundland-Labrador in 1976	T. Benjaminsen & T. Øritsland
76/X/2 (76/X/121*)	Canada: 1976 harp and hood seal catch in Northwest Atlantic - preliminary report	
76/X/3 (76/X/122*)	Sealing statistics - Norway, 1976	
76/X/4 (76/X/123*)	Revised catch and age composition data on harp and hooded seals in Northwest Greenland, 1972-1975	F.O. Kapel
76/X/5 (76/X/124*)	Harp seal catches by landmen, 1965-1976	

<u>Circular Letter No.</u>	<u>Title</u>	<u>Author</u>
76/56	Tag releases in the Northwest Atlantic, 1976	T. Øritsland

* Numbers assigned by Secretariat after meeting.

International Commission for



the Northwest Atlantic Fisheries

Serial No. 4020
(B.g.6)

ICNAF Summ.Doc. 76/XII/47
Appendix III

NINTH SPECIAL COMMISSION MEETING - DECEMBER 1976

Report of Scientific Advisers to Panel A (Seals)

Copenhagen, Denmark, 11 and 12 October 1976

* Executive Secretary, ICNAF, P.O. Box 638, Dartmouth, Nova Scotia, Canada B2Y 3Y9

NINTH SPECIAL COMMISSION MEETING - DECEMBER 1976

Report of Scientific Advisers to Panel A (Seals)

Copenhagen, Denmark, 11 and 12 October 1976

1. The meeting was called to order by the Chairman, Dr A.W. Mansfield (Canada), with the following participants.

Canada - Dr A.W. Mansfield
Dr C.K. Capstick
Mr P.F. Lett
Dr A.W. May
Mr M.C. Mercer
Dr D.E. Sergeant
Dr G.H. Winters

Denmark - Mr Sv.Aa. Horsted
Mr F.O. Kapel

Norway - Mr T. Benjaminsen
Mr T. Øritsland

ICNAF - Mr L.R. Day

2. Rapporteur. Mr M.C. Mercer (Canada) was appointed Rapporteur.

3. Agenda. The agenda (Annex 1), as proposed by the Chairman, was adopted without revision. A list of pertinent documents (Annex 2) was presented by the Executive Secretary, Mr L.R. Day.

4. Harp Seals

(a) Results of research in 1976

Canada reported results of 1976 studies relating to estimation of selectivity in the shooting kill of moulting seals, age at sexual maturity, and age composition of seals taken in the shore-based fisheries (Res. Doc. 76/X/124). A planned aerial census of Front and Gulf herds by the University of Guelph, using ultra-violet photography, was not completed. Estimates of mortality, stock size and production were made, and various management strategies indicated (Res.Docs. 76/X/127, 76/X/130, and 76/X/132).

In addition to providing co-authorship of one of the above documents (Res.Doc. 76/X/130), Norway reported on field operations on the Front in 1976 (Res.Doc. 76/X/132) and also provided further unpublished estimates of mortality and production from age samples collected there in 1976.

Denmark provided unpublished catch and age composition data on harp seals in Northwest Greenland, 1972-75, which indicated an inverse correlation between catch of pups in the Gulf and Front areas and subsequent catches of beaters and bedlamers in Northwest Greenland in the following summer.

(b) Mortality estimates

Estimates of total and natural mortalities were obtained in several ways:

- (1) In Res.Doc. 76/X/127 estimates of total mortality (Z) were derived from catch curves based on age composition data (sexes combined) for moulting seals of age-groups 5-13 for the years 1968-74. These were adjusted for instantaneous rates of change in recruitment (due to declining pup production) and changes with hunting mortality (F) with time. Instantaneous hunting mortalities were calculated separately by sex, combined and weighted by catch composition, and subtracted from Z to give $M = 0.115$ for both sexes combined. The mortality rate of immature seals was computed from cohort analysis and did not appear to be significantly different from that of adults.
- (2) In Res.Doc. 76/X/130 instantaneous total mortality rates were calculated using Paloheimo's linear formula (excluding 1-year-old seals), and hunting mortality (F) was derived from the halving of hunting effort following implementation of quota regulations in 1971. The estimate of natural mortality from the solution of appropriate equations was $M = 0.114$.
- (3) In Res.Doc. 76/X/132 hypothetical natural mortalities were applied to each age-group, with relatively high values for age-groups 0-2, and rapidly increasing values for age-groups 22 to 29. The

weighted average annual natural mortality was similar to that used in Res.Doc. 76/X/130. Mortality from the northern Canadian and Greenlandic hunt was considered as part of the natural mortality.

