

SURVIVAL SERVICE COMMISSION

# POLAR BEARS

Proceedings

of the 2nd Working Meeting of Polar Bear Specialists  
organized by IUCN at Morges, Switzerland  
2 — 4 February, 1970



International Union  
for Conservation of Nature and Natural Resources  
Morges, Switzerland  
JULY 1970

MUCH OF THE DATA AND INTERPRETATIONS  
CONTAINED IN THIS VOLUME ARE  
PRELIMINARY AND SHOULD NOT BE QUOTED  
WITHOUT PRIOR REFERENCE TO THE  
RESPECTIVE AUTHORS

## INTRODUCTION

The polar bear is listed in the Red Data Book of threatened species, a series of volumes that are prepared and maintained by the Survival Service Commission of the International Union for Conservation of Nature and Natural Resources. In addition to the collection of data on threatened species, the Commission has responsibility for the initiation of action to prevent their extinction. All species of animals and plants are included within its purview but, in its action programmes, some measure of priority is accorded to those species that are not only threatened but also require international co-operation for their effective conservation. The polar bear falls into this category, hence the Commission's particular interest in the species.

In September 1965, the arctic nations met at Fairbanks, Alaska, to consider the future conservation of the polar bear. Their Statement of Accord\* drew attention to the paucity of scientific data on the species, and suggested that the IUCN might act as the receiving and co-ordinating agency for international exchange of information. The IUCN fulfilled this function in 1966-67, but towards the end of this period, a growing need was felt for a meeting of polar bear scientists from each of the arctic nations to review current research activities and needs, and to consider more effective scientific co-operation on a continuing basis. In January 1968, therefore, the IUCN organized the first working meeting of polar bear specialists, at Morges. Some of the subjects discussed were considered to be confidential and no proceedings were published. A comprehensive report on the meeting was printed in the IUCN Bulletin of April/June 1968, however, and a reprint of the article is appended to the present proceedings for ease of reference. Information was freely exchanged and agreement was reached on a wide variety of proposals for future research. In addition, the delegates agreed to form themselves into a Polar Bear Group under the aegis of the Survival Service Commission; its principal objective would be to expedite the collection of data on the polar bear's natural history as a basis for future management. It was agreed that when the Group considered that sufficient data were available to make recommendations on conservation, it might request the IUCN Executive Board to organize another international conference on the management of the polar bear.

The Group decided that it should meet every two years to review progress, to co-ordinate research activities for the next biennium, and to discuss items of particular relevance to the future study and management of the polar bear. The second working meeting of polar bear specialists was called in February 1970, of which this volume comprises the proceedings. In brief, it presents a summary of the discussions, to which are appended the working papers and other material submitted or prepared during the meeting.

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\* Page 66. Proceedings of the First International Scientific Conference on the Polar Bear, Fairbanks, Alaska, September 6-10, 1965. U.S. Dept. of Interior (Government Printing Office 1966) 72 pp.

The IUCN wishes to acknowledge the ready co-operation and support provided by the participating Governments in the organization of these meetings. It would also like to record its thanks to the individual delegates, all of whom have contributed much to the success of the meetings. A special word of appreciation is due to Dr. John S. Tener, who, as chairman at both meetings, provided a combination of tact and understanding with a first-hand knowledge of the arctic and the problems of its conservation. Finally, the Union's sincere thanks are due to the Conservation Foundation, Washington, which provided the IUCN with financial support that was used to defray the expenses of the meetings and the publication of these proceedings.

C.W.H.

PROCEEDINGS  
OF THE SECOND WORKING MEETING OF POLAR BEAR SPECIALISTS

Morges, Switzerland - February 2nd - 4th 1970

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International Scientific Co-operation on the Polar Bear (Richard A. Cooley) insert  
A report on the first working meeting of polar bear specialists, Morges, January 1968, reprinted from IUCN Bulletin New Series Vol. 2, No. 7.

SECOND WORKING MEETING OF POLAR BEAR SPECIALISTS

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held at the Hotel du Lac, Morges, Switzerland  
from Monday, February 2nd to Wednesday, February 4th 1970 inclusive

PARTICIPANTS

Chairman:	Dr. John S. Tener	Director, Canadian Wildlife Service
Delegates:	Dr. Charles J. Jonkel	Canada
	Dr. Andrew H. Macpherson	Canada
	Dr. Christian Vibe	Denmark
	Mr. Thor Larsen	Norway
	Mr. Magnar Norderhaug	Norway
	Mr. James W. Brooks	U.S.A.
	Mr. Jack W. Lentfer	U.S.A.
	Dr. Savva M. Uspenskii	U.S.S.R. (Group Chairman)
	Dr. Alexandre A. Kistschinski	U.S.S.R.
	Dr. Richard A. Cooley	(Group Technical Secretary)
Convener:	Dr. Colin W. Holloway	IUCN Survival Service Commission
Interpreter:	Miss Inna A. d'Accault-Acco	IUCN Education Commission
Secretary:	Miss Catherine Bonnin	IUCN Survival Service Commission

Mr. Wolfgang Burhenne, Chairman, IUCN Legislation Commission, was present at the meeting from the mid-morning of Wednesday, February 4th.

Dr. Cooley, Dr. Jonkel and Dr. Tener acted as rapporteurs for the meeting.

AGENDA

- Welcome and Introductory Address by the Secretary-General of IUCN
- (1) Research Progress Reports by Countries 1968-69.
  - (2) Conservation Progress Reports by Countries 1968-69.
  - (3) Planning and Co-ordination of Research Programmes 1970-71.
  - (4) Future Activities and Organization of the Polar Bear Group.
  - (5) Discussion - International Convention for Research and/or Conservation of the Polar Bear.

NOTES OF THE MEETING

1. Introduction

The Chairman, Dr. John S. Tener, introduced the Secretary-General of IUCN, Mr. E.J.H. Berwick, who presented a brief welcome address. Mr. Berwick stressed the importance of small working groups of specialists as a means of reaching agreement among nations leading toward action for conservation of endangered species. He felt that conservation should become a unifying factor among nations and that there was a need to promote close co-ordination among disciplines and among the Commissions of the IUCN. He explained that the Ecology Commission of the IUCN is planning to establish an exploratory committee on arctic and sub-arctic environments and indicated the necessity of close co-operation with the work of the Polar Bear Group.

Following the welcoming address, the Chairman noted the receipt of a preliminary report and letter from Dutch scientists concerning their polar bear research expedition in 1968-69 to Svalbard and plans for a continuing programme in the future in co-operation with Norwegian scientists. This material was entered as part of the record (see Appendix VIII of these proceedings).

A proposal to publish the proceedings and working papers of the meeting as an IUCN Supplementary Paper was approved, subject to the proviso that it be noted in the document that the data were preliminary and should not be quoted without reference to the respective researcher. Delegates agreed to amend their working papers as necessary and to leave an amended copy with Dr. Holloway before they left Morges.

The advisability of a press release was discussed and approval was granted for Mr. Standish, IUCN's Public Relations Officer, to prepare a release as soon as possible for the use of the delegates upon their return to their respective countries (see Appendix X). Dr. Cooley agreed to prepare a more detailed summary of the meeting to be published in the IUCN Bulletin in the near future.

2. Summary of Research Progress by Country

Reports on research progress since the first meeting of the Polar Bear Group in 1968 were submitted and reviewed (see Appendices I, III, IV, VI and VII). Discussions centered primarily on population movements, denning areas, discreteness of populations, and, to a lesser extent, harvest figures, productivity, and density and abundance of the species throughout its circumpolar range. While insufficient data were presented to estimate the abundance of the species, some agreement emerged concerning movements of polar bears, the discreteness of certain populations and other matters.

Much discussion was devoted to the development of techniques for the live capture and tagging of polar bears. This work was carried out quite successfully on a co-operative international basis and over 450 polar bears have now been tagged. Radio telemetry equipment and techniques were also discussed in detail. The Canadian telemetry programme is already beginning to reveal useful information, and Alaska is experimenting with a new type of equipment that may greatly increase the effectiveness of the existing equipment.

Data were presented which helped to locate much more precisely the major denning areas in the Arctic. The main areas so far delineated are in Canada and the U.S.S.R., with minor areas found in north Greenland and in Svalbard (Spitzbergen). Only a very few dens have been located in Alaska but there is evidence to indicate some denning on sea ice. An important finding was that Kong Karls Land, once thought to be a major denning area, is perhaps relatively insignificant; most polar bears moving into the Svalbard region appear to come from the Soviet Union on the westward moving ice. Also, polar bears along the Alaska coast most likely move in from eastern Siberia (Wrangel Island) and from western Canada, but more data are required from this region before these hypotheses can be substantiated.

Dr. Vibe stressed the importance of gaining much more knowledge about climate and sea ice conditions in order to understand both the movements and population size of polar bear populations. This, he felt, is of primary importance in understanding population dynamics in Greenland and may also be highly relevant in all arctic regions. He indicated that polar bear research in Greenland has been hampered by lack of staff and funds but that he hopes to launch a tagging programme in 1971 in co-operation with scientists in Norway and Canada.

Good co-operation among the five nations has also occurred with respect to taxonomy studies, including morphometric analyses and electrophoretic studies of blood samples. Food habit studies as well as behavioral studies have been instituted by Canada in co-operation with universities. Physiological research is continuing in Norway by Nils Øritsland who wishes to co-operate with other nations in this endeavour. The work by Canada analyzing the concentration of DDT in fat tissues of the polar bear was discussed and it was suggested that this work should be extended internationally on a co-operative basis.

Summaries of information on polar bear population discreteness and movements revealed the possibility of two distinct populations in Alaska, one to the north and the other to the west. Some bears of the former population probably originate in Canadian territory and some of the latter from Siberia but tag returns suggest that mixing may occur. Norwegian and Soviet studies indicate that another common population exists, encompassing Franz Joseph Land, Novaya Zemlya and Svalbard, with some from this population moving with the ice to as far as southeast Greenland. Danish studies in Greenland suggest two separate populations, one frequenting the northeast coast and



the other joining with Canadian bears in Smith Sound on the west coast. In Canada, it appears that the James Bay--southern Hudson Bay population is a distinct group and that perhaps even the James Bay bears are partially separate from the main Hudson Bay population. In Canada the discreteness of polar bear populations and of human populations which hunt the bears, as well as bear movements are all considered together, and research and management regions are being prepared on this basis. The plan is to collect and analyze data so that recommendations can be made for each region accordingly. These regions contain varying polar bear populations, ranging from the discrete and un hunted southern bears of Hudson and James bays, where bears are very abundant, to the Ungava Bay-Labrador-southwest Greenland region where bears are almost extinct.

### 3. Conservation Progress Reports

The delegates from each of the five countries presented progress reports on conservation measures (see Appendices II, III, V, VI and VII). In discussions concerning these reports several additional points were revealed. The Soviet Union indicated that plans are being made for the creation of natural reserves (zapovedniks) on Taimyr Penninsula, Chukchi Peninsula, and at northeast Yakutsk. The Alaska representative considered that increasing economic developments in the Arctic would probably cause more hides to be sold and trans-shipped from the State without the knowledge of the authorities, which would reduce the accuracy of harvest assessment. The group expressed general concern that serious ecological problems could arise in the Arctic as a result of oil spills and off-shore drilling.

The Committee was concerned that far-reaching proposals advanced to the Norwegian Government in 1968 to provide for more effective polar bear management have not yet been implemented. It was agreed to request the Chairman of the Survival Service Commission of IUCN to write a letter to the Norwegian Government urging immediate adoption of these proposals.

The Danish delegate pointed out in the discussions that polar bear hunting was an intrinsic part of the culture of the Thule Eskimos, in addition to being a very important source of food and clothing. While it will be very hard to change their way of life, he noted that this will be necessary because the Eskimo population is growing faster than the polar bear population. Hunting of polar bears in Greenland is restricted to residents of a year or more. The Danish delegate indicated that he hoped to see a national park established in northeast Greenland from Scoresby Sound to Washington Land in the north, an area encompassing the major polar bear denning sites. He also indicated all hunting regulations in Greenland would be revised within the next few months. It was agreed to ask the Survival Service Commission to request the Danish Government to consider the extension of the polar bear hunting regulations that are presently applied to Northeast Greenland, only, to the whole of Greenland, and thus provide total protection for cubs, and sows with cubs throughout the year, and for other bears during the summer.

The Canadian delegate noted in his presentation that sport hunting of polar bears has been authorized by the Northwest Territories Government. This will be carried out within the existing quota system and should not result in an increase of the total harvest in Canada.

4. Planning and Co-ordination of Research Programmes, 1970-71

As an introduction to this subject, delegates discussed several technical matters requiring development and co-ordination. Included were tags, tagging, radio telemetry, and the use of heat-sensing (infrared) devices for detecting polar bears.

Because existing tags do not meet all requirements satisfactorily, a committee was established to develop new tags through better designs and materials. The committee will also examine the possibility of using a common international tag under IUCN co-ordination. Committee members are Mr. Lentfer and Drs. Jonkel and Uspenskii. The results of work on long-range telemetry and heat-sensing devices will be distributed to delegates as soon as they are available.

The Canadian Wildlife Service agreed to undertake a translation of the latest Russian book on polar bears entitled "The Polar Bear and its Conservation in the Soviet Arctic". Copies of the translation will be sent to all delegates as soon as possible. A publisher for the translation will be sought.

On the recommendation of Dr. Uspenskii it was unanimously agreed by all the delegates that the terms of reference for the Polar Bear Group should be modified by the addition of a statement clearly identifying that the study of the polar bear is an international circumpolar problem which should be conducted in the true spirit of scientific research and for peaceful purposes only.

A number of specific areas for research collaboration were discussed and agreement was reached to provide the materials and/or information requested. This included the collection of fat samples for pesticide determinations; blood, milk and skull collections for taxonomic determinations; and provision of food habits information. It was agreed that the next year Canada would examine the feasibility of initiating a comprehensive study of the correlation between polar bear numbers and movements, ice movements, seal distribution and abundance, and other factors with a view to developing a statistical model to describe polar bear population dynamics. Delegates agreed to provide information required for the proper development of the ecological model. There will be a full exchange of information about the model as it is developed.

Mr. Larsen stated that he needed blood samples from Greenland and the U.S.S.R., Mr. Lentfer requested known-aged teeth for his age determination studies,

and the Group agreed that the exchange of the taxonomists working on the polar bear, Mr. Manning of Canada and Dr. Tchernyavsky of the U.S.S.R., should take place as soon as possible. The importance of continuing surveys to locate new denning areas and of determining the production rates of known areas was emphasized. Dr. Uspenskii suggested that Canada and Greenland were the two most critical areas needing additional denning surveys during the next two years.

Norway suggested that the U.S.S.R. use aerial drop baits, containing chemicals that will stain polar bear bone material. The placing of baits would be restricted to Franz Joseph Land so that marked animals can be searched for and identified in Svalbard and Greenland. The U.S.S.R. agreed, indicating that this work could not be carried out in the Western Soviet Arctic in 1970, but that it may be possible to launch such a project in 1971 or 1972.

The texts of letters to the Norwegian and Danish governments supporting new hunting regulations (ref. section 3) were approved.

#### 5. Future Activities and Organization of the Polar Bear Group

It was agreed to co-ordinate the Group's work with the newly established "exploratory committee on the arctic and sub-arctic environments" of the IUCN's Ecology Commission. The new Chairman of the Polar Bear Group will serve in a liaison capacity.

The collection of data on polar bears is not sufficiently complete to allow compilation and analysis of data on an international basis. When the data are complete the Group recommends that the work be carried out by a research biologist. Delegates were urged to distribute all pertinent papers and publications concerning the polar bear to other members.

The Group decided that a newsletter should be circulated twice a year. To accomplish this the Secretary of the Survival Service Commission must receive submission of items from members by the end of June and December. Dr. Holloway agreed to send a reminder to the delegates in May and November.

Dr. Jonkel of Canada distributed copies of punch cards for recording biological and other data from bears. There was considerable discussion concerning items on the card and Dr. Jonkel agreed to prepare a final draft. Dr. Jonkel also agreed to prepare a similar card for autopsied bears. The Canadian Government will print and distribute Russian and English versions of the forms to members so that a duplicate data card for bear captured, observed or killed can be deposited with IUCN. It was decided to abandon the circulation of annual reports and harvest data from participating governments as the information was being provided satisfactorily through other means.

The Group discussed the merits of inviting observers to future meetings and expanding the present membership. Both were rejected. It was confirmed that memberships in the group should be confined to those countries with direct responsibilities for polar bear management and protection. Papers from outside specialists will be accepted and considered.

Dr. Andrew H. Macpherson was elected unanimously to succeed Dr. Uspenskii as Chairman of the Polar Bear Specialist Group; Dr. Colin W. Holloway was elected unanimously as Secretary. Both terms of office run for two years. The next meeting of the Group will be held in early February 1972 at IUCN Headquarters.

6. Discussion of an International Convention for Research and/or Conservation of the Polar Bear

Two items were discussed under this heading. The first dealt with a Soviet proposal to the IUCN. The proposal requested IUCN to appeal to the governments of the United States, Canada, Norway and Denmark to ban all hunting of polar bears for a five year period. After considerable discussion, agreement was reached on a modified wording of the proposal. The revised draft appealed to governments to examine their management programmes immediately with a view to drastically curtailing the harvesting of polar bears beginning the next hunting season and extending for the next five years (see Appendix IX).

The second subject was consideration of the possibility of an International Convention for Research and Management of the Polar Bear. The delegates were fortunate to have present Mr. Wolfgang Burhenne, Chairman of the IUCN Commission on Legislation. He presented an outline to assist the Group in developing a possible framework for a convention. He emphasized that the terms of the convention would have to be developed by the Polar Bear Specialist Group in consultation with their respective governments. Delegates agreed to do so in preparation for more comprehensive discussions on the subject at the next meeting.

The meeting was closed by the Chairman who expressed the general view that the deliberations had been successful because of the full participation of all the delegates and of the spirit of accord that existed. He suggested that the success of the meeting could well lead to greater international co-operation on other circumpolar problems. He extended the delegates' sincere thanks to the IUCN for its gracious hospitality, for the excellent arrangements, translation and secretarial assistance and for all the kindness which contributed so much to the success of the meeting.

\* \* \* \* \*

APPENDIX I

Preliminary data not for publication  
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THE PRESENT STATUS OF  
POLAR BEAR RESEARCH IN CANADA

by  
Charles Jonkel  
Canadian Wildlife Service

Much of our progress through 1968-1970 has been reported in the series of published papers (Harrington, 1968; Jonkel, 1968; Jonkel, 1969; and Jonkel, 1970). Additional papers relating to aerial survey techniques, the effects of aircraft on bears, and taxonomy are still in manuscript form (Jonkel and Kolenosky, 1969; Jonkel and Standfield, 1969; and Manning, 1969). We are currently preparing a paper on the results of our radio telemetry work.

Several popular accounts of polar bear research and biology in Canada have been written by our staff or by other persons (Anonymous, 1968; Bruemmer, 1969a; Bruemmer, 1969b; Jonkel, 1969; and Murphy, 1969). These journalistic accounts have been encouraged to acquaint the public with our research and management goals, to popularize certain management changes, and to encourage political action in support of research projects and management. Several of these articles which have not received a wide distribution outside of Canada are also attached.

Current Research

During summer and autumn, 1969, we captured 67 additional bears along the Manitoba-Ontario coastline, bringing the total number captured to 161. Of these, 121 were bears captured for the first time. Observations, recaptures, and kills by hunters were recorded for 105 marked bears, but a full season or year had elapsed in only 31 cases. Most of the 31 bears had not moved far since they had been captured, though one adult male was observed northwest along the Hudson Bay coast 450 km from where he had been tagged in 1968. Some bears, therefore, do range along almost the entire Manitoba-Ontario coast of Hudson Bay.

Southern Hudson Bay bears still do not appear to move north much beyond the Manitoba border. Over 100 bears are shot annually by Eskimos in northern Hudson Bay, and only one marked bear has been killed. This was a sub-adult female tagged at Churchill and shot 300 km north of Churchill in November, 1969.

The bears moved onto the sea ice on November 14, in 1969, compared with November 27, in 1968. A narrow crescent of ice formed offshore from

Churchill and northward along the mainland. This "ice highway" appeared to distribute the bears farther to the north in early autumn of this year. In 1968 the radio-tagged bears moved directly east onto the Bay until contact was lost about 150 km offshore. In 1969-1970 three bears radio-tagged in October at Churchill were still being followed in mid-January, 1970, when they were about 75 km offshore and about 300 km north of Churchill.

Six James Bay bears have now been recaptured, killed, or observed either one season or one year after their initial capture. All have remained in James Bay, though one was observed on Cape Henrietta Maria at the junction of James and Hudson bays. There has been a considerable increase in the kill by hunters in the Belcher Islands north of James Bay during 1967-1969 (15 bears), but no marked animals have been taken. James Bay bears, therefore, seem largely confined to the limits of James Bay, though exceptions will no doubt occur.

Two university graduate students have begun research projects in co-operation with our program. B. Knudsen, a Ph.D. student at the University of Montana, has centred his behavioural studies on North Twin Island in James Bay, but all members of the research group are co-operating with him by gathering supporting data from other areas. Should North Twin Island prove an adequate study area for his purposes, our mainland and High Arctic behavioural studies will be continued as part of our main project.

Behavioural studies on Cape Churchill and the Manitoba coast have shown a marked segregation of the polar bear population by sex and age as the bears return to land in July and August. The large males apparently retain the choice resting sites in the sand dunes and beaches near shore, while the females, females with cubs, and sub-adults move quickly inland for distances up to 100 km. This pattern of distribution apparently is maintained until Hudson Bay freezes in early November. In late October the bears begin a gradual movement north towards Cape Churchill, but the adult males remain on the coast and congregate at the Cape, whereas the other bears remain inland and congregate east of the Churchill River. Pregnant females apparently remain behind in the denning areas until late winter, but additional behavioural studies in this area are needed.

Segregation by sex and age is apparently reinforced by intraspecific fighting. During tagging operations in August, 1969, six bears were observed with fresh wounds, and an adult male was found near the coast devouring an adult female and two cubs he had apparently killed the previous day. Data from bears captured in James Bay indicate that adult males fight during April and May, though during August-October many adult males were observed moving or resting together and even touching without exhibiting aggressive behaviour.

Other mainland studies of behaviour indicate that polar bears have two modes of orientation when travelling. While bears are feeding, moving locally, or investigating other bears, their movement patterns are random and

meandering. Bears moving inland great distances, however, travel in almost straight lines, apparently under photo-taxic influence. Bears travelling in straight lines do not deviate for obstacles normally avoided by land mammals; for example, the bears travel directly through bogs and dense timber, over raised beaches at right angles to the ridge, and through large and small bodies of fresh water. They do not change direction to follow game trails, ridge tops, or lake shorelines as would be expected. Such photo-taxic movements, interspersed with meandering tracks, have been observed repeatedly along the entire Ontario and Manitoba coasts. Similar movements have been observed in high arctic areas, where bears sometimes walk directly across precipitous islands rather than travel along shore on the sea ice.

R.H. Russell, a M.Sc. student at the University of Alberta, is conducting a food habits study of polar bears in the Hudson Bay and James Bay regions. His study includes a comparison of the food habits of island and mainland bears and a comparison of the food habits of high arctic bears and southern polar bears.

T.H. Manning is continuing his morphometric studies on polar bears under contract with the Canadian Wildlife Service. Additional skeletal material is now available in Canada, and he plans to travel to St. Mathew and St. Lawrence islands in the Bering Sea and obtain the necessary specimens from that region by searching through bone piles and along former bear trails. He will also visit the U.S.S.R. to measure specimens available there whenever his present computer analyses are completed.

#### Future Research

Southern Hudson Bay studies will be continued, but will receive less emphasis. Movement studies will be expanded by recapturing bears and by making observations of marked bears along the Hudson Bay coast and in James Bay. Further data will be gathered on the denning areas in Manitoba and Ontario in late winter and summer, 1970. The food habits and behavioural studies will be continued under the direction of graduate students on contract to the Service. The skeletal collection for southern Hudson Bay is still inadequate for statistical analyses, and additional specimens will be sought from Indian hunters.

Field work during 1970 will be extended to Lancaster Sound in the High Arctic. Tagging operations by helicopter are planned during May, and will be expanded if the operation is successful. Staff additions now approved for the project may also enable us to begin tagging and denning studies in the Western Arctic in the vicinity of Banks Island. Work in the Banks Island and Lancaster Sound areas is essential for co-ordination of Canadian research and management programs with those of Alaska and Greenland, as bears no doubt cross international boundaries in both areas. In addition, polar bear management problems in the Canadian High Arctic are different from those in the Hudson Bay-James Bay area where our present studies have been concentrated.

Our laboratory work on skeletal and reproductive specimens has been delayed because of a shortage of staff, but lab work will receive increased emphasis during 1970-1971. We have adequate collections to determine the sex and age composition of bears from many different geographical areas, and we have considerable information on litter sizes, growth rates, natural mortality, annual harvest, and related topics. These will come under more detailed study in 1970 to provide data for management zones now being drafted for the Canadian Arctic.

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APPENDIX II

Preliminary data not for publication  
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POLAR BEAR MANAGEMENT CHANGES IN CANADA

by

Andrew Macpherson and Charles Jonkel  
Canadian Wildlife Service

One significant legislative change has been made in polar bear management in Canada since the 1968 meeting. Quebec, which formerly allowed unlimited hunting of polar bears by all residents, banned hunting in 1968. Indians and Eskimos residing in Quebec still have hunting rights under their treaties, and under rather vague management and enforcement policies. Similar conditions exist in Manitoba and Ontario, where the hunting of polar bears is prohibited, but Treaty Indians do kill bears under special conditions of their treaties. In Manitoba, Treaty Indians may sell polar bear hides if they receive provincial approval, but the sale of such hides is prohibited in Ontario.

A quota system limiting the legal kill to a total of 386 polar bears was enacted by the Northwest Territories Council in 1968 and has significantly lowered the kill of bears in the High Arctic (Table 1). Problems in adhering to settlement quotas have occurred, but a liberal interpretation of the ordinances has allowed a transfer of the harvest errors of one year into the quota for the following year. The settlements killed a total of only 20 bears over their quota the first year of the quota system, which is very commendable considering that nine of the 20 were bears killed near Grise Fiord by Greenland Eskimos. Quotas of several settlements have been adjusted to the wishes of the hunters, but management recommendations based on harvest, sex and age ratios, and productivity are still premature. The provinces have not joined in the quota system, but similar plans are under discussion.

Little progress has been made in establishing a national marking scheme for legal hides, thereby restricting the marketing of illegal furs. The Northwest Territorial Council provides a seal for attachment to hides, and the Canadian Wildlife Service is currently drafting a marking plan for all of Canada. Provincial participation has been hampered by variable and poorly defined Indian hunting rights under provincial law.

The establishment of polar bear management zones for regional management within Canada has been proposed and will be discussed at Federal-Provincial meetings during 1970. Research and harvest data are currently being gathered for management zones and suggestions for the co-ordination of regulations will be made as more data become available.

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Year	Cubs Captured	Bears Killed	Total Captured and Killed
1960-61	5	236	241
1961-62	0	330	330
1962-63	0	444	444
1963-64	0	558	558
1964-65	1	565	566
1965-66	1	603	604
1966-67	0	710	710
1967-68	2	454	456

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Table 1. Polar bear harvest figures for Canada. These data are based on R.C.M. Police, Hudson Bay Company, and Provincial game reports, supplemented with data gathered by the Canadian Wildlife Service on scientific collections and from settlements not covered by the above reports or not within the Northwest Territories. The kill figures may be slightly higher as new data become available.

The practice of set-gun hunting has been discontinued for several years in Canada, and an ordinance permanently banning such hunting was introduced to the Northwest Territorial Council in January, 1970.

A Federal-Provincial Administrative Committee for polar bear research and management was established on July 7, 1969. This Committee will meet to evaluate management and enforcement problems annually, and will introduce proposals prepared by its Technical Advisory Committee to the Federal-Provincial Wildlife Conference. The Administrative Committee also advises the Government of Canada on the character of its representations at international polar bear meetings.

A bill introducing sport hunting of polar bears was submitted by the Northwest Territorial Council in 1969, but was withdrawn on the advice of the Commissioner. It has been re-introduced in January, 1970 and is likely to pass. The ordinance would allow an Eskimo hunter, with approval from the local Eskimo Council, to sell his polar bear licence or seal to a sport hunter holding a Northwest Territories hunting permit. The Eskimo hunter would, under the agreement, act as guide for the sport hunter, and extract a fee for his duties. The sport hunter would also be required to pay a "settlement" fee to the local Eskimo Council, because the quota is awarded to the settlement rather than to individual hunters. Under this scheme, the sport hunting kill of polar bears would come out of the settlement quota, and the polar bear harvest in the Northwest Territories would thereby not be increased. Such sport hunting would be allowed only in areas where polar bears were deemed abundant by the Commissioner, and only four such permits were provided for 1970-1971. Similar sport hunts are under discussion by provincial authorities in Manitoba and Ontario.

The Northwest Territorial Council has also introduced a plan for capturing live polar bears under a Territorial permit. Successful applicants would be charged \$1,500 per animal, and the bears taken would be deducted from the quota in the area where the bear is captured. Polar bears taken in this manner come under a general ordinance of the Territorial Council to allow the capture of numerous arctic game animals such as musk-ox, barren-ground grizzly and caribou, and others.

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APPENDIX III

THE POLAR BEAR SITUATION IN GREENLAND

by

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Following the decline in the polar bear population in Greenland after 1920, when the total catch for all Greenland was close to 300, the situation has again stabilized in the last six years with an increase in the total catch from about 70 in 1961 to about twice that number.

This increase is not due to increased hunting activity. Regular hunting by European trappers has stopped in Northeast Greenland, and the hunting effort of the Greenlanders and the Danish personnel at weather stations and on sledge patrols has not altered.

The actual increase in harvest figures must be considered along with the present alternation of the whole climatological and ecological situation in the Arctic. The Arctic regions are more Continental to-day. Thirty years ago they were more Atlantic.

The ecological conditions of the Arctic have changed as a result of this alteration of the climate. Some high Arctic regions get colder winters and less open water in summer. The productivity of the sea decreases in the Arctic and increases in regions nearer the Atlantic. The ringed seal moves to the areas of higher productivity, and the polar bear follows the seal.

This is the situation to-day in Northwest as well as in Northeast and Southeast Greenland. All other animals in Greenland, in the sea as well as on land, are affected by the same climatological fluctuations, which are reflected in a regular shift between Arctic and Atlantic conditions (or Continental and Atlantic) over a period of 56 to 66 years; they are more marked every second time the period culminates. The climatic situation of to-day, with intense movements in the drift ice in summer, is very similar to that 110-20 years ago. For the polar bear, especially in East Greenland, that means unstable living conditions, more roaming, and probably greater loss of animals by drowning in scattered drift ice off South Greenland.

Under the Atlantic conditions of forty years ago, the drift ice from the Polar Basin kept moving throughout the winter and melted at high latitudes in summer. The situation for the polar bear was quite the opposite to that of to-day. It then had to go ashore early in summer at high latitudes - and fewer got lost.

Alternatively, we could say that the polar bear probably was more numerous 30-40 years ago - as all Arctic animals were - but the Arctic-Continental

climate of to-day has forced it south to regions with unstable drift ice conditions and within the range of man.

#### The polar bear situation in Northwest Greenland

The open water south and north of Smith Sound (The North Water) is of vital importance to the ringed seal. The young seals, particularly, hibernate at the mouth of the fjords and bays around this open water. The older seals hibernate further away from the ice edge, to the north near Humboldt Glacier, to the west in the fjords of Ellesmere Island and to the south in Melville Bay and along the eastern coast of Baffin Island, in places where the shorefast ice is solid and snowcovered and thus suitable for seal dens.

In winter the bear chooses to hibernate in the same regions as the old ringed seals. The female bear makes a den on the adjoining shore and produces its young there. In early spring she digs out the seal dens for pups, and later when the seal pups go into the water and head for the open sea at the ice edge in Baffin Bay, the bear and her cubs do the same.

**Here** she stays till the ice breaks up and the seals go north to regions with more solid drift ice. Now the bear also goes north with her cubs. Thus, there is a steady wandering of seals and bears towards open water at a firm ice edge in early spring, northwards in summer to solid drift ice, and back to the denning areas in autumn and winter.

From ancient times the Thule eskimos used to go to the northern part of Kane Basin to hunt bears in the immense fields of grounded icebergs in front of the Humboldt glacier, where seals were numerous along the tide water cracks of the grounded icebergs. But in the last few years these icebergs have disappeared - and with them the seals and bears. The colder climate has stopped iceberg production from the glacier, and gradually the grounded bergs have drifted away without being replaced by new ones. The seals and the polar bears then left the area for the eastern coast of Ellesmere Island where the bear is now hunted by the eskimos along the ice edge south of Pim Island from 78° south to 77°. In later years the bear seems to have become more numerous here.

The Greenlandic hunters have permission to pass the Canadian promontories on their way to the hunting fields along the edge of the drift ice east of Ellesmere Island, but hunting may take place only outside Canadian coastal territory. Mother bears and their cubs are totally protected. The annual bag in this field is hardly more than 10 bears, but many more are seen including mother bears with cubs.

Many old bears are said to come from the fjords on the west side of Ellesmere Island. They cross the land and make for the ice edge early in

spring. Later in spring, bears are said to migrate north following the northgoing ringed seal. It is a common belief among the eskimos that old male bears will hunt mother bears with cubs to kill and eat the cubs, and such incidents have often been witnessed.

In certain years ice conditions may be so bad that sledges cannot pass Smith Sound. The eskimos at Thule also tell about certain years when there are no or very few young seals. This problem has received little study. It is obvious that a year without seal cubs must be serious for the mother bear - she probably will loose her cubs - and the male bear will be more aggressive. Fluctuations in number of polar bears probably correspond closely to fluctuations in the number of seal pups.

Little is known about the denning area in Melville Bay, but dens have often been found in the area between Cape Melville in the north and Cape Seddon in the south, usually several hundred meters from the coast and high up in the mountains. In the same area mother bears with cubs are usually seen from sledges passing Melville Bay between Thule and Upernavik. In one occasion a mother bear had three cubs. In May they seek the ice edge in Baffin Bay.

Formerly, when a permanent annual sledge route was established between Thule and Upernavik, bear hunting in Melville Bay was popular. The regular sledge route no longer exists, and bear hunting in Melville Bay is decreasing. At present the bag is hardly more than 5-10 bears yearly, some of which are killed by hunters from the Thule district, and others by hunters from the Upernavik district.

Hunting on the drift ice far out at sea in Baffin Bay takes place in May when hunters from the Thule district go out on the drift ice due south of Cape York. They drive their dog sledges 4-5 days journey onto the ice to shoot bears. They usually break adrift with the ice, but as it will again sooner or later drift back, they do not get lost. The bag is normally 5-6 bears a year (usually old bears). When the ice in summer drifts south towards Baffin Island some bears may follow it, but presumably most bears on the Baffin Bay drift ice go north with the seals before the ice goes adrift.

To-day most polar bears are found on the Canadian side of Baffin Bay. In the middle of the last century, bears were also numerous on the Greenland side. It is not known why the bears nowadays prefer the west coast of Baffin Bay. Melville Bay on the Greenland side is still a desolate area, the hunting has not increased and hunting from motorboat and ship in Melville Bay is prohibited. A possible explanation may be that old breeding ringed seals stay north. The young winter seals are mostly visitors from west and north - and the bears prefer to stay with the old breeding seals.

But why do old breeding ringed seals occur in Melville Bay in smaller

numbers than in the last century? We know too little about the ecological situation in Melville Bay to give an answer.

#### The polar bear situation in Northeast Greenland

Northeast Greenland has quite a lot of polar bears in the area between Liverpool Land and Nordostrundingen. Very little hunting takes place in this large area, which is closed by drift ice all the year round. The only inhabitants are the Danish personnel on the weather stations at Danmarkshavn and Daneborg, the police station at Daneborg and the crew at Mesters Vig runway. The yearly bag does not exceed 10-20 bears a year for the whole area.

Polar bear dens may be found anywhere, but are presumed to be most numerous in the northern area, although this may have altered in the last decennium. Due to little research in this desolate area, few dens have hitherto been located, but mother bears with cubs are frequently seen on the shorefast winter ice. When this ice melts in early summer, the bear families move out in the drift ice, where seals are numerous in summer, coming from the fjords of Southeast Greenland to feed in the northern pack ice area.

Previous to 1950 most of the northern bears managed to stay in the north without drifting southwards, but to-day this situation seems to be different. Many bears, including females with cubs and pregnant females, are observed nowadays at Scoresbysund and south to Angmagssalik and Cape Farvel. It is quite clear that most of these animals have gone astray, have got away from their normal habitat and are facing difficulties which may result in their death. Cases where many bears are seen crowded in small area may be examples of similar situations.

#### The polar bears in Southeast Greenland

According to the eskimo bear hunters in the Angmagssalik district, polar bears are coming to this area with the drift ice, which is lying close to the coast of Southeast Greenland during autumn, winter and spring, slowly drifting southwards. The majority are older bears, young bears are rare, and mother bears with cubs or one year old cubs are very rare and are not seen every year. Such bears are more frequent in the northern part of Southeast Greenland from Kangerdlugssuaq to Scoresbysund.

In the southern regions, the mother bear is seen with one cub only, rarely two. It is assumed that the conditions are so difficult that the mother bear is unable to rear her young, she will lose one cub and then the other. It has also been observed by eskimos that a male bear has killed two cubs.

The bears on the drift ice are said to seek land when they wish to hibernate,

or when the weather is bad causing strong movements in the sea ice. Coming ashore, the bears pass through the fjords to the land near the glaciers, where some of them hibernate. Bear dens have often been found by following the track of the bear right to the den, and in spring the track may be followed back to the abandoned den. The den is always situated on land, often far from the coast and high up in the mountain. For many years no more than one bear has been found in a den and never cubs, but formerly, in rare cases, mother and cubs could be found in a den. It is generally assumed that the bear hibernates in December or somewhat later. It will stay in the den until March, but it may be forced to leave the den when precipitation turns to rain, and the den collapses.

The bears are seen to leave their dens in April-May, when they come down from the land near the glaciers. They set off in search of seal pups in the fjords.

All the bear hunters agree that roaming bears found on the drift ice or along the coast in spring and summer are heading north.

All bear hunters maintain that the bear will always strike with its left paw. The same was said in Thule. It is therefore wise to approach the bear from its left side!

#### Plans for future investigations

In March to August 1969, Ivars Silis went to Northeast Greenland to make observations on polar bears in the area around Daneborg. In particular, Silis was charged with the task of finding a suitable operation area for future bear investigations in the field.

Based upon Silis' reports a joint Norwegian-Danish expedition is planned to take place in spring 1971 with the headquarter at Mesters Vig runway and making use of aircraft and helicopters in search for dens and bears.

In early spring 1970, Ivars Silis was invited by the Canadian Wildlife Service to participate in the Canadian bear marking experiments in James Bay, Canada. This kindness of the Canadian Wildlife Service gave Silis valuable experience in handling bears and marking techniques, which will be very useful for future operations in East Greenland.

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Polar Bear Hunting Statistics, Greenland  
(True figures are probably slightly higher)

	N.W. Green- land	S.W. Green- land	Ang- mags- salik	Sco- resby- sund	East Greenl. weather & police stations *)	Thule	Total for Greenl.	Average per Year
1955	6	2	31	21	(20)	25?	105	}
1956	2	1	26	54	(20)	25?	128	
1957	4	1	42	28	(20)	15?	110	
1958	12	1	29	61	(20)	25?	148	
1959	5	17	86	18	(20)	25?	171	
1960	7	8	28	23	(20)	35?	121	
1961	9	4	25	19	(20)	35?	112	
1962	14	0	8	15	(20)	30?	87	
1963	8	2	21	15	(20)	40?	106	
1964	2	4	27	15	(20)	40?	108	
1965	4	8	55	35	(20)	60??	182	
1966	6	2	45	25	(20)	18	116	
1967	1	5	70	31	(20)	23	150	
1968	2	2	52	62	(20)	15?	153	

\*) Estimated average

## APPENDIX IV

This paper not to be cited without  
prior reference to the author

### NORWEGIAN POLAR BEAR INVESTIGATIONS

by

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#### Introduction

A Norwegian polar bear programme, arranged as a cooperative enterprise between Universitetet i Oslo and Norsk Polarinstitutt, has previously been presented at the First International Scientific Meeting on the Polar Bear in Fairbanks, Alaska, September 1965, and at the First International Meeting of Polar Bear Specialists in Morges, Switzerland, January 1968. Activities in 1968 and in 1969 have mainly been focused on polar bear field studies in the Svalbard (Spitsbergen) region. A summer expedition, mainly sponsored by the World Wildlife Fund U.S. National Appeal, worked in the eastern Svalbard pack ice in August 1968. 31 polar bears were successfully trapped and tagged and studied according to methods developed previously (Larsen 1967 & 1969 a). One bear marked in 1967 was also trapped, and none were lost due to trapping and handling (Larsen 1968). From September 1968 and one year onwards, an expedition which was established in Tjuvfjorden, Edgeöya, worked with ecological and physiological polar bear investigations (Larsen 1969 b). The group, consisting of four men, was headed by Mr. T. Larsen, (ecological programme) and Mr. N.A. Öristland (physiological programme). The same winter, a Finnish expedition in Sveagruva on Spitsbergen and a Dutch group at Kap Lee on Edgeöya worked with polar bear studies.