- (4) Unpublished data presented by Norway included age frequencies of moulting males in 1969-76. Mortality rates, calculated from catch curves for males in age-groups 2-12 corrected for changes in recruitment, gave a mean value of $M = 0.1058$.
- (c) Estimates of production in 1976 and sustainable yield in 1977
 - (1) In Res.Doc. 76/X/127 survival indices and a stock recruitment model were used to derive estimates of 310,000 to 340,000 with a sustainable yield of 215,000.
 - (2) In Res.Doc. 76/X/130 cohort analysis was used to derive a figure for the population in 1961. This population, projected forward to 1976, gave a pup production of 327,000, with a sustainable yield of 190,000 in 1977. These values were lower than those calculated in Res.Doc. 76/X/127, owing in part to the incorporation of random variation in natural mortality (M) and landsmen's catches.
 - (3) In tables of unpublished data presented by Norway, the mortality rate was used to estimate production of 346,000, or a more conservative estimate of 315,000 using functional regression. Sustainable yield from the latter estimate was 210,000.
 - (4) In Res.Doc. 76/X/132 a model, hereinafter called the Guelph model, was used to derive five population forecasts. These gave pup productions ranging from 193,000 to 321,000, with sustainable yields from 65,000 to 160,000 (exclusive of the aboriginal catch). Three of these, considered by the authors to be the most appropriate, gave productions ranging from 249,000 to 313,000 and sustainable yields from 103,000 to 130,000.

The Guelph model is based on:

- (i) a projection forward from a population based on a pup production of 645,000 in 1951, obtained from the first aerial census performed on harp seals in Canada;
- (ii) distribution of the bedlamer and adult catches in proportion to relative abundance in each age-group;
- (iii) hypothetical age-specific natural mortality rates, which are much higher in the immature age-classes than those described in the other Research Documents (76/X/127 and 76/X/130) and the unpublished Norwegian data. These are considered to be one of the principal factors in producing the low sustainable yields mentioned above.

(d) Advice on catch levels in 1977

A submission (Res.Doc. 76/X/133) suggested that management criteria, established by the International Whaling Commission (IWC) in 1974, be considered when formulating management policy for the harp seal population. The Scientific Advisers concluded that:

- (1) harp seal and large whale populations have quite different vital rates which would affect their recovery time;
- (2) the IWC-management regime was formulated as a response to widely different management objectives, some of which were not biologically based. It has no particular relevance to harp seal management;
- (3) there is no biological reason why a seal stock cannot be managed at a much lower level than that providing Maximum Sustainable Yield (MSY).

The Scientific Advisers' interpretation of the current management policy for the Northwest Atlantic harp seal stock is that the stock be allowed to rebuild towards MSY level. These objectives may require re-examination depending on the future assessment of relationships between seals and other marine life.

The majority of Scientific Advisers agreed that the MSY population size lay between 1.6 and 2.0 million seals, 1 year of age and older. The sustainable yields associated with this level of population were from 240,000 to 270,000, assuming the same proportion of adults to pups in catches as those currently observed. Furthermore, a Total Allowable Catch (TAC) of 170,000 (including aboriginal kill) would allow a continued increase towards attainment of MSY level in about 15 to 20 years. However, the population projections in the Guelph model considered appropriate by the authors indicate that levels of kill above 130,000 (excluding aboriginal kill) would cause a population decline.

(e) Recent trends in landsmen's catch

The Scientific Advisers noted a recent increase in the landings by landsmen, particularly in that part

of the catch taken by vessels of less than 150 tons (Fig. 1). Participation increased consistently from 45 vessels in 1972 to 180 in 1976. The Scientific Advisers also noted that the average level of annual catch over the period 1965-76 was 48,421.