So far, a total of 103 polar bears have been trapped and tagged in Svalbard. Of these there have been 17 recoveries. Biological samples, hunting statistics and observations have been collected from trappers, meteorological stations and from trophy hunters from 1966 onwards. This collecting will be continued

In addition to the programme outlined above, polar bear investigations have been performed by Mr. o. Lönö, Oslo. His paper, "The polar bear in the Svalbard area" is now in print, but with his permission, some of his data and evaluations will be presented in this report.

## Research Progress Report

### a. Counts and estimates

Polar bear counts have been performed in the Svalbard region from aircrafts, from ships crow's nest and on ground, in particular in the eastern waters. Although observation data have not been thoroughly examined, it seems that polar bears are rather abundant in the eastern Svalbard summer pack. Evidently, it is a higher bear density there than off the Alaskan coast in early spring. This view is confirmed by Mr. J.W. Lentfer of the Alaska Department of Fish and Game and Dr. A.W. Erickson of the University of Minnesota. Both have long experience from polar bear research in Alaska, and both have joined us on field expeditions to Svalbard - Dr. Erickson for three months.

The marking/resighting/recovery data are not sufficient for a statistical evaluation of the polar bear abundance in Svalbard.

Mr. Lönö states that there has been a decrease in the number of bears in Svalbard since the 1900's, probably somewhat less than 25%. His view is based on an evaluation of catch data from several regions (Lönö 1970).

### b. Sex and age structure

The sex composition of 605 polar bears caught in Svalbard between 1954 and 1966 are presented in Table 1. Of particular interest is the abundance of females in the November catches, which may be explained by the fact that they seek to the shores to den in late fall. One will see that males dominate the midwinter catches. Data from the summer is lacking in this table. But sex composition of 95 bears trapped in the pack the summers 1967 and 1968, are 31 males to 22 females and 13 males to 19 females respectively, with an average of 44 males to 41 females for those two summers.

There is nothing which might indicate a selection between sexes with different hunting methods. Trophy hunters do have the possibility to choose a big bear, which should result in a selection towards old males as in Alaska. However, the hunters normally take the first bear sighted rather than risking no bear at all.

The age composition of 85 polar bears studied during the ecological polar bear programme is listed in Table 3. Estimates are based on tooth wear and on the width of the canine enamel line. Two independent age estimates were made on each bear. A pm 4 has been pulled on each bear handled in 1968 summer expedition, i.e. 32 specimens. They have not yet been sectioned for age determinations.

The age composition of 83 bears, trapped by Lönö the winter 1964/65 are given in Table 3. It should be noted that Mr. Lönö does not distinguish between males older than 6 years and between females older than 4 years. His age determinations are based on the counting of tooth cementum layers in the incisors, on skull measurements and on the closure of cranial sutures. Lönö states that two zones are deposited in the cementum annually up to the fourth year, and only one zone is laid down annually thereafter (Lönö 1970). This does not correspond with Mr. Lentfer's investigations, nor with what have been found by Marks and Erickson (1966) and by Stoneberg and Jonkel (1966) in their age studies on the black bear.

### c. Individual reproductive performance

In his paper, Mr. Lönö has presented some valuable information on the breeding biology of the polar bear. Of particular interest are his histological examinations of polar bear testis and ovaries. He also presents data about litter sizes at different periods of the cub's life.

Mr. Lönö states that the male polar bear reach sexual maturity at the age of 3½ year. Females also become sexually mature at this age, but often they do not breed until the following year. His estimate of the ovulation frequency is based on the examination of 14 ovaries, which gives an average of 2.07 corpora lutea per female. In Table 4 the observation of litter sizes of polar bear cubs 2-4 months old are listed, with an average of 1.67. Litter sizes of cubs in their second winter are presented in Table 5, and comparative data from several regions in Table 6.

It has been discussed whether the polar bear females will breed every second or every third year. Generally, it has been assumed that because the sows are accompanied by their cubs for 1½ year or more, they do not accept a male until the following spring. There are some observations from Svalbard, however, which indicate that this is not so. In late March 1965, Lönö observed a big male approaching a female with a yearling, obviously in an effort to mate (Lönö 1970). In late January 1969, we trapped a female with two yearlings, which were accompanied by an old male. The group stayed together for some days. An analogous observation was made at Kap Lee in late April the same year when a female with her two yearlings were observed with a male for almost one week (P. Oosterveld p. comm.). Two such observations were also made by the trapper K. Torsvik on Ryke Yse öyane medio March 1968 and medio April 1969 (K. Torsvik p. comm.).

Lönö (1970) states that breeding season has its height between late April and late July, and that most cubs are born in mid-January. This last statement is verified by the sizes of two foetus collected from a sow shot on Ryke Yse öyane on December 21, 1968. These specimens are now in the collections at Institute of Marine Biology in Oslo, to be examined later.

d. Production at denning areas

Spring activities on the 1968/69 winter expedition on Edgeöya were mainly focused on den surveys. Although Edgeöya and Barentsöya both were carefully surveyed by means of ski-doo and dog teams from February to late May 1969, dens were only found on Negerpynten (2) and on Kvalpynten (1). Denning might also have occurred in Diskobukta and in Freemannssundet. Lönö (1970) points out that denning depends on the occurrence of ice along the coast. However, in 1968 the ice came unusually early, and Storfjorden, Freemannssundet and Tjuvfjorden were frozen already by late October. Conditions should therefore be excellent for denning, but nevertheless, I would be surprised if more than a dozen females denned on the two islands that winter. According to previous air surveys, the number of denning females on Kong Karls Land do not exceed 30 at the best. Some dens are evidently located on Nordaustlandet and some on Kvitöya. But even so, it seems very unlikely that the Svalbard archipelago can recruit the annual harvest of polar bears in that region. It is more probable that the bears migrate to the islands from Frans Josef Land or from Novaya Zemlya in the Soviet Arctic.

e. Estimation of hunting and natural mortality

The difference between an ovulation rate of 2.07 and an average litter size of 1.67 when the cubs are about to leave the dens, suggests a mortality rate of about 20% during pregnancy and in the cub's first weeks of life. The mortality rate in the cub's first year of life, calculated from tables 4 and 5, is also probably around 20%. Death may be caused by various injuries in the pack, by drowning (C. Vibe p. comm), or by cannibalism. Cubs are often killed when they have lost their mother. Observations have been made of cubs abandoned by their mothers. This is likely to happen when the family is chased by other bears, by dogs or by man. On the other hand, there are observations of cub and yearling adoption in the polar bear (Lönö 1970, K. Torsvik p. comm.).

The drowning of bears which drift away with the pack ice is probably an important mortality factor. Vibe (1967) has shown a correlation between the polar bear abundance and pack ice conditions, what we also have observed on our summer expeditions to Svalbard. We noted that bears were often found close to the edge of the ice. When big icefloes or sections of the pack drift off, bears in that ice will most likely perish.

During the 1967 summer expedition, two dead bears were found in the pack, one by our expedition vessel and another one by "Fortuna", a sealer trophy hunting in the same region. The bodies had no scars or bullet wounds, and a brief autopsy did not reveal the cause of death. Both bears were about 6 years old, and in fair condition.

Preliminary evaluations of the age composition of the Svalbard polar bear catches do not indicate an over-harvest of that population. The average age

in the non-selective catch is relatively high compared with the Alaskan polar bear harvest, which is highly selective towards big, and hence old males. See Table 3. The recovery of 17 bears of a total of 103 marked is alarmingly high however, and deserves attention.

An evaluation of the polar bear hunting statistics will be presented under item 2, Conservation Progress Report. Figure 1, which is from Lönö's publication, demonstrates however the correlation between the polar bear catches on the meteorological station on Hopen and the price on polar bear hides and the ice conditions around the island. Although there is a clear correlation between ice conditions and catches over short time intervals, it is more questionable whether ice conditions alone can explain the increased catch from the middle of the 50thies onwards. It should be noted that the increase starts at about 1956, when the Russians prohibited polar bear hunting in the Soviet Arctic. A possible correlation between the abundance of polar bears on Hopen and this prohibition should not be neglected, particularly in view of a probable connection between polar bear stocks in Svalbard and in the western Soviet Arctic.

#### 2a. Capturing and marking

During the summer expeditions for polar bear trapping and marking to Svalbard 1966/67/68, a total of 87 bears have been trapped and tagged (4, 51 and 32 respectively). The winter 1968/69 additional 16 bears were marked, 4 in Tjuvfjorden and 12 at Kap Lee. So far, there have been 17 recoveries, of which 16 are from Svalbard region, and most of them not very far from where they have been marked. Only one has been shot in Nanortalik in SW Greenland. See Fig. 2.

There has been a recovery of a polar bear from the Thule district, NW Greenland, with an old wound, evidently from a bullet, in its front (C. Vibe, p. comm.). This bullet hole seems to have been caused by a vertical set gun. Mr. Lönö reports however, that he is the only one who ever has used this hunting device on polar bears in Svalbard, and that he never lost a bear in this trap. This skull can therefore not be taken as a proof of a migration of polar bears from Svalbard to the northwestern regions of Greenland. It must be remembered that set guns have also been used in Greenland by polar bear trappers.

Recoveries of polar bears tagged in Svalbard, Canada and Alaska confirm the theory that polar bears rather belong to separate populations or breeding groups with limited exchange between them, than to one circumpolar stock migrating around the Pole. Most probably, the Svalbard polar bear stock is connected with bear populations at Frans Josef Land and Novaya Zemlya. Some bears seem to migrate from Svalbard to east Greenland. This is most likely to occur in years with much ice in the Greenland Sea. Aerial surveys, observations during the 1968/69 winter expedition on Edgeöya and the recoveries of tagged bears, indicate a westward migration of bears in late fall, when bears move from the eastern pack to the fjords on the west coast

of Spitsbergen. In late winter and early spring, there is a strong migration eastwards again, and bears are very frequent outside Kvalpynten and Negerpynten where there is pack ice between the land and the open sea further south (Larsen 1969b).

### 2b. Taxonomy

The taxonomic investigations of polar bears in Svalbard and other regions, are mainly based on electrophoretic studies of serum proteins. Preliminary investigations show that there is a difference between the Svalbard and the Alaska polar bear populations. Additional samples have been collected, but have not yet been analyzed due to the 1968/69 field effort on other topics, outlined above.

### 3. Other topics

Observations on polar bear behaviour, of stomach content and on local migration have been made throughout the study, but have not yet been analyzed. Trichina samples have been collected for examination.

Mr. N.A. Öritsland, leader of the physiological polar bear programme, has performed laboratory studies on captive polar bears in Svalbard and in Oslo since 1967, as well as anatomical and histological studies on dead bears. He has in particular focused on the temperature regulatory mechanism in the polar bear under various conditions. He has also studied the effects of the immobilizing drugs Etorphine (M 99) (Reckitts) and Sernylan (phen-cyclidine hydrochloride) (Parke Davis & Co.). His results will be published in the near future.

Planning and Coordination of Research Programmes 1970-1971

After the completion of the 1968/69 field investigations in Svalbard, the analysis of biological samples and observation data have been initiated. The serum analysis and the age determination on skulls and tooth material have got the highest priority in 1970.

While studying the skulls of the 1967/68/69 polar bear catch from Ryke Yse öyane, an interesting fact has been revealed: There is a sexual dimorphism in both the upper and the lower molar rows in the polar bear. Of 49 females and 42 males studied so far, there is only an overlap of four observations in these measurements. See Fig. 3. Polar bear specialists should be aware of this fact, which may be used in classifying unidentified skull material regardless of age, provided the permanent teeth have completely erupted in the specimens. The result of this study has not yet been published, as additional material is required.

Most probably, field investigations in Svalbard will not be repeated before 1971 at the best. There is however an urgent need to map and to study polar bear denning regions, as previously suggested by the Russians. Although harvest statistics do not reveal an overharvest of polar bears in Svalbard, the increasing activity by man in the archipelago - i.e. by oil and mineral prospectors, by scientific expeditions, sport hunters and tourists - may prove to be fatal for the polar bear. An increased activity in the denning areas will undoubtedly have a much greater effect on the population than hunting alone, which easily can be regulated and controlled.

Therefore, large scale surveys of the polar bear denning regions should be conducted on an international basis. As problems of population discreteness and migratory patterns have not yet been solved - partly because of lack of information from some Arctic regions - data can best be obtained through radio tracking and telemetry techniques. There is an urgent need for a long range radio transmitter and receiver system, a device which already has been under development for the Alaskan polar bear project (J. Lentfer, p. comm.). Eventually, the nations involved in the current polar bear investigations around the Arctic, should carry the development cost of such equipment, which later could be applied in each country's bear projects.

We are in particular dependent upon a close collaboration with Danish and Russian scientists and institutions in future radio tracking and marking programs. There is a strong evidence that the Svalbard polar bear stock is recruited from bear populations in the western Soviet Arctic, and that some bears migrate from Svalbard to Greenland.

Lentfer and Brooks (1969) have published data on the durability of the ear tags used in the Alaskan polar bear study. It seems that their nylon tags are not of the same quality as those used in the Norwegian programme (Salascolor Ear Tags). It is very important that the ear tags are strong and durable, as the recovery of the relatively few bears marked will furnish



scientists with invaluable data and information. During our study, we have found that the model metal tags (National Band and Tag Co) tend to cause infections and that they are more often lost than the nylon tags. It is a question whether the metal tags should be abandoned. Instead effort should be made in developing better eartags which will not cause infections or irritations, and which will keep even under the harsh conditions that prevail in the Arctic.

There is a need for additional serum samples from various regions in the Arctic, in order to study populations as previously outlined. In particular, samples from the Soviet Arctic, Canada and Greenland are required.

Oslo, January 1970

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Table 1. (from O. Lönö: The polar bear in the Svalbard area)

*Sex composition of 605 polar bears caught in winter in Svalbard.*

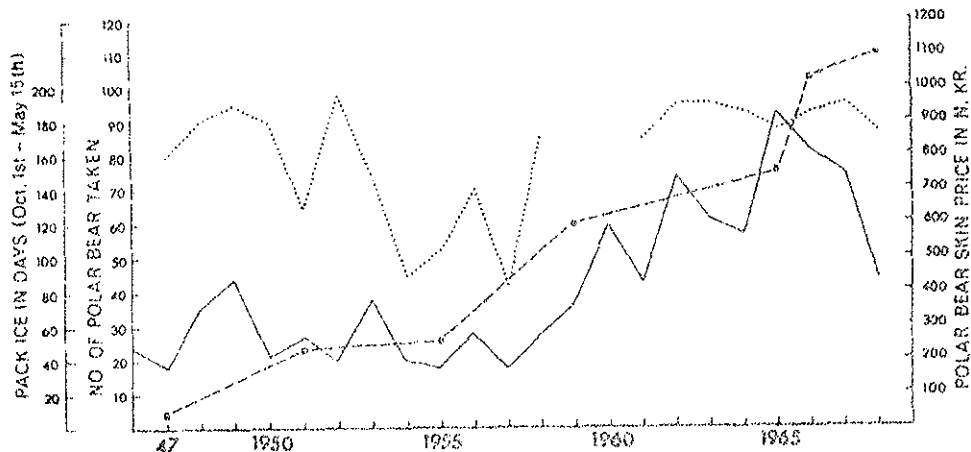
	Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		Sum	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Zieglerøya 1954/55	0	0	0	0	4	2	2	0	5	3	16	4	8	8	1	0	0	1	36	18
— 1964/65			5	4	5	7	6	5	10	2	8	7	9	4	3	4	1	2	47	35
Bjørnøya 1962/63							1	0	3	3	5	1	2	2					11	6
Hornsund 1962/63	1	0	2	0	1	0	17	9	3	1	5	0	13	3	0	5			42	18
Halvmånesøya 1963/64			3	1	5	12	16	9	12	2	15	8	4	5	3	1	0	1	58	39
— 1964/65			4	5	10	28	3	9	12	11	11	5	9	3	2	0			51	61
— 1966/67			4	6	8	3	2	2	6	6	5	3	9	5	9	9	2	1	45	35
Hopen 1963/64						10	4	6	2	3	1	5	4	2	1	0	2	0	19	26
— 1965/66						7	1	5	8	5	4	4	6	7	6	3			29	31
Sum	0	0	18	18	42	69	52	45	61	36	70	37	64	37	25	22	5	5	338	267
Per cent	100	0	47	53	37	63	54	46	63	37	65	35	63	37	53	47	50	50	50	56

Table 2. (from O. Lönö: The polar bear in the Svalbard area)

*Population composition in summer (June 1 to September 1) based on catch and observations from M/S «Havella» operating east and north of Spitsbergen.*

Category	No.	Per cent of total population
Cubs 6 to 9 months old	30	14.5
Females with cubs	18	8.7
Yearlings accompanied by their mother	3	1.4
Females accompanied by yearlings	2	1.0
Males (catch)	57	27.5
Females (catch)	40	18.8
Other bears	58	28.0

Fig. 1. (from O. Lönö: The polar bear in the Svalbard area)



*Polar bears caught on Hopen (—). Winter pack ice in days (October 1 to May 15) round Hopen (....). Prices received by trappers for raw polar bear skins in Tromsø (---).*

Table 3. Age composition in polar bear populations, Svalbard and Alaska. (Number in parentheses are numbers in sample).

Age composition in the polar bear winter catch on Edgeöya, Svalbard 1964/65 (From Lönnö 1970).

	Females %	Males %
Less than 1 year	8.3 (3)	10.6 (5)
1 year	22.2 (8)	12.8 (6)
2 yrs.	13.9 (5)	6.4 (3)
3 yrs.	11.1 (4)	10.6 (5)
4 yrs.	8.3 (3)	14.9 (7)
5 yrs.	36.1 (13)*	8.5 (4)
6 yrs.	*(i.e. 4 yrs	4.3 (2)
More than 6 yrs.	or older).	31.9 (15)

Average age of polar bears studied during the ecological investigations in Svalbard the summers 1967-69.

	Females	Males
Adult bears	6.7 (28)	9.4 (32)
Cubs and yearlings incl.	5.3 (37)	6.4 (48)

Average age of the total polar bear harvest in Alaska, 1966-68. (From Lentfer and Brooks 1969).

	Females	Males
Arctic Ocean	6.1 (69)	7.4 (118)
Chukchi Sea	6.7 (38)	7.9 (219)

Table 4. (from O. Lönö: The polar bear in the Svalbard area)

*Litter size in the polar bear. Catch of cubs and observation of tracks of litters on the south-eastern part of Edgeøya and Hopen after 1946*

Date	Size of litter			Informant	Notes
	3	2	1		
Mar 10-55			x	Author	Tracks. The female probably forced to leave the day we had visited the den twice
" 28-51		x		"	The den not found, large cubs
Apr 8-48			x	BJÆEN	The cubs taken in the den, small cubs
" 9-67			x	FORFANG	The den not found, small cub
" 10-48			x	BJÆEN	Taken when leaving the den
" 10-48		x		"	Taken in the den
" 11-47		x		Author	The den not found, small cubs
" 13-51		x		"	Tracks
" 15-56		x		KULSENG	Taken when leaving the den (on Hopen)
" 17-62		x		TORRVIK	Taken when leaving the den (on Hopen)
" 18-65		x		BJØRNSVIK	Tracks
" 19-67			x	FORFANG	The den not found, small cub
" 20-47		x		Author	The den not found, small cubs
" 20-67		x		FORFANG	The den not found, small cubs
" 23-48				BJÆEN	Taken when leaving the den
" 23-48		x	x	"	Taken in the den
" 23-51		x		Author	The cubs run away
" 27-47	x			"	Tracks
" 29-47			x	"	The den not found, large cubs
" 29-65			x	"	The den not found, large cub. Weight May 6, 29.3 kg
May 1-65		x		"	The den not found. Weight May 6, 15.8 and 16.3 kg
" 3-48			x	BJÆEN	The den not found, large cub
" 5-48				"	The den not found
" 9-51				Author	Small cubs. Left the den a few days before sand in the fur
Total: 24 litters					Litter-size frequency: single cub 37.5 per cent twin cubs 58.3 -- Triplet cubs 4.2 -- Mean litter-size: 1.67

Table 5. (from O. Lönö: The polar bear in the Svalbard area)

*Catch and observation of twin-litters (2) and single-litters (1) when the cubs are in their second winter. Information from the trappers MUNKEBYE, BJÆEN, K. JOHANSEN and the author.*

	Oct		Nov		Dec		Jan		Feb		Mar		Apr		Total	
	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1
	Byørnøya 1962-63					2	1	1	0	0	1	0	1			3
Zieglerøya 1950-51					1	1	0	2	2	1	0	0	1	1	4	5
--									1	6	2	1	0	1	3	8
--	1	0	1	2	0	2	0	0	2	2	0	6	0	2	4	14
Halvmanøya 1946-47	1	0	2	1	0	4	1	0	2	6	2	3	1	1	9	15
--			2	8	1	2	0	0	2	5	2	1	1	1	8	17
--	3	1	0	1	0	1	0	1	3	1	2	2	0	1	6	8
	3	1	5	12	4	11	2	3	12	22	8	14	3	7	37	70

Litter size frequency: twin cubs 34.6 per cent, single cub 65.4 per cent. Mean litter-size: 1.34.

Table 6. (from O. Lönö: The polar bear in the Svalbard area)

*Litter size in polar bears in natural dens in various areas and captivity.*

Location	References	No. of litters	Litter-size frequency per cent				Mean litter size
			1	2	3	4	
Canada	HARINGTON 1968	99	31.3	59.6	8.1	1.0	1.79
Franz Josef Land	PAROVSSIKOV 1964	141	22.7	77.3	0.0	0.0	1.77
Svalbard (Edgeøya)		24	37.5	58.3	4.2	0.0	1.67
N. E. Greenland	MANNICHE 1910	35	28.6	71.4	0.0	0.0	1.72
Wrangeløya	USPENSKIY et al. 1965	14	50	50	0.0	0.0	1.50
Various Zoos	HARINGTON 1958 and AFONSKAJA et al. 1958	63	38.7	59.7	1.6	0.0	1.65

Recoveries (per 30. November 1969) from 103 polar bears  
marked in Svalbard, 1966-1969.

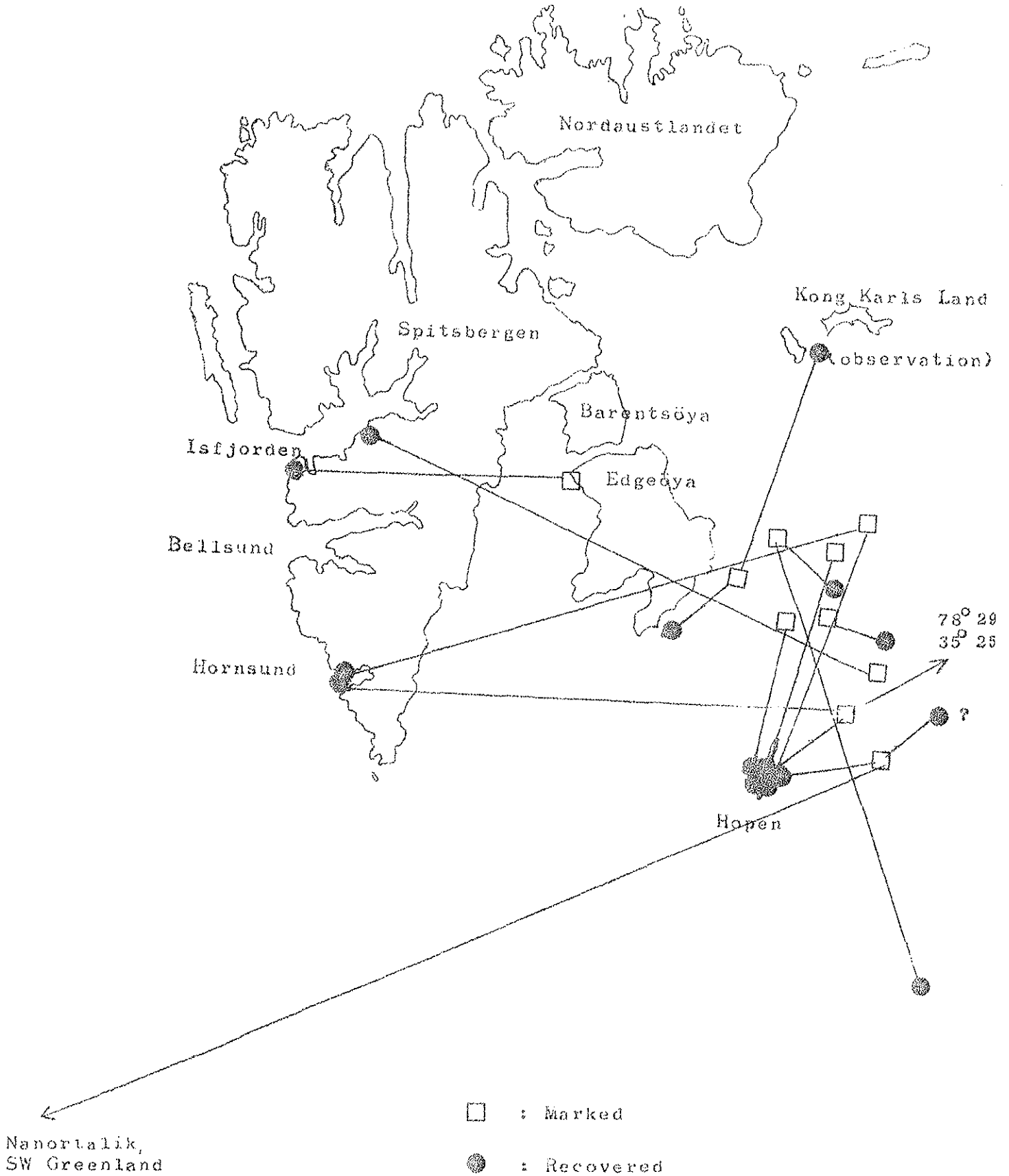
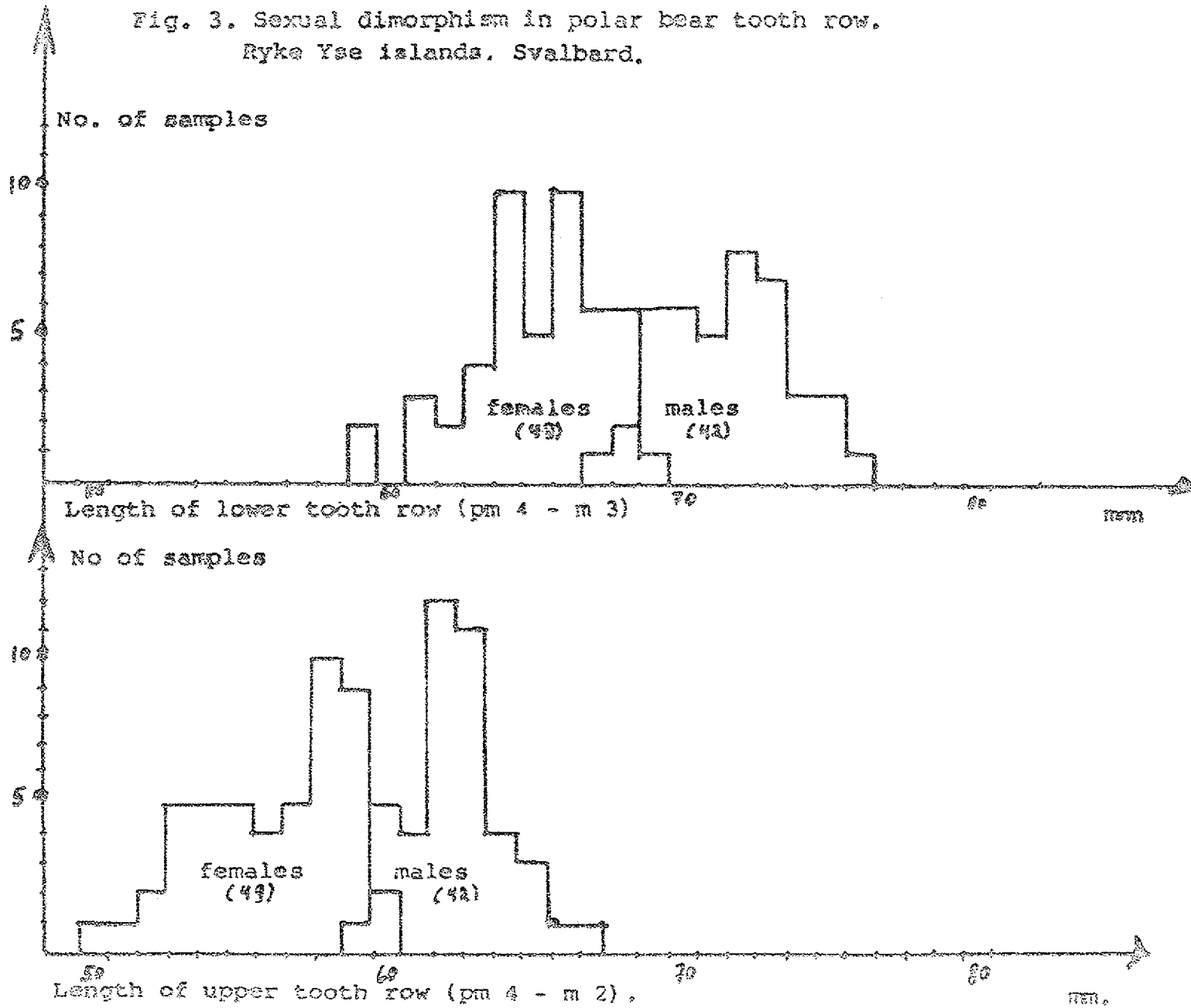


Fig. 3. Sexual dimorphism in polar bear tooth row.  
 Ryke Yse islands, Svalbard.



APPENDIX V

HARVEST AND MANAGEMENT OF THE POLAR BEAR IN NORWAY, 1967-1969

by  
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Polar bear harvest in Svalbard, 1967-1969

During the last 3 years, 1967-1969, a total of 876 polar bears were taken during Norwegian hunting activities. More than 95% of the total harvest were taken in the Svalbard area.

Like the previous years, different categories of hunters took part in the hunting activities in 1967-1969, and the number of polar bears taken by the different categories are still changing from one period to another. The main groups were weather station crew, wintering hunters, miners and residents, tourist hunters and sealers.

The main part of the total harvest were taken by weather station crew and wintering trappers (632 of the total 876 animals). The annual harvest from sealing vessels are no longer of any importance, due to the marked decrease in sealing activity in the Svalbard waters since the middle of the 1960's. During the last 3 years only 20 polar bears out of the total 876 animals were taken by sealers.

The number of polar bears taken by tourist hunters during the summers, varied between 33 and 38 in the last 3 years.

The harvest from miners, other residents (and a few scientific expeditions) varied between 28 and 49 in the same period.

The harvest during the period 1967-1969 indicates an increasing trend in the annual kill compared with the average per year for the 1960's in general.

Recoveries of 17 polar bears from the 103 marked in Svalbard waters 1966-69 reflect also the rather heavy hunting pressure in this part of the Arctic at the moment.

Polar bear harvest in Svalbard 1960-1969. A summary.

A total of 2765 polar bears were taken during Norwegian hunting activities in the Arctic in this period, the main part in the Svalbard area. Only 14 of these were cubs. However, the loss of cubs in connection with the use

of setguns is not known. In the five year period, 1960-64, the annual harvest varied between 137-437, and in the period, 1965-69, between 185-435. Average per year in the first and second five year period were 253.8 and 299.0 respectively, indicating the increased trend in the Norwegian harvest during the last years. The variation in the total harvest, 1960-69 is shown in Figure 1.

In Figure 2 the polar bear harvest in the 1960's is compared with the harvest since 1945. The number taken by the different hunter categories in the last two five year period appear from Figure 3.

As seen from the figure, 76.5% of the total harvest were taken by weather station crew and wintering trappers in the last five year period (compared with 52.2% in the period 1960-64). The percent taken by sealers decreased from 29.1% to 2.1%, while the number taken by tourist hunters during the summers remained fairly constant (13.7% - 12.2%). The relatively low and stable number of polar bears killed by tourist hunters during the 1960's are explained by two factors, the restricted number of tours, and the quota of one animal per hunter.

For people in the mining town Longycarbyen, and other residents on Svalbard, an increasing participation in the polar bear hunting is observed, partly as the result of an increasing number of skidoos on Spitsbergen. Hunting is not allowed from skidoos, but people use it for transport to a much wider hunting area than previously. Illegal hunting from skidoos also occurs. A summary of the hunting statistics, 1960-69 appears in Table 1. Some reservations regarding the accuracy are necessary as errors may occur in the Norwegian statistics on the polar bear harvest. This is caused by the present, very unsatisfying report system.

#### Present hunting activities

As seen from the statistics, the annual kill of polar bears in Svalbard has increased since 1966. This is mainly a result of the increasing number of polar bears taken at the weather stations (mainly Hopen) and by wintering trappers.

The increasing trend most probably reflects increased hunting effort and not any increase in the number of polar bears in Svalbard. The increased hunting effort could be explained by two different but closely related factors:

1. The proposal for new regulations presented early in 1968 made it clear that a total regulation of the polar bear harvest and a prohibition of the setgun method could be put into force.
2. During the last years, prices for polar bear skins have increased steadily. This increase has been very marked since the middle of the 1960's, mainly as a result of increasing demand for polar bear skins on the international market. This is again caused by the restricted



number of skins at the market and the impression that the polar bears are near extinction and accordingly will be unobtainable within a few years.

Increase in hunting effort include increasing number of wintering trappers (all are people leaving other occupations for this purpose), but probably also a greater number of setguns and increased hunting activity in general at the weather stations. Data on the relation between number of killed bears and hunting effort on Hopen has been collected by T. Larsen, but are not yet analyzed.

Relation between increased prices and the polar bear harvest on Hopen are presented in O. Lönö's recent paper (and included in the research report by T. Larsen at this meeting).

In 1966 the prices paid to hunters for winter skins were about 1,000 N.Kr. In 1969 a main part of the Norwegian harvest were sold directly to the international market, probably at prices close to 2,000 N.Kr. per skin. This winter (1969-70) the hunting effort is still more expanded, due to the factors mentioned above.

Six groups of wintering hunters are staying in Svalbard in addition to people at the weather stations and the communities. The location of the groups appear from Figure 4. As seen from the figure, the concentration of the hunting groups is found in the southern and southwestern parts of the archipelago (where polar bears occur in greatest number).

It is impossible at this time of the year to give exact number of the harvest in 1969-70, but the harvest may well result in a total between 350-400 for this season.

#### Hunting regulations

In April 1968 a proposal for new hunting regulations for polar bears was presented to the responsible ministry (The Ministry of Agriculture) by a working group appointed by the Interministry Advisory Board for Svalbard Affairs. Important paragraphs in this proposal were (unofficial translation):

- 2: Hunting of polar bears must not take place without special permission from the responsible Ministry. The hunting of polar bears are regulated by a yearly quota.
- 6: It is prohibited to kill cubs or females accompanied by cubs.
- 7: No guns other than rifles cal. 6.5 mm and over, must be used for polar bears.  
All traps, including setguns and poison are prohibited.

Tracking and hunting from aircrafts, motordriven vehicles and motorboats are prohibited.

- 12: It is illegal in Norway to import, deliver, sell or receive unprepared skins of polar bears without tags from the responsible Ministry.

Unfortunately, no action in relation to this proposal has so far been taken by the Ministry of Agriculture. New regulations have been announced, but at the present time it is still uncertain when they will be put into force.

### Reserves

Kong Karls Land in the eastern Svalbard was visited by a biological field group from Norsk Polarinstitutt in the first week of August, 1969. Svensköya, the western part of Kongsöya and the pack between the two islands were surveyed.

No bears were seen on this island or in the pack, in spite of favourable ice conditions (7-9/10 ice cover). Two bears were, however, seen 9 naut. miles west of Svensköya 4 August and one 3 naut. miles west of the same island 5 August. One, or probably two old dens were observed in snow slopes at the southwestern part of Svensköya.

It is impossible from a short and incomplete summer survey to make any conclusions regarding the importance of Kong Karls Land as a denning area for polar bears. It seems, however, reasonable to conclude, that the general opinion of Kong Karls Land as a densely populated area should be treated with more care. These small islands are, however, an unique and isolated part of Svalbard where bears probably den every year. This is taken into consideration in the present planning of national parks and reserves in Svalbard. The protection of the polar bear on Kong Karls Land in 1939 included only prohibition of hunting in this area and not a protection of the habitat. In the plans, now in preparation, Kong Karls Land will be proposed as a permanent polar bear reserve.

The increasing importance associated with the maintenance of habitats and communities of arctic wildlife should preferably be discussed further in connection with the future activities of this working group.

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Table 1. Norwegian Polar bear harvest, 1960- 1969.

Year	Sealers all areas.	Trappers Svalbard	Weather station crew.	Tourist hunters	Other residents and exped.	Total harvest.
1960	11	57	70	24	23	185
1961	42	9	52	23	11	137
1962	42	11	85	39	19	196
1963	127	62	86	32	7	314
1964	147	152	79	56	3	437
1965	9	273	120	28	5	435
1966	3	23	96	45	18	185
1967	9	102	86	38	28	263
1968	3	120	68	38	38	267
1969	8	123	133	33	49	346
TOTAL	401	932	875	356	201	2765

	<u>1960-1964</u>	<u>1965-1969</u>
5 year total	1269	1496
Average per year	253.8	299.0

Figure 1. Polar bear harvest in Svalbard 1960-1969.