(f) Future research on harp seals

The Scientific Advisers agreed on the following priorities in research in 1977:

- complete aerial photographic (ultra-violet) census of pups with refined survey design and rigorous ground control;
- detailed age and sex sampling of landmen's fisheries;
- refined estimates of natural mortality, especially of juveniles;
- refined estimates of age at maturity and pregnancy rates in the Gulf and on the Front;
- refined estimates of sex ratio by age-classes.

The Scientific Advisers agreed that since age samples of moulting seals were necessary for the best scientific advice, and since quota catches by large vessels now rarely included moulting seals, scientific permits might be required for Canada and Norway to take a total of about 1,200 animals. This number would be needed to ensure a sufficient sample of 800 males.

5. Hooded Seals

(a) Results of research in 1976

Canada reported results of 1976 studies concerning aerial survey of breeding seals in Davis Strait, tagging and branding recoveries, and estimates of production and yield (Res.Doc. 76/X/126). Norway reported on field operations on the Front in 1976, during which a few hooded seals were tagged and a large number sampled for age (Res.Doc. 76/X/131). Recoveries in Newfoundland and on the west coast of Greenland of three hooded seals tagged in Denmark Strait in 1974 were also reported. Denmark provided preliminary data on catches of hooded seals in Greenland (Fig. 2) which suggest that the species has become more readily available in the last decade, especially in South Greenland.

(b) Mortality estimates

No new data were available.

(c) Estimates of production in 1976 and sustainable yield in 1977

- (1) Davis Strait. Whelping hooded seals were discovered in Davis Strait by aerial survey on 22 and 24 March 1976, close to where they had been located in March 1974. Incomplete, photographic estimates of the small patch seen on 22 March gave a count of 4,200 adult seals. On 24 March a patch of scattered seals was seen on more diffuse ice in the same general area, but it could not be determined if this was the same group seen previously. Visual estimates suggested a population size of between 5,000 and 10,000 adult seals.
- (2) The Front. A sample of 208 females, collected in 1976, was aged and combined with five years' similar data from Norway collected in 1967 and 1971-74, and 2 years' data collected in Canada in 1953 and 1966. The percentage of 5-year-old females in each sample was plotted against catch of young and gave an estimate of production of 23,000 from the functional regression. While there is some evidence that the hunt is intensive, it was noted that the catch per unit effort, as calculated for the Norwegian fleet for 1966-76, remained stable.

(d) Advice on catch levels in 1977

The Scientific Advisers considered that the new evidence did not provide a firm basis for altering for 1977 the TAC of 15,000 recommended for 1976 by the Scientific Advisers at their last meeting in Bergen in December 1975.

(e) Future research on hooded seals

The Scientific Advisers agreed on the following programs of research in 1977:

- the joint development of a population model, employing all available data;
- further aerial survey of whelping seals in Davis Strait.

The Scientific Advisers noted that Norway has a large age sample from the moulting patches in Denmark Strait which still needs to be analyzed. Although outside the ICAF Area, Denmark Strait is thought to be the main moulting area for hooded seals from both the Front and Jan Mayen populations. The Scientific Advisers urge Norway to complete analyses of these data.

6. Assessment of the Relationship Between Seal and Fish Populations

Harp seals have a very wide food spectrum which comprises small pelagic fish, shrimps, and euphausiids. The most important fish by weight eaten in the Northwest Atlantic is capelin. At the current population level, annual consumption of capelin has been variously estimated to be of the order of 300,000 to 500,000 metric tons (Res.Doc. 76/X/125), most of which is taken about Newfoundland, but some also at West Greenland. A similar amount may also be eaten by the great whales. The dependence of a vast biomass of cod and many species of seabirds on capelin means that complex models will have to be constructed. The use of such models to predict changes in the level of one species from changes in the level of another will require the input of much biological and environmental data which may take many years to obtain.

7. Time and Place of Next Meeting

The Scientific Advisers stress the difficulty of providing analyses of new data from the current sealing season in time for the Annual Meeting of ICNAF. They, therefore, recommend that their next meeting take place in the fall of 1977.

8. Other Business

Release of research documents

Because of the general public interest in the subject of seal management, the Scientific Advisers agreed that pertinent documents should be released with prior approval of the authors. For this purpose the current "Restricted" label should be removed from the documents concerned and replaced by a legend "Not to be cited without prior reference to the author". This is the practice currently followed by ICES.