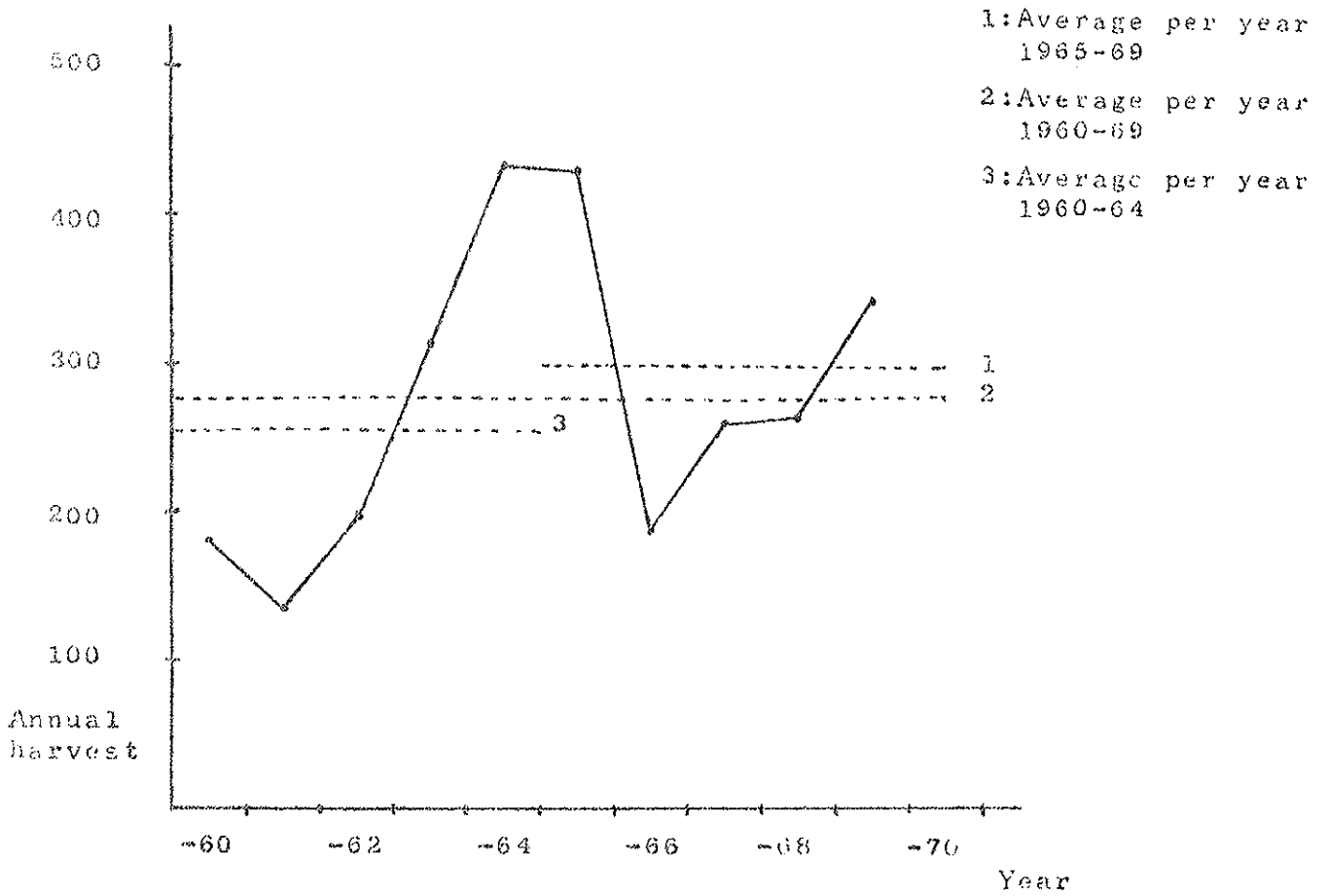


Figure 2. Polar bear harvest in Svalbard 1945-1969

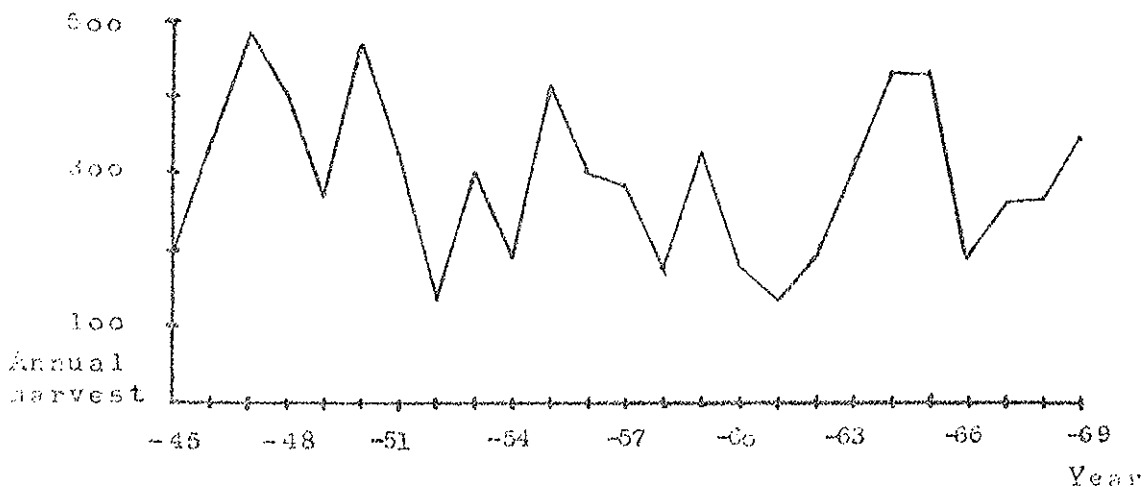


Figure 3. Changes in the Norwegian Polar bear harvest, 1960-69, in relation to hunter type.

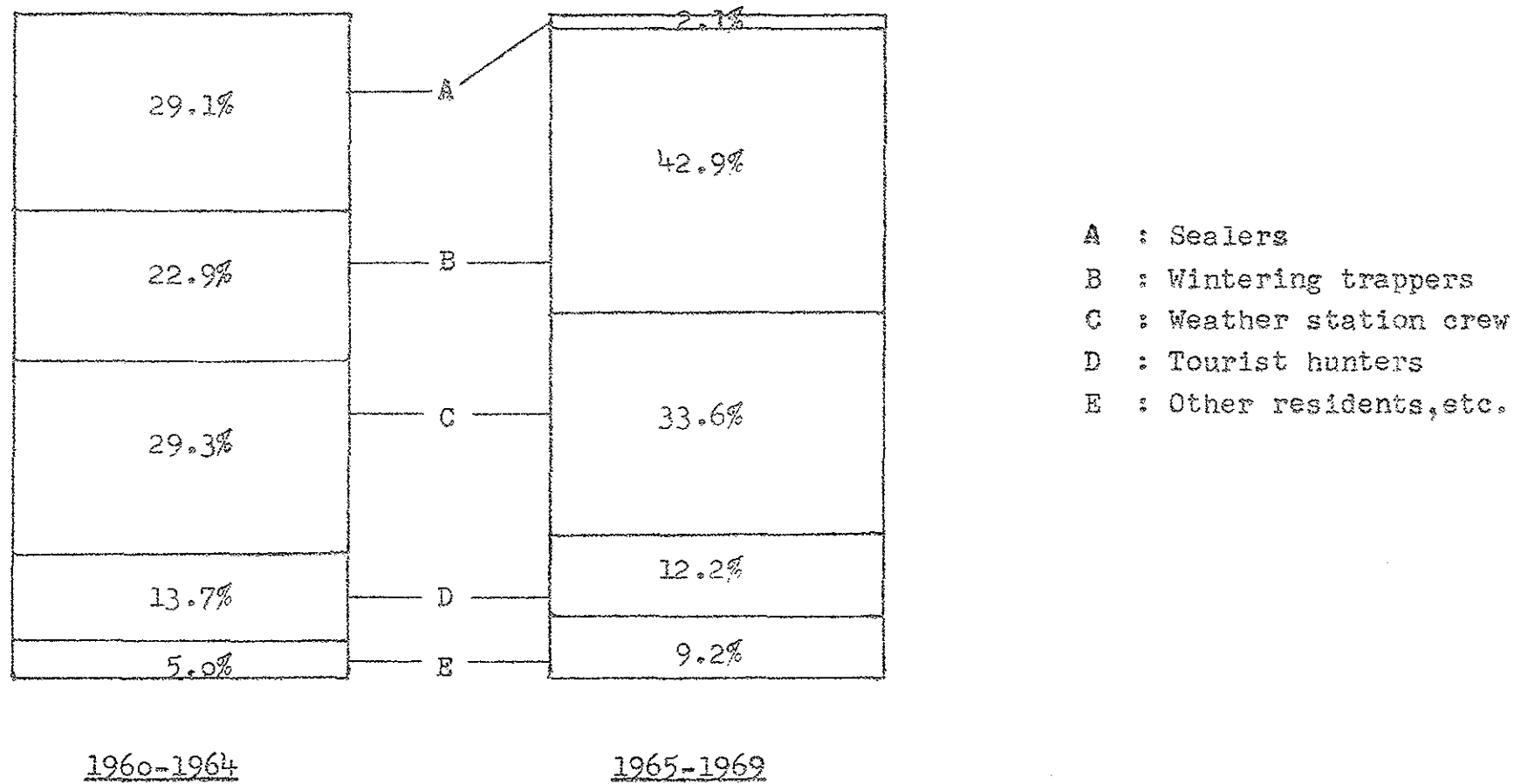


Fig. 4. HUNTING ACTIVITIES (POLAR BEAR) IN SVALBARD,  
WINTER 1969/1970.



● WEATHER STATION CREW, MINERS, ETC.

⊗ WINTERING HUNTERS.

APPENDIX VI

This report follows the subject headings employed at the first working meeting of polar bear specialists in January 1968. Some data and interpretations are preliminary; it is requested that information from the report not be published without permission.

POLAR BEAR RESEARCH AND CONSERVATION IN ALASKA, 1968 - 1969

by

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Agenda Item 1  
Research Progress Report

ESTIMATION OF ABUNDANCE, PRODUCTIVITY, AND MORTALITY

Counts and Estimates

We have attempted to census polar bears by making aerial counts in sampling areas from fixed-wing light aircraft. The method appears to be unsuitable for obtaining estimates of total numbers because it is difficult to see white bears against a white background and there is no way to determine how many bears are present in sampling areas and not seen (Lentfer, et. al. 1967). Infra-red photography or heat-sensing equipment will probably be used in the future as an aid in locating bears.

We are obtaining data from hunting guides on the number of bears they see per unit of time spent flying over the ice. Data for three of the villages from which much of the hunting occurs are presented in Table 1. These data cannot be used to predict total numbers within areas of observation, but we feel they are somewhat comparable from year to year and can be used as indicators of total numbers.

Changes in abundance of bears in an area from year to year can be caused by differing ice conditions as well as by changes in population size.

Sex and Age Structure

We are obtaining data at very little expense from hunting guides on composition of bears which they see while hunting (Tables 2 and 3). These data do not represent true samples of populations since guides concentrate on tracking single bears rather than family groups. However they are probably





Figure 1. Reference map of northern Alaska.

Table 1. Number of polar bears seen as reported by airplane hunting guides, 1966-1969.

	Flying Time (Hours)	Hunting Time (Hours)	Bears Per Flying Hour	Bears Per Hunting Hour
1966				
Teller	240	153	1.5	2.4
Kotzebue	439	156	1.2	3.3
Barrow	250	210	0.7	0.9
Total	929	519	1.1	2.1
1967				
Teller	197	77	0.8	2.1
Kotzebue	179	42	0.9	3.9
Barrow	140	106	0.8	1.0
Total	516	225	0.8	1.9
1968				
Teller	159	100	1.9	3.0
Kotzebue	163	68	1.4	3.4
Barrow	228	176	1.0	1.3
Total	550	344	1.4	2.2
1969				
Teller	47	9	2.1	11.6
Kotzebue	261	131	1.3	2.6
Barrow	262	192	0.7	1.0
Total	580	331	1.1	1.9

Table 2. Composition of polar bears seen as reported by airplane hunting guides, 1966-1969.

	Females with			Other Bears			Bears	Total
	1 young	2 young	3 young	Small	Medium	Large	Killed	
1966								
Teller	31	52	2	51	55	11	27	370
Kotzebue	37	62	1	47	108	32	65	516
Barrow	18	15	1	3	29	2	61	180
Total	86	129	4	101	192	45	153	1066
1967								
Teller	14	21	1	26	25	7	22	175
Kotzebue	12	13	0	7	62	34	23	189
Barrow	5	7	0	14	20	9	31	105
Total	31	41	1	47	107	50	76	469
1968								
Teller	24	44	2	28	49	12	21	298
Kotzebue	11	23	0	7	67	44	22	231
Barrow	19	15	0	31	57	4	47	222
Total	54	82	2	66	173	60	90	751
1969								
Teller	7	16	0	15	5	1	6	89
Kotzebue	13	49	1	23	81	37	28	346
Barrow	18	11	0	12	24	22	56	183
Total	38	76	1	50	110	60	90	618

Table 3. Composition of polar bears seen as reported by airplane hunting guides (data combined for all hunting locations shown in Table 2).

	Total	Single Bears	Females w/Young	Young	Average Litter Size
1966	1066	491 (46%)	219 (21%)	356 (33%)	1.6
1967	469	280 (60%)	73 (16%)	116 (25%)	1.6
1968	751	389 (52%)	138 (18%)	224 (30%)	1.6
1969	618	310 (50%)	115 (19%)	193 (31%)	1.7

of some value in furnishing comparisons from year to year.

The only population structure information that we are able to collect directly is from bears killed by hunters and from animals immobilized for tagging. This will be presented in other sections of this paper.

We are able to obtain a tooth for age determination from nearly all bears harvested and from bears which are immobilized for tagging. A  $PM_1$  is taken from live bears and a  $PM_1$  or  $M_3$  is taken from dead animals. The molar is preferred because its larger cross section provides more area for examination. Teeth are decalcified in 3 percent hydrochloric acid until they are flexible or feel slightly rubbery. Premolars decalcify in 18-24 hours; molars require 3-4 days. After being decalcified, teeth are washed in running tap water for a minimum of 3-4 hours to remove acid. Cross sections approximately 50 microns thick are cut with a microtome cryostat at a temperature of -15 degrees C. Sections are cut from the portion of tooth about one-third of the distance from the root tip to the root-crown junction. It appears that the maximum number of annuli which have been formed in the cementum are present here, and that annuli here may be somewhat more distinct than in other portions of the tooth. Sections are stained for 3-5 minutes in Harris-Hematoxylin modified for Papanicolaou staining (Paragon C. and C. Co., Inc., New York, New York). Layering in the cementum is examined with a zoom binocular dissecting microscope at magnifications between 50x and 120x.

Layering in cementum of polar bear teeth is more difficult to read than in brown bear teeth, and subjective interpretation must be made in some cases to assign an age. The greatest difficulty in interpretation occurs when what appear to be annual layers split into two or more layers. Different persons examining the same teeth are generally in close agreement however. The very limited number of teeth that we have from known-age bears suggests that the technique is valid. Our tagging program should yield more teeth from known-age animals as recoveries are made of bears tagged as cubs, yearlings, and 2-year-olds. We have been able to obtain only one known-age tooth from a zoo bear and are still most anxious to obtain known-age teeth and/or skulls from zoos and other workers.

### Reproduction

Female reproductive tracts are being collected to aid in understanding individual reproductive performance. This method has limitations since females form a relatively small portion of the harvest, and females accompanied by cubs cannot be taken by hunters; therefore, it is difficult to obtain adequate specimen material. The specimens examined thus far indicate that corpora lutea are not visible macroscopically after a year and that placental scars may persist for as long as 6 years and can be distinguished for at least two different pregnancies. With adequate reproductive tract specimen material, teeth for age determinations, and field observations and ages of young accompanying females, it should be

possible to estimate the number of young that a female can produce in a lifetime. Examination of reproductive tracts of old females will probably not reveal the exact number of young produced by individual animals.

Testes and epididymides are also being collected and examined to better understand male breeding biology. Testes and epididymides from 43 animals have been examined for presence of sperm (Table 4). Sperm were not seen in specimens from a yearling and a 2-year-old animal. Sperm were seen in February, March, and April specimens of all bears 3 years old and older. The oldest was aged at 19 years. Sperm were not seen in August specimens from mature animals.

#### Production at Denning Areas

There is only a very limited amount of denning by pregnant females along the northern Alaska coast. Dens have been reported along cut banks of rivers and in shore ice adjacent to small islands east of the mouth of the Colville River. Dens are much more sparsely distributed along the Alaska coast than in denning areas which have been described in other countries (Uspenskii, S.M. and F.B. Chernyavski 1965; Harington 1968).

It is believed that some females den on heavy pack ice north of Alaska. Cubs of the year and tracks have been seen in April as far as 60-80 miles from shore. In some cases cubs were so small and the ice was rough enough that it is believed they could not have walked from shore. We have not found any dens on the pack ice however. Because most of our work is within 80 miles of shore, we do not have observations further from shore than this.

#### Estimation of Hunting and Natural Mortality

Annual hunting mortality in recent years has ranged from 200 to 400. Details will be presented in the section on harvest statistics. We have no measure of natural mortality.

### MOVEMENTS AND POPULATION DISCRETENESS

#### Capturing, Marking, and Radio-Tracking

The major effort to determine discreteness of populations off the Alaska coast has been a movements study based on a mark and recovery program. Animals are located by tracking on the ocean ice with a helicopter in February, March, and April and marked after immobilizing with phencyclidine hydrochloride (Sernylan) and promazine hydrochloride (Sparine). Animals are marked with ear tags, tattoos, fur dye, and collars. Details on immobilizing and marking are given by Lentfer (1968; 1969). In 3 years of

Table 4. Results of examination for sperm in polar bear testes and epididymides.

Age Class (Years)	No. of Specimens	Date or Time Period	Sperm Observed
1	1	Jan. 3	No
2	1	Mar. 10	No
3	2	Feb. 3 - Mar. 25	Yes
4-19	34	Feb. 2 - Apr. 23	Yes
Mature	5	Aug. 12-16	No

tagging, 202 bears have been tagged off the Alaska coast by the Alaska Department of Fish and Game and the U.S. Bureau of Sport Fisheries and Wildlife (Table 5).

Three marked animals have been recaptured and fifteen have been killed by hunters. A number of resightings have also been made, most during the period immediately following tagging. Recovery data not including resightings are summarized in Table 6. There are not yet enough tag recoveries to draw conclusions about movements and population identity. Nearly half the recoveries made 9 months or longer after tagging have been in the same general area where tagged. Animals have also been recovered east and west of the tagging site. The longest movement has been by a male tagged north of Barrow and recovered 2 years later 500 miles to the southwest off the Russian coast. There was also a long movement to the east by a female with two cubs marked north of Barrow. She was recaptured a year later with two yearlings northeast of Barter Island. In considering these movements as indicated by tag recovery, it should be noted that recovery effort is not uniform and is intensive in areas where tags have been applied.

Table 7 presents data on condition of marks on bears which have been recaptured or taken by hunters. Neither the nylon nor the metal tag appears to have a distinct advantage over the other. Some metal tags were gone when animals were recaptured or skins presented for examination, and some nylon tags were broken so that numbers could not be read.

We are also attempting to mark animals by having them ingest a chemical which marks bones and teeth for a long period of time. The chemical marker is demethylchlortetracycline (DMCT), an antibiotic which chelates with calcium ions in bones and teeth. The presence of DMCT in these tissues is indicated by the emission of a characteristic golden-yellow fluorescence under ultraviolet light. Linhart and Kennelly (1967) have reviewed literature and presented data on fluorescent bone labeling of coyotes. Fluorescence was more evident in younger coyotes but could be recognized in all treated animals, the oldest of which was 12 years. Frost et. al. (1961) found fluorescence persisting for as long as 9 years after administration of the drug. For marking polar bears we have used 2400 milligrams of DMCT (Declomycin, Lederle Laboratories, Pearl River, New York) in about a 10-pound piece of seal meat and blubber. These baits have been placed along the coast between Barrow and Wainwright at locations where bears most often occur or where there are walrus carcasses to attract bears. Baits are placed on platforms above the ground so that foxes cannot reach them. Our program of monitoring the harvest should allow us to examine under ultraviolet light skulls and/or teeth of nearly all bears killed.

We have been attempting for more than 2 years to have radio-tracking equipment developed which would aid in determining movements. Available equipment is judged to be unsuitable because of battery life and range limitations. Our first attempt was a cooperative project with the University of Sydney, Australia. We dealt with electronics firms who had not



Table 5. Location and sex and age composition of polar bears tagged in Alaska, 1967-69.

	Cub-of- Year <u>1/</u>	Yearling			2-year-old		Sub-adult		Adult		Total
		M	F	Unk.	M	F	M	F	M	F	
Bering Strait											
1968		1				2			4	3	10
Lisburne											
1968		2	3	1	3	4	8	7	7	15	50
1969							1	2	4		7
Barrow											
1967		3	3		4	2	2	4	4	9	31
1968		8	1		3	7	6	11	7	37	80
1969	2		1			4	2	2	2	9	22
Barter Island											
1969		1	1								2
Total	2	15	9	1	10	19	19	26	28	73	202
Percent	1	12			14		22		50		100

1/ Cubs-of-year not sexed.

Table 6. Recovery data on polar bears tagged in Alaska.

Location Tagged	Location Recovered	Direction of Movement	Distance Between (Miles)	Time Interval	Sex	No. of Recoveries
Bering Strait	W. of Kotzebue	N	75	1 Mo.	M	1
Lisburne	W. of Pt. Hope	W	100	1 Yr.	M	1
Lisburne	Wainwright	NE	175	9 Mos.	M	1
Lisburne	Franklin Pt.	NE	200	1 Yr. 9 Mos.	M	1
Lisburne	Barrow	NE	300	1 Yr.	M	1
Barrow	N. of Van Karem-Russia Coast	SW	500	2 Yr.	M	1
Barrow	W. of Pt. Hope	SW	350	1 Yr.	M	2
Barrow	Wainwright	SW	75	9 Mos.	M	1
Barrow	Barrow	--	0	4 Days	M	1
Barrow	Barrow	--	0	1 Yr.	M	3
Barrow	Barrow	--	0	1 Yr.	F	4
Barrow	Barter Island	E	350	1 Yr.	F	1

Table 7. Condition of marks on recovered polar bears. <sup>1/</sup>

Tagging to Recovery Time	No. of Re-coveries	Nylon Tag			Metal Tag			Collar		Tattoo	
		Intact	Broken	Present Without Infection	Present With Infection	Missing	Collar Retained	Not Collared	Legible	Illegible	Not Tattooed
4 days	1	1		1				1	1		
1 mo.	1	1		1			1		1		
9 mo.	2	1	1	1		1		2		1	1
1 yr.	11	5	6	7	2	2	4	7	5	4	2
1 yr. 9 mo.	1	1		1				1			1
2 yr.	1	1		1				1			1

<sup>1/</sup> Does not include one hunter-killed bear for which data are incomplete.

had experience in biotelemetry and whose background was in the defense and space field. Results were unsatisfactory. We are now working with a laboratory that has had experience in biotelemetry, and we will have radio collars and aircraft receivers for testing in the spring of 1970.