The Scientific Advisers also recommend to the Panel that the Commission should be asked to consider early release of the reports of meetings of the Panel, together with reports of the Scientific Advisers.

9. Approval of Report of Scientific Advisers

The Scientific Advisers met at the Ministry for Greenland, Hausergade 3, on 13 October, and approved the draft report. There being no other business, the Chairman adjourned the meeting.

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Circular Letter No.

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HARP SEAL CATCHES BY LANDSMEN, 1965-76

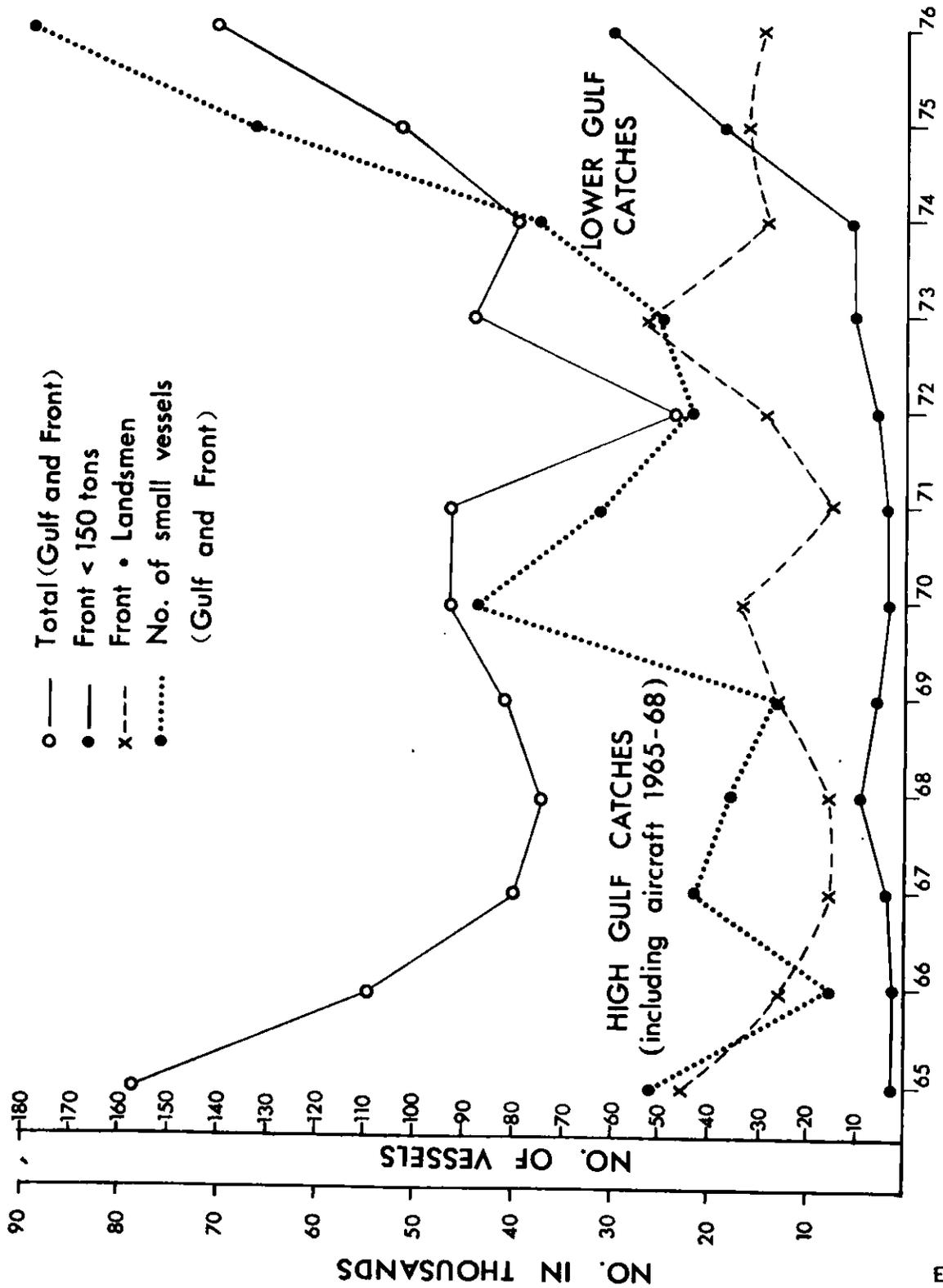


Fig. 1. Harp seal catches by landmen, 1965-1976.