#### Taxonomy

We have collected about 200 skulls as part of the cooperative program whereby Mr. Tom Manning of Canada and Dr. F.B. Tchernavsky of Russia will make morphometric comparisons of skulls from different parts of the polar basin. We have measured and examined these skulls and are obtaining length, width, and condylobasal length measurements from bears killed by hunters. We have not yet made statistical comparisons, but it appears that male bears from the Chukchi Sea west of Alaska are larger than males of the same age from the Beaufort Sea north of Alaska. This tends to substantiate some of the preliminary findings of Manning (pers. comm.). Body measurements also tend to be larger for Chukchi Sea animals than for Beaufort Sea animals. Skull measurements are now being processed for computer analysis.

We are also collecting blood samples so that Mr. Thor Larsen of Norway can make electrophoretic serum comparisons with samples from other locations in the polar basin.

Electrophoresis screening by the Institute of Arctic Biology at the University of Alaska of blood enzymes, transferrin, hemoglobin, general plasma proteins, muscle myoglobin, and cytochromes have shown no difference that might indicate different races of bears north and west of Alaska. However a preliminary series of antibody precipitation tests has shown some differences between polar bear serum proteins from the two areas. Work on this is continuing at the Institute of Arctic Biology.

#### Other

Ice movements undoubtedly affect bear movements and distribution and may account for differences in abundance from year to year. For instance, in the fall of 1967, winds brought heavy ice south to Bering Strait unseasonably early, and bears were far more common along the Alaska coast than usual. We plan to review available ice records and attempt to relate ice movements to what we know of bear abundance and distribution in recent years and what we observe in the future. We are also obtaining information from Eskimos on ice and current movements and their effect on bear movements.

Present studies by all nations are confined for the most part to coastal areas. It will eventually be necessary to study the distribution, movements, and abundance of bears throughout the polar basin. Drifting ice stations may provide bases for studies away from shore and have provided some very preliminary information on distribution. Figure 2 shows locations of bears seen and recorded at the United States Ice Islands Arlis II and T-3 and also

# U.S. ICE ISLAND AND BRITISH TRANS-ARCTIC EXPEDITION BEAR SIGHTINGS

LEGEND: X- SINGLE BEARS  
O- FAMILY GROUPS

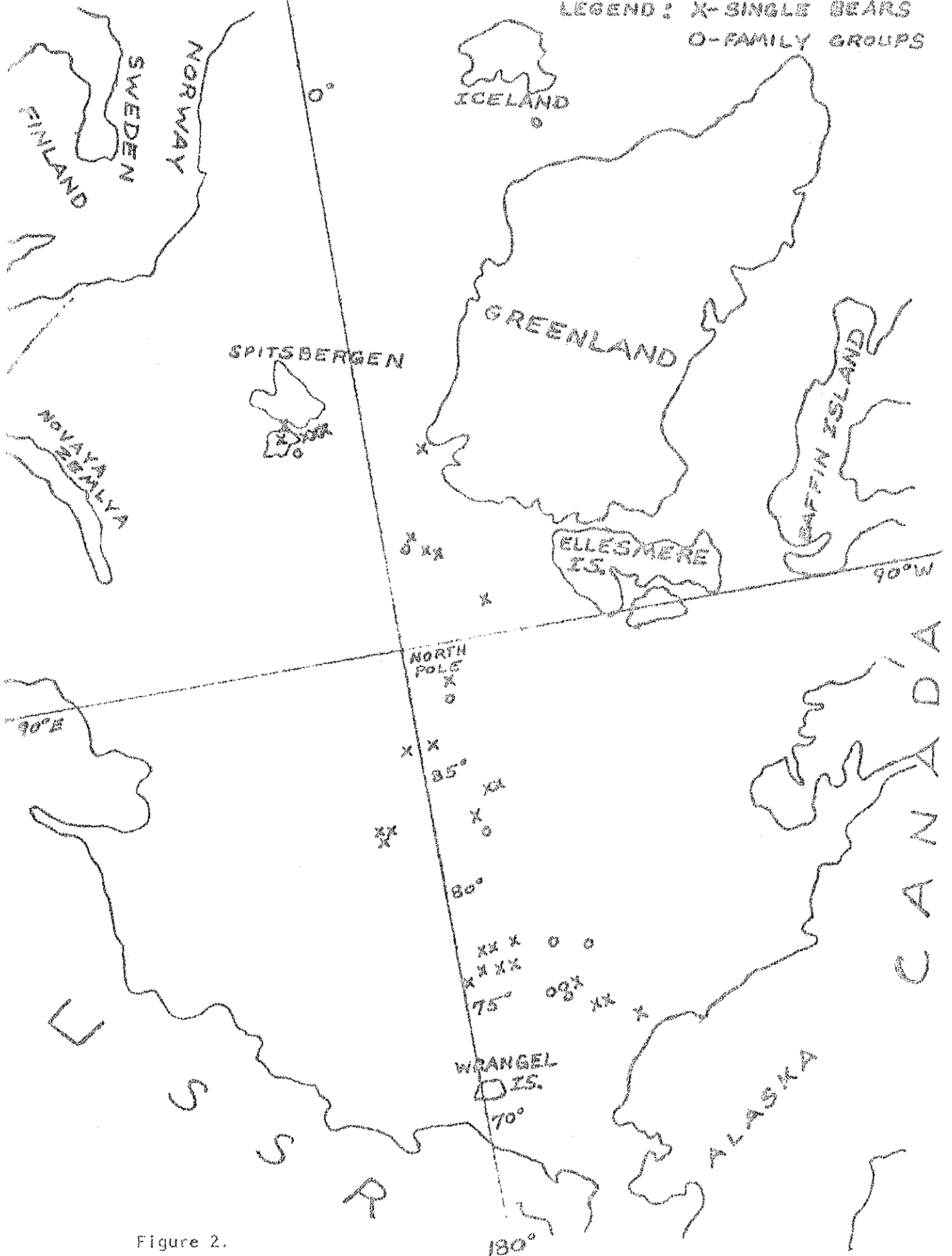


Figure 2.

by the British Trans-Arctic Expedition (records on file at the Naval Arctic Research Laboratory, Barrow, Alaska).

#### OTHER FUNDAMENTAL TOPICS OF ECOLOGY AND ADAPTATION

##### Food

We are not conducting specific food habit studies. Incidental examination of stomach contents and scats and observations made while tracking bears for tagging indicate that bears on sea ice feed almost exclusively on ringed and bearded seals. Bears on the beach in the winter feed also on carrion, mainly walrus, seal, and whale carcasses.

##### Behavior and Physiology

We are not doing behavior or physiology studies although some information on behavior is obtained incidental to other work.

##### Diseases and Parasites

Approximately 70 meat samples, mostly masseter muscle obtained in 1967, have been examined for presence of Trichinella. About half the samples were from bears killed west of Alaska and about half were from bears killed north of Point Barrow. Of the bears from the west, 67 percent were positive for Trichinella and of the bears killed north of Point Barrow, 72 percent were positive.

Analysis is continuing on 1968 and 1969 specimens, and incidence and intensity of infection will be reported by area and age class of animal.

The U.S. Department of Agriculture is interested in Trichinella in the Arctic from a public health standpoint and believes that the Arctic type may be more viable than types found to the south. More detailed work, including viability studies, will probably be done in conjunction with the Department of Agriculture.

Observations on other parasites and pathogenic conditions are being recorded. The only other activity of this nature which is planned is collection of fat tissue samples for insecticide analysis as has been done by Jonkel (1969).

Agenda Item 2  
Conservation Progress Report

HARVEST STATISTICS

During the hunting season we station men in the villages from which most hunting occurs in order to collect data and specimens. Hunters are required by regulation to present hides and skulls to us for examination and allow us to collect a tooth for age determination. We thereby obtain quite complete harvest information. Figure 3 is the form which is filled out when the hide and skull are examined.

Detailed information for 1968 and 1969 on harvest by area and type of hunting are presented in Tables 8 and 9. The high harvest in 1968 was mainly because of an increased Native kill. There were many more bears on the coast in the winter of 1967 - 1968 than there are most years, apparently because heavy ice moved south earlier than usual in the fall of 1967 and brought bears with it.

Table 10 presents harvest and sex ratio data by class of hunter for years 1961-1969.

Tables 11 and 12 present skull size and age composition data for the years 1966-1969. Bears from the two areas are treated separately because, as has been pointed out, there is some possibility that separate populations are involved. The harvest figures indicate that the three classes of hunters are distinctively consistent with respect to sex of bears harvested.

Non-resident (not residing in Alaska) hunters are most selective for males, resident white hunters are moderately selective, and native hunters are rarely selective except that cubs of the year and yearlings may not be taken in every instance. Actually, the difference in selectivity between non-resident and resident trophy hunters is attributable to the guides who seek larger bears for non-residents and commonly charge them a higher fee than they charge residents.

We do not know the degree to which changes in age composition of the harvest from year to year are caused by true changes in the population or are caused by varying conditions for hunting or other factors. Our present system of monitoring and results of other studies should allow an evaluation within a few years.

Alaska Department of Fish and Game Department

BEAR SEALING CERTIFICATE NO. 50

(For Department Use Only)

Skull \_\_\_\_\_

Hide \_\_\_\_\_

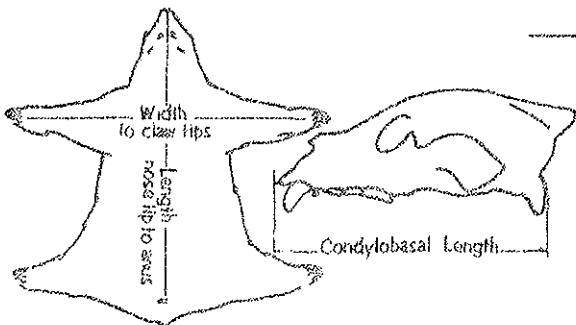
SPECIES <small>(See Numbers)</small>	SEX <small>(Place of Sealing)</small>	SEX IDENTIFIERS <small>(Place of Sealing)</small>
Brown _____ Grizzly _____ Polar _____	Male _____ Female _____ Unknown _____	Penis Sheath _____ Vaginal Orifice _____ Teats: L _____ M _____ S _____ None _____
SKULL	HIDE	SPECIMENS COLLECTED
Length _____ in. Width _____ in. Total _____ in. Condylbasal Length _____ in.	Length _____ ft. _____ in. Width _____ ft. _____ in. Total _____ ft. _____ in. Rubbed _____ Unrubbed _____	Tooth _____ Skull _____ Repro. _____ Other _____
TRANSPORTATION USED		
Aircraft _____ Off-road Vehicle _____ Boat _____ Snow Machine _____ Dog Team _____ Other _____	Days Hunted _____ Date of Kill _____ Location of Kill: Unit _____ Mt. Range and Drainage _____ Specific Location _____	

Name of Hunter \_\_\_\_\_

<small>(License)</small> LICENSE NO.	<small>(Tag)</small> TAG NO.	<small>(State)</small> GUIDED HUNT
Resident _____		Yes _____ No _____
Non-Resident _____		Guide's Name _____

\_\_\_\_\_  
(Signature of Hunter)

\_\_\_\_\_  
(Signature of Guide)



\_\_\_\_\_  
(Sealed by)

Remarks: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Figure 3. Bear sealing certificate which is filled out when a hide and skull are presented for examination and sealing.



Table 8. 1968 Known Polar Bear Harvest By Area, Type of Hunter, and Sex of Bear.

HUNTING BASE	NON- RESIDENT			RESIDENT- WHITE			RESIDENT- NATIVE			T O T A L						
	♂	♀	Sex Unk.	♂	♀	Sex Unk.	♂	♀	Sex Unk.	♂	♀	Sex Unk.	All Bears	% Total Kill	% Male	% Non Res.
Teller	25	5	-	4	2	-	-	-	-	29	7	-	36	10.3	81	83
Kotzebue	79	7	-	15	3	-	-	-	-	94	10	-	104	29.6	90	83
Pt. Hope	18	2	-	6	-	-	16	8	-	40	10	-	50	14.2	80	40
Barrow	23	12	-	6	11	-	17	5	1	46	28	1	75	21.4	62	47
Nome	-	-	-	-	2	-	-	-	-	-	2	-	2	.6	0	0
St. Lawrence	-	-	-	-	-	-	9	7	-	9	7	-	16	4.6	56	0
Diomede	-	-	-	-	-	-	3	-	-	3	-	-	3	.9	100	0
Wales	-	-	-	-	-	-	1	-	-	1	-	-	1	.3	100	0
Shishmaref	4	1	-	-	-	-	1	-	-	5	1	-	6	1.7	83	83
Kivalina	-	-	-	-	-	-	1	-	-	1	-	-	1	.3	100	0
Wainwright	-	-	-	-	-	-	19	19	2	19	19	2	40	11.4	50	0
Colville R.	1	1	-	-	-	-	-	-	-	1	2	-	3	.9	33	100
Barter Is.	5	5	-	6	1	-	1	-	1	12	1	1	14	4.0	92	36
Sub Total	155	29	-	37	19	-	68	39	4	260	87	4	351			
Percent	84	16	-	66	34	-	61	35	4	74	25	1	100	100		
TOTAL	184 (52%)			56 (16%)			111 (32%)									

Table 9. 1969 Known Polar Bear Harvest by Area, Type of Hunter, and Sex of Bear

HUNTING BASE	NON-RESIDENT			RESIDENT - WHITE			RESIDENT - NATIVE			T O T A L							
	♂	♀	Sex Unk.	♂	♀	Sex Unk.	♂	♀	Sex Unk.	♂	♀	Sex Unk.	All Bears	% of Total Kill	% Male	% Non- Res.	
Teller	25	2	-	1	-	-	-	-	-	26	2	-	28	9.4	93	96	
Kotzebue	77	14	-	3	-	1	-	-	-	80	14	1	95	31.9	85	96	
Pt. Hope	37	14	-	12	5	-	1	-	-	50	19	-	69	23.2	72	74	
Barrow	22	21	-	10	8	-	5	1	-	37	30	0	67	22.5	55	64	
Shishmoref	3	3	-	-	-	-	-	-	-	3	3	-	6	2.1	50	100	
Wainwright	-	-	-	-	-	-	7	9	-	7	9	-	16	5.4	44	0	
Colville R.	4	1	-	-	-	-	-	-	-	4	1	0	5	1.8	80	100	
Barter Is.	4	-	-	1	3	-	2	-	-	7	3	-	10	3.4	70	40	
Kivalina	-	-	-	-	-	-	-	2	-	-	2	-	2	.7	0	0	
Sub Total	172	55		27	16	1	15	12	-	214	83	1	298	100			
Percent	76	24	0	63	37		56	44		72	28		100	100			
TOTAL	227 (76%)			44 (15%)			27 (9%)										

Table 10. Polar bear harvest and sex ratios, 1961 - 1969.

Year	Non Resident		Resident White		All Sport Hunters		Resident Native		All Hunters	
	No.	% Male	No.	% Male	No.	% Male	No.	% Male	No.	% Male
1961	70	93	59	57	129	77	23	52	152	73
1962	78	85	103	60	181	70	16	50	201	69
1963	106	88	57	68	163	81	22	68	189	79
1964	142	89	86	60	228	78	23	69	253	77
1965	159	89	116	64	275	79	21	50	296	76
1966	195	89	152	66	347	79	52	46	399	74
1967	124	97	42	69	166	90	25	50	191	80
1968	184	84	56	66	240	80	111	61	351	74
1969	227	76	44	63	290	69	27	56	298	72

Table 11. Average skull size <sup>1/</sup> in inches of polar bears taken by airplane hunters based in Alaska, 1966-1969.

Hunting Area	Non-Resident		Resident-White		Total	
	Male	Female	Male	Female	Male	Female
<u>Chukchi Sea</u>						
1966	25.1 (139) <sup>2/</sup>	21.0 (9)	24.1 (48)	21.4 (20)	24.8 (187)	21.5 (29)
1967	24.9 (79)	21.2 (6)	23.1 (14)	22.1 (4)	24.6 (93)	21.6 (10)
1968	25.2 (121)	21.3 (12)	24.5 (24)	19.1 (4)	25.0 (145)	20.8 (16)
1969	24.5 (119)	21.3 (24)	24.0 (10)	21.3 (3)	24.4 (129)	21.3 (27)
<u>Beaufort Sea</u>						
1966	24.1 (25)	20.5 (6)	22.4 (44)	19.9 (26)	23.0 (69)	20.0 (32)
1967	23.6 (22)	20.0 (5)	22.6 (14)	19.9 (7)	23.2 (36)	19.9 (12)
1968	23.7 (23)	21.1 (12)	23.0 (5)	19.7 (10)	23.6 (28)	20.4 (22)
1969	23.4 (20)	21.2 (20)	22.5 (10)	20.0 (7)	23.1 (30)	20.9 (27)

<sup>1/</sup> Skull size is greatest length without lower jaw plus greatest width.

<sup>2/</sup> Numbers in parentheses are numbers in sample.

Table 12. Average age based on tooth cementum layering of polar bears in hunter harvest, 1966-69.

	Male			Female	
	Airplane		Ground	Airplane	Ground
	Non-Resident	Resident			
<u>Chukchi Sea</u>					
1966	9.1(64) <sup>1/</sup>	7.0(13)	--	7.2(14)	3.0(1)
1967	7.0(39)	7.0(7)	--	6.0(12)	--
1968	8.2(76)	5.8(21)	--	8.3(8)	4.0(3)
1969	6.2(106)	4.7(10)	--	5.4(27)	4.5(2)
<u>Beaufort Sea</u>					
1966	10.1(16)	7.2(13)	10.6(4)	6.6(8)	5.0(6)
1967	7.7(17)	6.0(10)	4.5(2)	7.0(8)	5.0(2)
1968	8.1(21)	6.4(7)	5.6(28)	5.8(22)	6.2(23)
1969	7.4(30)	6.1(9)	5.9(14)	5.4(31)	5.2(6)

<sup>1/</sup> Numbers in parentheses are numbers in sample.

### HUNTING RESTRICTIONS

Prior to 1967, the main restrictions on trophy hunting were by bag limits and seasons (one bear, exclusive of cubs and females with cubs, between January 1 and April 30). An upward trend in the number of bears harvested each year indicated a need for more restrictions.

In 1967, for the first time, guides were limited in the number of hunters they could take out. One guide could take out six hunters, or two guides working together, as is commonly done, could take out twelve hunters. Hunters were required to have permits but there was no limit to the number of permits issued. There were no serious problems with this regulation in 1967 and 1968. By 1969, however, more persons had become eligible to guide and were taking out hunters. In addition, there were violations of regulations by guides who took out more than six hunters.

It is now believed that the best method of restricting is by issuing a limited number of permits directly to hunters. A recommendation will soon go to the Alaska Board of Fish and Game, the regulatory fish and game body for the State, for the issuance of 350 permits to hunters who apply. It will be recommended that permits be allocated by quota for the two major hunting areas which possibly have different groups of bears and by quota for the two types of hunters (resident and non-resident). If applicants exceed quotas, applicants to receive permits will be chosen by drawing.

Residents are now allowed to take bears at any time and without limit for food as long as cubs and females with cubs are not taken and an airplane is not used. The primary reason for Arctic coast residents to take bears is shifting from a desire for food to a desire for obtaining skins for sale. It will be recommended soon that residents not be allowed to take more than three bears per year for subsistence purposes.

### FORMATION OF RESERVES

Reserves have not been established or proposed because there are no areas in Alaska where bears come ashore in great numbers to feed or den.

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APPENDIX VII

POLAR BEAR RESEARCH AND CONSERVATION MEASURES IN THE U.S.S.R.  
1968 - 1969\*

by

S.M. Uspenskii, A.A. Kistchinski  
(Central Laboratory on Nature Conservation,  
U.S.S.R. Ministry of Agriculture)

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\* A general review on the polar bear research and conservation measures in the U.S.S.R., as well as the results of such studies in the previous years, are given in the report by S.M. Uspenskii on the First International Working Meeting of Polar Bear Specialists, and in the book "The Polar Bear and its Conservation in the Soviet Arctic" (Leningrad, 1969).



In 1968-1969, the main attention in the polar bear research in the U.S.S.R. was paid to the numbers, dynamics, and structure of polar bear population. The main sources of data were the following: maternity den counts in the main breeding areas; tagging; aerial counts on vast areas; analysis of distribution and numbers of bears in some sample areas of Soviet Arctic; analysis of questionnaires; parasitological, biochemical, morphological, and, to some extent, ethological studies. These studies also expand our knowledge on general aspects of the biology of the species.

The research program "Polar bear and its conservation in Soviet Arctic" is worked out by the Central Laboratory on Nature Conservation, U.S.S.R. Ministry of Agriculture (under the guidance of Dr. S.M. Uspenskii). The Laboratory also co-ordinates research and practical measures concerning polar bear conservation, carried out in the U.S.S.R. by other institutions and departments.

Counts of maternity dens were made in 1969 (March 17 - April 10) in the main breeding area - the Wrangel Island. There were carried out ground routes about 1,000 km long as well as double air surveys. The technique of den survey was the same as in 1964 (Uspenskii and Tchernyavsky, 1965).

Due to a very small depth of snow as well as non-typical distribution of snowbanks and non-typical sea-ice conditions in the autumn of 1968, the distribution of dens on the Island was unusual (as compared, for example, to 1964). During our work, dens were found in few snowbanks, and in such places often at a distance of several meters one from another. Because of a rather thin snow cover over the dens (sometimes 5-10 cm only), the "snow-porches" formed of excavated snow in front of den entrances were small and hardly visible on the snow slopes. It made the counts of dens difficult. Under these conditions we had to abandon attempts for total den counts and to study more thoroughly areas with the greatest concentration of dens.

In 1969, we found 77 dens on the Wrangel Island. Due to the above mentioned reasons, this figure does not allow us to evaluate changes in numbers of breeding females against 1964. One may only suppose that the numbers have not changed essentially. Nevertheless, investigation of more than 60 dens made possible to enrich our knowledge on the winter ecology of the polar bear, as well as to improve the technique of den counting.

In the Drem-Head mountains (the north-west of the Wrangel Island) measuring about 8 x 3 km, in 1969, there were about 60 dens. Taking into account that the majority of slopes had no dens, such a density of denning females is probably unique for the whole Arctic. For example, we found two dens divided only by snow partition 50 cm thick. We may suppose that females during the denning period are probably indifferent to one another.

The overwhelming majority of dens was situated on the south-east and south

slopes (whereas in 1964 they were situated mainly on the north-east and north slopes) ranging in their altitude from 2-3 m to 350 m (usually 20-100 m). Dens were usually made at a height of 10-50 m above the foot of the slope. The majority of dens had one room averaged 1.75 m long by 1.45 m wide by 0.90 m high. The entrance-ways from the room were 1-6 (usually 2-3) m long by 70-110 cm wide by 50-60 cm high. Den entrance was usually lower than the bottom of the breeding room; it is effective in conserving warm air in the den. Some dens had more complicated structure - several (up to five) rooms and passages between them. It proves that the activity of female (in particular, den digging activity) takes place during parts of the winter. Some dens had narrow ventilation holes.

In 1969, 15 females (of 18 observed) had two cubs each and 3 - one cub. Mean litter size - 1.8. Cubs found in "open" dens (March 30 - April 10) weighed 8.2 - 10 kg (males, n=10) and 8.2 - 11 kg (females, n=3).

First female outside her den was observed on March 11. A mass "opening" of dens took place from March 20 to April 5. The majority of bear families left dens and went to sea ice from March 25 to April 8. The intensive mating period occurred in the middle of April (some pairs and paired tracks were observed).

The expedition has proved that in years (or areas) with poor snow, total ground counts of bear dens are hardly reliable. Such counts only allow to study general distribution and to estimate relative numbers of dens. To count all dens under such conditions it would be necessary to survey thoroughly and repeatedly every slope. The efficiency of aircraft (especially helicopter) for total den counting was also proved. However, the technique of such work should be improved.

Polar bear tagging. Taking into account the importance of studying the rate of attachment of female bears to a breeding territory, the Central Laboratory on Nature Conservation began, in 1967, experiments on immobilizing and tagging female polar bears in and near their dens, on the Franz-Joseph Land. In 1969, such experiments were rather successfully continued on the Vrangal Island.

In March and April of 1969, bears were immobilized by "Cap-Chur" powder projector (U.S.A.) and by similar Soviet guns. The drugs were Sernylan (U.S.A.) and myorelaxin (D.D.R.). The technique of immobilizing was modified according to the location and structure of dens as well as to the she-bear's behaviour. Sometimes, investigator approached the den in a vehicle or tractor, or on foot, and shot the syringe into the cheek (musculus masseter) of a female protruding its muzzle from the entrance hole. In other cases (if den was deep or female was harboured), a narrow "well" (20-30 cm in diameter) was dug from above to the room; through this well a shot was made. One female which had just left the den with her cubs, was overtaken from a vehicle and immobilized in the open tundra. During

experiments on immobilization, one or two members of the team guarded the investigator with rifles.

Sernylan proved to be an excellent drug the more so as it may be used in ethyl alcohol solution. The best results for female bears of middle size were received when using mixture of 3,0 cc 10% aqueous solution of sernylan and 2,0 cc of ethyl alcohol. The optimal dosages were 1,7 - 2,0 mg/kg. The results of the experiments are presented in Table 1. Maybe the lesser dosages are also good.

The interval between injection and immobilization was 8-10 minutes. The animals remained immobilized longer than in experiments of Canadian, Norwegian and American zoologists (Jonkel, 1967; Larsen, 1968; Lentfer, 1968) with the same or even lower dosages of sernylan. These differences may depend on the peculiarities of the physiology of lactating females. The immobilized animals had open eyes, and normal pupil reaction. Breathing was uneven; there was alternation of several deep breathes with short (up to 10-20 sec.) pauses and quick superficial respiratory movements. The total frequency of breathing in 1-2 hours after immobilization was 10-12 (in one female 21-23) times per minute. Rectal temperature was 38,2-39,2°C. Immobilization in all cases was followed by short-time convulsions and salivation. Tranquilizers were not used.

Bears recovered completely after the passage of 4-8 hours since immobilization. Females whose cubs had been taken away, went to the seashore and to ice. Once cubs were left with their immobilized mother in the dilapidated den; on the next day the family still remained in the den and was probably quite all right.

Myorelaxin (analogous to ditylin and succinylcholinchloride) was tested on one female lying in a large den of a complex structure, where it was difficult to observe her. The drug was injected three times repeatedly, and animal died due to overdosage. The results of this experiment are not quite clear, but we believe that myorelaxin cannot be reliable for immobilizing in winter when temperature is -25 -30°C. The aqueous solution froze immediately in the needle of syringe. Myorelaxin is hardly dissolved in ethyl alcohol; in mixture of water and ethyl alcohol, when temperatures are low, it falls quickly into sediment, and it is almost impossible to determine the true dosage received by animal.

Immobilized female bears were tagged on one or two ears with stainless steel tags, plastic tags, and "flags" of red polyvinyl chloride. Figures (30-40 cm high) corresponding to the ear tag numbers were dyed by a red dye on the sides of animals. One female was marked by a round orange tag (21 cm in diameter) of polyfluoroethylene attached to her back by "straps" of steel wire 4 mm in diameter, passed under the forepaws. Results of the tagging are presented in Table 2.

The total length and (by sight) weight of each immobilized female were

Table I

The results of the immobilizing female bears by sernylan  
(the Vrangel Island, 1969)

No.	Date	Age, years (appr.)	Weight, kg (appr.)	Dosage, mg	Minutes from inj. to immob.	Duration of immobi- lization
1.	March 31	8-10	200	500 <sup>*</sup>	8 - 9	7 hours
2.	March 31	4-5	150	300	10	After 1 hr. 40 min. bear was moving by head and forepaws; after 6 hr. 30 min. bear was absent in the den
3.	April 6	4-5	150	300	9	After 2 hrs. bear was moving by head and forepaws
	April 7	"	"	300 <sub>+</sub> +100	10 <sup>**</sup>	After 9 hrs. bear was moving by head; after 20 hrs. it was absent near den
4.	April 8	10-13	200	300 <sub>+</sub> +300	2 <sup>***</sup>	8 hours
5.	April 8	8-10	200	300	10	More than 3 hours

\* The day before, on March 30, this female received a dosage of sernylan (not exactly known because of unsuccessful shot), but we did not work with this bear at that time.

\*\* After injection of 300 mg of sernylan, female was immobilized in 5 min., but moved by head freely; these movements did not cease during 30 min.; after this time the second dosage was given.

\*\*\* In contrast to the other cases, this bear was immobilized from vehicle in the open tundra. After first dosage (300 mg) female continued to run during 20 min. though it became weak; after this time the second dosage was given.

Table 2

The results of female bear tagging (Drem-Head mountains, the Wrangel Island, 1969)

No.	Date	Age, years (appr.)	Steel tags, numbers		Plastic tags, numbers		Numbers dyed	
			left ear	right ear	left ear	right ear	left side	right side
1.	March, 3I	8-10	-	783	-	783	-	83
2.	March, 3I	4-5	784	-	784	-	84	-
3.	April, 6	4-5	78I	782	78I	782*	-	82
4.	April, 8	10-13	773	774	773	774**	73	73
5.	April, 8	8-10	-	768	-	768**	-	68

\* besides, a "flag" of red polyvinyl chloride was fixed in the right ear; round tag of polyfluoroethylene was attached to animal's back (see text).

\*\* besides, "flags" of red polyvinylchloride were fixed in both ears. Flags had 13 cm long and 3 cm wide.

measured; age was roughly determined according to the development of teeth; frequency of respiration and rectal temperature were measured; the blood smear was taken from the ear of one female.

In the Soviet Arctic aerial counts on vast areas are conducted (at the time of aerial ice surveys) by the Arctic and Antarctic Institute, the Main Board of the Hydrometeorological Survey of the U.S.S.R. The results of observations made in 1967-1968 are presented in a special article in the book "Polar Bear and its Conservation in the Soviet Arctic" (1969)\*. In April, 1969, such observations were also made.

Exploration of "sample areas". The Yamal Peninsula (north of the west Siberia) was surveyed as a such area in June and July, 1968. In this area the border of the polar bear area is clearly expressed. The collected data and questionnaire sources show that there were no essential changes in the limits of polar bear area compared with the beginning of the XXth Century (Zhitkov, 1912) or with the 1930's (Rakhmanin, 1939). These facts as well as questionnaire and published data concerning other Arctic regions probably testify to a relative stability of the area during last half Century (in spite of an essential decrease of the territories with high bear numbers and total numbers of the species).

In March-May, 1968, an expedition was organized to the Novosibirsk Archipelago. It was discovered that the numbers of polar bears visiting these islands are now quite low. Bears come rather regularly to the northern shores of the islands Belkovsky, Kotelny, and Faddeevsky (near the "Great Siberian Polynia") and only accidentally - to the other parts of the Archipelago. Not more than 10-20 females probably breed now on the Novosibirsk Islands (except the De-Long Archipelago and Novaya Sibir). The results of the study are published in the "Polar Bear ..." (1969)\*\*.

Parasitological research on polar bear is carried out at the Institute of Medical Parasitology of the U.S.S.R., Ministry of Health, under the guidance of Dr. N.N. Ozeretskovskaya. The main efforts are directed to the study of role of polar bear in the circulation of trichinellosis invasion and to the application of parasitological indicators for studying the species' population structure. The results of the work are partly published in the "Polar Bear ..." (1969)\*\*\*.

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\* Uspenskii, S.M. V.I. Shilnikov. Distribution and numbers of the polar bear in the Arctic, according to the data of aerial ice surveys.

\*\* Kistchinsky A.A. The Polar Bear on the Novosibirsk Islands.

\*\*\* Ozeretskovskaya N.N., V.I. Romanova, A.M. Bronstein. Trichinellosis in the Soviet Arctic of the polar bears' meat.

These studies are proceeding. Some samples were brought from the Vrangeli Island in 1969, where total helminthological autopsies of three polar bears were made. All the bears were invaded by trichinellosis. A coprological analysis of II samples was made by the method of Fulleborn and Kalantaryan. Besides, in the autumn of 1969, some samples were brought from the Hudson Bay (Canada), with a kind help of Dr. Jonkel.

Morphological and biochemical studies are being carried out at the Institute of Evolutionary Morphology and Ecology of the Animals, U.S.S.R. Academy of Sciences (under the guidance of Prof. Sokolov, V.E.) and at the Institute of Medical Parasitology, U.S.S.R. Ministry of Health (Dr. E.V. Pereversyeva). The results of the total autopsy of three polar bears made in 1969 on the Vrangeli Island, provided materials for the study. Various organs and tissue samples were brought to the Institutes, among them: cerebrum, eyes, thyroids, adrenals, uterus and ovaries, samples of intestine tissues and other parts of digestive tract, heart tissue, samples of skeletal muscles, bone and fat tissues, tongue, blood smears, kidney, liver, spleen, skin samples. Blood samples were also taken from cubs.

Studies of the polar bear behaviour and ethology were begun in 1969 at the Moscow State University and at the Moscow Zoo, under the guidance of Prof. L.V. Krushinski. At the Moscow Zoo, experiments are being carried out aimed at the improving of the immobilizing techniques.

The results of studies already completed and those in progress in the U.S.S.R. do not testify to any sufficient growth of the polar bear numbers (in the Soviet Arctic, in any case), in 1968-1969. This fact probably shows that the rate of annual harvest is now almost equal to the annual population gain. We believe that it is a new indirect indication to the following: a) present polar bear stock is hardly more than 10 thousands (considering that annual population growth is nearly 10%); b) geographically isolated populations of the species have rather large areas; c) the problem of bear conservation and hunting regulations is as actual as before and it may be solved only by international efforts.

Progress in conservation measures. In 1968-1969, polar bear hunting in the U.S.S.R. was prohibited as before. In 1969, on the Vrangeli Island, according to a special permission, 14 cubs were caught alive for zoos, and 3 female bears were killed for research.

In 1968, the Main Board of Wildlife Management of the Council of Ministers of the R.S.F.S.R. passed a decision according to which the Reserve on the Vrangeli Island acquired the rights of a republican reserve (it was previously under the authority of the Magadan Region Department of Wildlife Management). The new statute of the Reserve provides for establishment especially protected areas in places of the greatest concentration of animals and dens. It stipulates a more strict protecting regime in the area and a stationary polar bear research program. Since 1969, the Main Board of Wildlife Management of the Council of Ministers of the R.S.F.S.R. has banned

to kill female bears when catching living cubs for zoos under license.

Polar bear research plans for 1970-1971. In the U.S.S.R., it is planned to proceed with the research aimed mainly at the study of the population numbers, dynamics, and structure. In particular, bears are supposed to be tagged in their dens on the Wrangel Island every year; however, this tagging will not be carried out on a large scale. In 1971, we intend to carry out counts of polar bear dens in the central parts of the Soviet Arctic, and to ascertain by different means the present distribution, numbers, and population status of the species in this area. We suppose to prepare for publishing the next collection book "Polar Bear and its Conservation in the Soviet Arctic".

\* \* \* \* \*



APPENDIX VIII

INTERNATIONALE SPITSBERGEN-EXPEDITIE 1968-1969

NEDERLANDSE SEKTIE

Onder auspiciën van het

Rijks Instituut voor Veldbiologisch Onderzoek t.b.v. het Natuurbehoud (RIVON)

Stichting tot ondersteuning van de Nederlandse Spitsbergen Expeditie 1968-1969

Wereld Natuur Fonds-Nederland (World Wildlife Fund-Netherlands Appeal)



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adv. dir. Gekerkhof,  
Abt. Bank Nederland N.V.;

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Arnhem;

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dir. Rijks Instituut voor  
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Ooiglezer Nat. beh. en Mb.,  
Wageningen;

D.R.C. van Tienhoven  
dir. Ned. Overzee Bank  
Amsterdam, voorzitter  
Wereld Natuurfonds  
Nederland;

dr. A. van Wijngaarden,  
hoofd afdeling zoologie  
van het RIVON

Adresse.

Subj.: Planned Dutch  
Polarbear research.

Dr. G.W.Holloway,  
Secretary SSC - IUCN.,  
Les Utins 1110,  
Morges,  
Zwitserland.

Zeist, 27 January '71

Dear Dr. Holloway,

In addition to the letter from Dr. Van Wijngaarden to Mr. Berwick (R 36 486/AN of 15-1-'70) I'll inform you on the planned Dutch Polarbear research for the future .

Financial difficulties of the previous expedition are almost eliminated now and on a recent meeting of the expedition board the following plan has been developed. The advancing two weeks will be considered if there are possibilities for a continuation of the bear tagging program on Svalbard this spring already by sending a team of two man. In any case a scientific team will work on Kapp Lee during the summer of 1970, continuing the other research programs started in 1968-'69; simultaneously the base will be equipped for a Polarbear program to be carried out in the spring of 1971. Preparations are made for measuring all the polarbear skull material, available in Dutch scientific collections for comparative studies. I should like to be kept abreast of the results of the coming meeting of Polarbear scientists.

With kind regards,

c.c. Dr. A. van Wijngaarden.

(P.Oosterveld)

THE DUTCH EXPEDITION TO SPITSBERGEN 1968 - 1969

Preliminary Report series nr 2.

by

P. Oosterveld

Research Institute for Nature Management

Due to various circumstances as the location of the station, the very heavy ice-year 1968-'69 and the restricted possibilities for moving around during winter time, the total amount of collected data on polar bears have to be called scarce. 24 animals were seen of which 12 were tagged (see lists below). One of the tagged animals died under operation.

Four animals were caught by syringe gun, while they were running free, three were trapped; although twice a member of a family was trapped (1 time 4 bears, 1 time 3 bears), the total result of trapping amounts to 8 animals. One bear was trapped twice again after tagging.

running nr.	tagged	first obs.	sex	estimated age	particulars
1	251	1/ 9'68	m	3	shot at Isfjord okt '68
2	-	11/ 9'68	q	2	
3	252	5/10'68	m	4	
4	-	12/11'68	m	old	
5,6,7	-	5/ 2'69	f	with two cubs	last obs. 22/2'69
8	-	15/ 2'69	q		
9	253	29/ 3'69	m	8	trapped
10	-	5/ 4'69	q		
11	-	23/ 4'69	q		10-13 ... all the same
12	-	28/ 4'69	q		not excluded
13	254	30/ 4'69	m	5	
14	255	30/ 4'69	f	7	
15	256	30/ 4'69	m	1	14-16 certainly not the same as 5-7
16	257	30/ 4'69	f	1 (trapped)	
17	258	3/ 5'69	m	15	died during operation
18	-	10/ 5'69	q		
19	260	26/ 5'69	m	4	
20	-	13/ 7'69	q		
21	259	19/ 7'69	f	8	
22	261	19/ 7'69	f	0,7	trapped
23	262	19/ 7'69	m	0,7	
24	-	28/ 8'69	q		

Recovery of 255, 256 and 257 at 24/6'69

Detailed list of observed polar bears and polar bear tracks

- 1/ 9'68 Arrival of bear nr. 251, nickname "Barend", most probably coming from Freemansundet. The bear stayed around Kapp Lee station from 1-9 till 6-9, and from 12-9 till 19-9 and was tagged on the 15th of September. Until 15-9 the bear was fed on pelsifood, but apart from that he was eating from some carcasses of seals on the beach. Daily behaviour observations of that time are available; in the observed time hairshift took place by rolling on the tundra and the ice. The bear got 500 mg. Sernylan + 100 chlor.pr., was hit in the hip and got down in 6 min.; recovered after operation within a few hours and showed no additional effects; stayed fully recovered for some more days around the station. The bear was shot at Ishfjord radio station on Vest Spitsbergen on the 17th of October, further particulars on the sheet.
- 11/ 9'68 Young, most probably male polar bear, nickname "IJsbrandt", around the station from 11-9 till 12-9; was eating from the seal carcasses and behaved rather shy; could not be tagged; probably chased away by "Barend" later.
- 5/10'68 No. 252 coming from the North; he got 450 mg Sernylan + 100 chl.pr. Was hit in the hip and got down after 11 min. Recovery took a considerable time, almost a day and first after two days did not show any more after effects, was observed fully recovered at 9-10. During recovery tremendous periods of shivering and cramps were seen.
- 12/11'68 Bear around the hut in the dark, most probably an old male; was running away very fast after he had been spotted.
- 5/ 2'69 A female with two year-old cubs on the ice in front of the coast, reappearing the 16th and disappearing S. of Ternöya; they destroyed the trap there. On the 17th they were seen at the same place inspecting the rubbish pile and disappeared South again; back on the 19th and running away NW. after approach; they destroyed on the 21st the trap on Ternöya another time. Last observation on the 22nd, disappearing South.
- 15/ 2'69 "Male" polar bear 500 m. in front of the hut on the ice, running away in the direction of Freemansundet.
- 21/ 2'69 Two bear tracks on Thomas Smith öyane, a big one and a smaller one, both running West.
- 16/ 3'69 Bear track behind Ternöya running S.N.