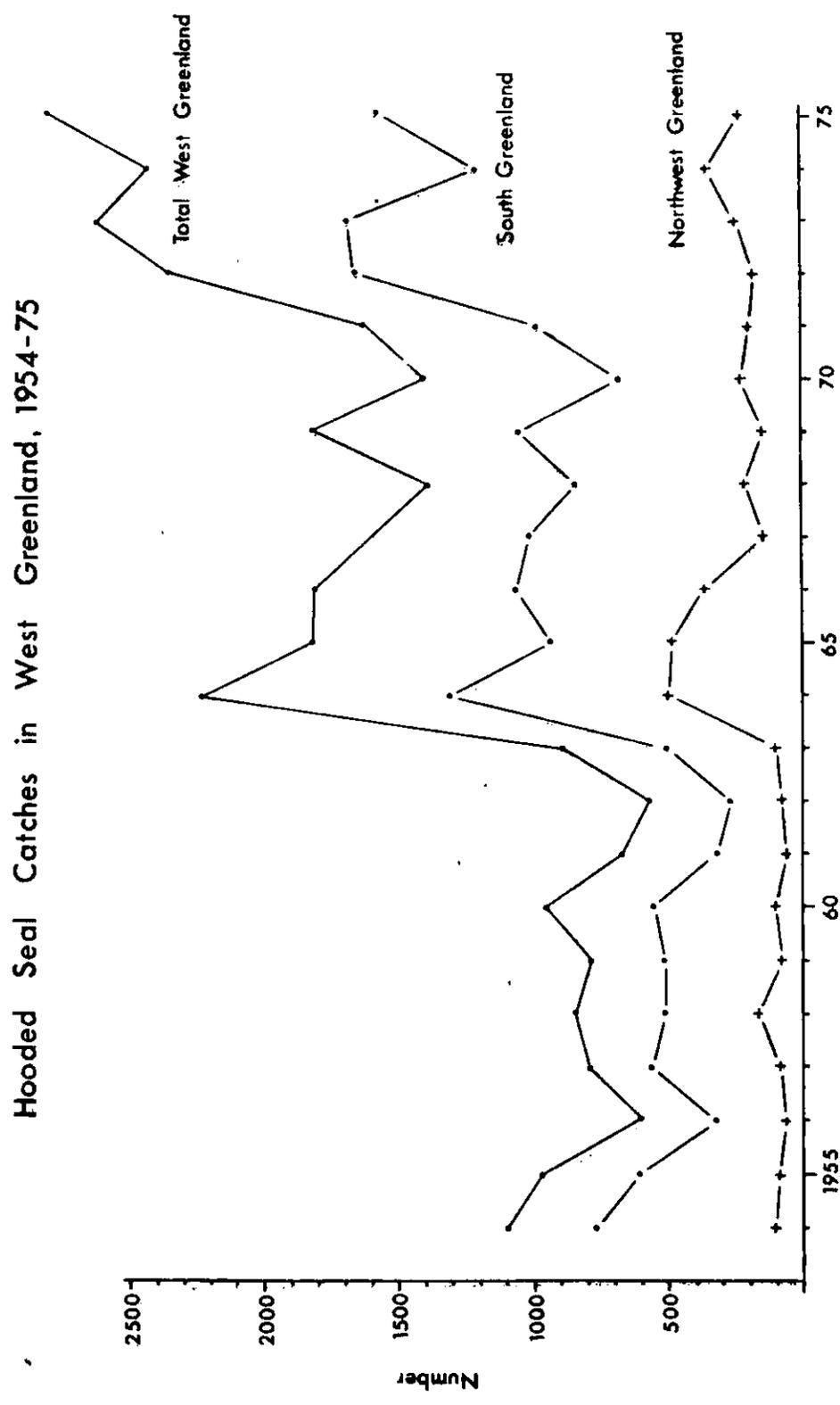


Fig. 2. Catch of hooded seals in West Greenland, and in two important regions within that area, 1954-1975.