- 29/ 3'69 First visit of male polar bear during the night, nickname "Uspuk"; back on 30-3 during the night and trapped at about 10 in the morning in the house trap; tagged 253 in the afternoon. He got 600 mg Sernylan administered in two times and was hit in the hip; got down after 75 min. and recovered within a few hours.
- 5/ 4'69 Bear observed on the ice in front of the station, disappeared after hunting, direction S.W.
- 11/ 4'69 Bear trap on Ternöya destroyed; no visible tracks.
- 23/ 4'69 Single bear around the hut disappearing in the storm in N.W. direction; damaged probably the trap on Ternöya another time.
- 25/ 4'69 Female bear track S. of Thomas Smith öyane, with two one months cubs running N.W.
- 28/ 4'69 Single polar bear destroyed the trap on the ice in front of the coast and visited the station afterwards, while nobody was present; disappeared S.
- 30/ 4'69 One year female cub was trapped in the lagoontrap; mother and brother stayed and a single male accompanied the party. All were tagged (254-257) 254 got 400 mg Sernylan + 100 mg chl.pr.; was hit in the middle part and went suddenly down after 3 min.; fully recovered after 5 hours shivering and with light cramps. 255 female got 600 mg Sernylan + 100 chl.pr. administered in three times; was first hit in the middle part later in the hip; fully down after 80 min. and fully recovered after 6 hours; attacked the male one (254) before and during the operation. 256, male cub, got 300 mg Sernylan + 120 chl.pr., administered in three times and was hit in the hip; fully down after 2 hours and fully recovered after 3½ hours. 257, female cub, got 150 mg Sernylan + 100 mg chl.pr. and was hit in the side; fully down after 6 min. and recovered, somewhat crippled after 5½ hours. They disappeared in N.W. direction. All four of them were seen fully recovered on 1,5-2 km North of the station (see 5-5 and 24-6).
- 1/ 5'69 Bear track observed E. of Bromulen running N.W.
- 3/ 5'69 Three bear tracks found on land near the "klyfta", 30 m high, running into Freemansundet. Most probably nrs. 255, 256 and 257.
- 3/ 5'69 Male, about 15 years old, seen on the ice 2 km W. of Ternöya, which was waiting near a seal hole; hunted by snowscooter, tagged

258; shot with 250 mg Curasit and hit in the chest cavity. Bear died almost immediately. The whole skeleton is collected, the skin and some of the entrails (heart, testis and parts of liver and milt).

- 5/ 5'69 Bear no. 254 trapped in front of the hut and released after 300 mg Sernylan; this silly bear was trapped again on 7-5 in the lagoon trap and once more released after a 200 mg Sernylan injection; the last time he did not destroy anything.
- 10/ 5'69 Single one; disappeared after visiting the station westwards and destroyed the trap on Ternöya.
- 19/ 5'69 A couple of tracks were observed in the middle part of Storfjorden, about 4 running in all possible directions through each other.
- 26/ 5'69 No. 260, male, hunted by snowscooter in Freemansound (W. part); got 600 mg Sernylan + 100 chl.pr. administered in two times. Full effect after 80 min. - 5 min. after second shot - hit in the hip; fully recovered after about 4 hours.
- 24/ 6'69 255, 256 and 257 passed by the station in good health coming from the South, passing the Doleritt peninsula and disappearing in direction Freemansound, running at 70 m height along the slope of Leefjell.
- 13/ 7'69 Single one on the tundra near the hut; disappeared shortly afterwards walking along the coast; entered the packice at the cape and turned N.W.
- 19/ 7'69 Female bear trapped in the lagoon trap, accompanied by two 7 months old cubs. The bear destroyed the trap completely and dragged the heavy driftwood tree about 50 m with her in the pack-ice. She got no 259 and 650 mg Sernylan + 100 chl.pr., administered in three times; down after about half an hour and walking away after 5 hours.  
261, female cub, nickname "Brommer" got rather a lot of darts, but most of these failed in working correctly for one reason or another. She got down after about an hour and was fully recovered after 3 hours without any side-effects. 262 the male cub, nickname "Grauwer" gave the same difficulties with the darts, but went finally down after some time and recovered as fast as "Brommer". While the cubs were fighting and running around in the neighbourhood already, the female started moving slowly. After a bath she walked away calling her cubs in vain; they went on fighting and crying and did not respond.  
The female left going Westwards into the packice and did not

return to pick up the cubs. These were observed and fed for two days, while they were still staying on the same spot. After that period they were caught again each by a 150 mg Sernylan injection, in order to keep them better under control. "Grauwer" escaped almost directly, but stayed in the neighbourhood and was fed for two days more, but disappeared later Southwards. "Brommer" escaped after a week damaging a 5 mm steel cable.

15/ 8'69 Polar bear observed near Agaardh by helicopter pilot Uwe Karlquist.

28/ 8'69 Polar bear observed North of Agaardh in the packice out of the boat.

### Traps

During winter time only two traps were working, one close to the hut and another one on Ternöya. However due to snowdrifts during most of the time it was rather difficult to keep them clean and ready for use. In the beginning of April four more traps were erected; three on the ice along the coast to Kapp Lee, one on the peninsula near the lagoon, 200 m South of the station.

In the end of May the ice traps were broken down, as it was not possible to fasten them strong enough any more to the melting ice clumps. The trap on Kapp Lee was rebuilt on land. Only the traps near the hut and the lagoon trap appeared to be successful in capturing bears.

The trap at Ternöya was visited a lot of times and as often destroyed. For a good working trap the noose of the steel cable should be laid somewhat above the surface of the soil with the frontside a little higher, while at the same time other possible localities for setting a paw, must be eliminated by pricking sticks around. The visibility of the trap seems of greater importance than the quality of the bite.

### Drugs

Bears were shot with syringe gun and immobilized by injecting Phencyclidine hydrochloride (Sernylan, Parke Davis and Co., Detroit). Simultaneously or shortly afterwards up to 0,5 mg of a tranquilizer Largactil chlorpromazine (Philips Duphar) was added 200 mg/ml sol. to prevent the harmful influence of Sernylan (cramps).

Average dosage of Sernylan was 2 mg/Kg body weight (see Table).

Young animals - 5 bears up to 4 years old, needed an average dosage of 2,32 mg/Kg body weight. Depending on the spot where a bear was hit and of its physical condition, immobilization took place within 3 to 120 min. Bears

hit in the middle part, got down very fast in general; however always the shot was aimed at the hip. The collected data on recovery are very different, polar bears appeared to react very individually to the injected Sernylan. Full recovery took place from 3 hours to 48 hours after immobilization. Young animals recovered faster than older animals.

Table

Bear no.	Age Years	Estimated Weight Kg.	Administered Sernylan mg.
251	3	200	500
252	4	250	450
253	8	450	600
254	5	300	400
255	7	300	600
256	1	80	300
257	1	80	150
259	8	350	650
260	4	250	600
261	0.7	70	
262	0.7	80	+) )
251-260 9 bears		2,260	4,400

+) Treating those bears repeatedly the dart mechanism was failing partly or completely.

During discussions with Dr. Erik Nyholm from the Finnish Wintering Team some doubts arose on the effect of Sernylan on polar bears; as to his experience bears should die about 3 months after having been immobilized with Sernylan (2 animals tested); experiments on mice with an adapted dosage gave the same results.

Out of own experience later has to be concluded that Nyholm's hypothesis is wrong generally spoken; bears treated with Sernylan appeared to be in good health after three months. It is not sure if Nyholm used a tranquilizer with the Sernylan.

The arisen doubt was the reason that bear no 258 was shot with curasit; the used dosage was about half of the quantity which was indicated for animals of that size. The bear died under operation, because he was hit in the chest cavity.

### Tagging

Bears were tagged with nylon tags in both ears and had the ear tag number tattooed on the inside of the upper lip.

Tag numbers were 251-262. Bears were measured and weights estimated.

### Migration

Although the collected data on polar bear migration around the N.W. point of Edgegöya are very scarce (24 animals observed) some general tendencies can be noted.

From September '68 till February '69 bears came from the North (N. and N.E.) and disappeared in Southern direction (S. and S.W.). During the period in which most bears were observed, March-May 1969, they most probably came from Western directions (S.W. to N.W.) and disappeared almost without exception in N.W. direction; during that time open water was reported in the most Northern part of Sterfjorden. In spring time, June, July 1969, bears came from the South and disappeared North. The local polar bear migration is completely correlated with movement of the ice in times that this is broken up. (Summer, autumn).

### Denning

In cooperation with the Norwegian winter team all valleys running South to Freemansundet from Sundneset to Freemanbreen were inspected during the end of March. In April the North Western coast of Edgegöya from Kapp Lee to Middendorfbjerget was inspected. No dens have been found.

The observation of a bear track with two small tracks next to it on the 25th of April 1969 in the middle part of Freemansundet indicates that somewhere in the neighbourhood at least one den was located, but denning in these surroundings did not take place at a large scale during the winter '68-'69.

At Dolerittneset three skeletons were found (2 males, 1 female) on spots where during winter and spring time huge amounts of snow were concentrated. At a similar place 5 Km. inside Rosenbergdalen another complete male skeleton was found.

### Behaviour

An interesting observation was made on 30-4-'69 when a female yearling was trapped in the neighbourhood of the station accompanied by a female and a male cub. At the same time a male joined the party. It is generally accepted that polar bears do not mate as long as they are with cubs and that family parties break up in the mating season. However the male joined the group for two more days and the family was observed intact (female with two cubs) two months later. Whether mating actually took place is not observed.



The Norwegian team encountered a similar situation. Another unfamiliar event occurred on 19-7-'69 when a female after the tagging operation left her cubs alone; most probably a Sernylan after effect.

#### Collection and Working Out

The complete skeleton of the bear, who died under the tagging operation, the skin and samples of the entrails are collected. The liver is sent to the toxological department of the Veterinary Highschool in Utrecht (Dr. Koeman) for research. The testis will be sent to Oslo (Cand. real. Larsen) for histological research. A sample of the flesh will be tested for trichine and a part of the guts will be investigated for parasites at the State Museum for Nature History in Leiden, which Institute also bought the skeleton and the skin for her collection. Eight bear skulls are collected and will be measured following the Uspenskii standard. All data gained on tagging, migration and skull measurements are placed at the disposal of Cand. real. T. Larsen (Inst. for Marinbiologi, Oslo) for working out in a larger connection.

#### Polar bear Management

The scientific activities around the polar bear in the Svalbard area during the last years have contributed to the fact that the new measures come into force to ensure the survival of the species. A fixed amount of harvesting will be laid down; hunting will be subjected to an extensive permission system; set guns (self-shooting installations) will be prohibited. About 100 polar bears are tagged now in the Spitsbergen area. Tagging operations started in 1966. The recovery percentage, about 10% is rather high in such a short time and forms an indication that the population is not as large as formerly was accepted.

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APPENDIX IX

AN APPEAL

presented by the Soviet Delegation to the  
Second Working Meeting of Polar Bear Specialists  
and forwarded to the Executive Committee of I.U.C.N. after  
discussion and endorsement by the Polar Bear Specialists, for  
transmission  
TO THE GOVERNMENTS OF CANADA, DENMARK, NORWAY, AND U.S.A.

In recent decades, one of the most valuable mammals of the arctic, the polar bear, has become an endangered species because of human activity and associated damage to the polar environment. The polar bear occurs in international waters and also moves between arctic territories and adjacent waters that are under the jurisdiction of different countries. Co-ordinated international effort is therefore required for the conservation of the species. Some Governments of States in the Arctic Basin have restricted the numbers of polar bears that are killed or captured within their territories and adjacent waters, and in one of these States, namely the U.S.S.R., the polar bear is completely protected. The International Union for the Conservation of Nature and Natural Resources approves these measures but notes, nevertheless, that polar bear numbers, in general, have not essentially increased, due in an unknown but presumably substantial degree to heavy harvests in certain jurisdictions and in international waters. Hence, these measures are as yet insufficient.

At present, scientists in Canada, Denmark, Norway, U.S.A. and U.S.S.R. have research programmes for a detailed study of polar bear biology, in order to provide the basic data for co-ordinated international measures for the restoration of numbers and the rational management of the species. These scientists are members of a Polar Bear Specialist Group, which is under the aegis of the Survival Service Commission of the I.U.C.N. Their studies and the subsequent preparation of necessary international measures will require some time for their completion.

In view of these considerations, the I.U.C.N. requests the Governments of Canada, Denmark, Norway, and U.S.A. to review, with urgency their polar bear management programmes, with a view to drastically curtailing harvests, beginning in the next hunting season. It is recommended that these measures be enacted for a period of five years to promote the restoration of polar bear populations. The I.U.C.N. trusts that the Governments of these countries will give sympathetic consideration to these proposals and take necessary action in the areas within their jurisdiction. If national action proves inadequate, international measures may be required to ensure the conservation of the polar bear.

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APPENDIX X

For release February 5, 1970

SCIENTISTS FROM FIVE NATIONS VOICE CONCERN  
FOR POLAR BEAR SURVIVAL

The great white polar bears (Ursus maritimus) which are found only in the five nations surrounding the north pole and in the Arctic no-man's land are an endangered species, but prospects for their survival are good - if mankind is careful.

This consensus appeared yesterday at the conclusion of a three-day meeting of polar bear scientists from five nations who came to Morges, Switzerland, to discuss progress and compare data on their individual programs of polar bear research.

The International Union for Conservation of Nature and Natural Resources, which has been given responsibility for compiling scientific research data on the bear, convened the meeting.

All the scientists noted the increasing economic development in the Arctic, and expressed general concern that serious ecological problems could arise as a result of oil spills, off-shore drilling and other economic activity. Pressure on the bear is also increasing because of growing markets for polar bear hides.

Scientists at the meeting were from Canada, Denmark, Norway, the U.S.A. and the U.S.S.R. - the five circumpolar nations. They are members of the I.U.C.N. Survival Service Commission's Polar Bear Group. Dr. John S. Tener, Director of the Canadian Wildlife Service, was Chairman of the meeting.

Considerable progress was reported in the research activity of the last two years.

Discussions centered primarily on bear movements, denning areas, discreteness of populations, and, to a lesser extent, harvest figures, productivity, and the density and abundance of the species throughout its circumpolar range. While insufficient data were presented on which to base precise estimates on the abundance of the species, some agreement emerged, concerning movements of polar bears and the discreteness of certain populations, about which little has heretofore been known. From the tagging program and other research, it now appears that there are probably five more or less identifiable bear populations. These are located in: (1) the Spitsbergen - Franz Joseph Land - east Greenland region, (2) the

Hudson Bay region of Canada, (3) the high Canadian Arctic, (4) the high Canada - eastern Alaska region, and (5) the western Alaska - eastern U.S.S.R. region.

Two years ago the group standardized research techniques involving ear tags, dye numbering on the fur, lip tattoos and tag exchanges. Much discussion was devoted to the development of techniques for live capture and tagging. This work has been carried out successfully on a cooperative international basis and more than 450 polar bears have now been tagged.

Radio telemetry equipment and techniques were also discussed in detail. The Canadian telemetry program is already producing useful information, and Alaska is experimenting with a new type of equipment that may greatly increase the effectiveness of existing equipment.

Data were presented which helped to locate much more precisely the major denning areas in the Arctic. The main areas so far delineated are in Canada and the U.S.S.R., with minor areas found in northeast Greenland and in Spitsbergen. It appears that bears rarely den in Alaska. An important finding was that Kong Karl's Land (sic), near Spitsbergen, once thought to be a major denning area, is perhaps relatively insignificant, and that most polar bears moving into the Spitsbergen region appear to come from the Soviet Union on the westward moving ice. Also, polar bears along the Alaska coast most likely move in from eastern Siberia (Wrangel Island) and from western Canada.

The need for much more knowledge about climate and sea ice conditions was stressed in order to understand both the movements and size of polar bear populations. This is of primary importance in understanding the occurrence and abundance of bears in all Arctic regions.

Good cooperation among the five nations was reported with respect to all research. Food habit studies as well as behavioral studies have been instituted by Canada in cooperation with universities. Physiological research is continuing in Norway and it is hoped that the other nations will cooperate in this endeavor. The work by Canada analyzing the concentration of DDT in fat tissues of bears was discussed and this work will be extended on a cooperative basis. New research in Alaska involves radio tracking and censusing with heat-sensitive scanners aboard aircraft.

It was noted that polar bear hunting is an intrinsic part of the culture of the Thule and many Canadian Eskimos in addition to being a very important source of food and clothing. While it will be very hard to change their way of life, this may be necessary because the Eskimo population is growing faster than the polar bear population. Hunting of polar bears in Greenland is restricted to residents of one year or more.

The polar bear is totally protected in the U.S.S.R. It is also protected

in reserves on Kong Kari's Land (Norway), James Bay (Canada), and Wrangel Island (U.S.S.R.). Cubs and sows with cubs are protected throughout much of the animal's range.

The scientists estimated that a total of 1250 polar bears were killed in 1968.

The group did not make an estimate of the total number of polar bears. The Soviet Union's scientists, however, believe the total is 10,000.

In addition to continuing established activities, a number of specific areas for research collaboration were agreed on. These include collection of blood, milk and skulls for taxonomic determinations, food habits studies, and collection of fat samples for pesticide determinations.

It was agreed that next year Canada would initiate a comprehensive study of the correlation between polar bear numbers and movements, ice movements, seal distribution and abundance, and other factors with a view to developing a statistical model to describe polar bear populations dynamics. Delegates agreed to provide information required for the proper development of an ecological model. There will be a full exchange of information about the model as it is developed.

The Group elected Dr. Andrew Macpherson of Canada as its Chairman for the next two years, succeeding Dr. S.M. Uspenskii of the U.S.S.R. The chairmanship rotates every two years.

The next meeting of the Group will be in January, 1972.

Participating were Dr. John S. Tener, as Chairman of the meeting; Dr. Charles J. Jonkel and Dr. Andrew Macpherson of Canada; Dr. Christian Vibe of Denmark; Mr. Thor Larsen and Mr. Magnar Norderhaug of Norway; Mr. James W. Brooks and Mr. Jack W. Lentfer of the United States; Dr. Savva M. Uspenskii and Dr. A.A. Kistschinski of the U.S.S.R.; Dr. Richard A. Cooley (Group Technical secretary), and Dr. Colin W. Holloway, executive secretary of the I.U.C.N. Survival Service Commission.

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Concern for the future welfare of the polar bear brought together a small group of leading Arctic scientists at IUCN Headquarters, Morges, Switzerland, during the last three days of January 1968. IUCN had earlier accepted responsibility for acting as the coordinating agency among Arctic nations which first met at Fairbanks, Alaska, in September 1965 to exchange information on polar bear conservation problems\*. The Union considered it important to call a meeting at this time to review present research activities, to discuss research needs and priorities, and to consider how to achieve more effective scientific collaboration on a continuing basis. Because polar bears share a vast common habitat and may move freely from nation to nation on the slowly revolving Arctic ice pack, the future of the species is a matter of international concern. The polar bear is one of the species listed in IUCN's *Red Data Book* of the world's rare and endangered animals.

Scientists from the circumpolar nations of Norway, Canada, the Soviet Union, the United States and Denmark (Greenland) were invited to attend the meeting. While IUCN was aware that many organizations and individual scientists and conservationists throughout the world were deeply interested in the future of this species, it was decided that more effective results would be achieved by inviting only a limited number of scientists actively involved in polar bear research to participate in a closed working session, as distinct from an open conference. Scientists at the meeting were: T. Larsen and M. Norderhaug from Norway; A.H. Macpherson (who acted as rapporteur) and C.J. Jonkel from Canada; S.M. Uspensky and A.G. Bannikov from the U.S.S.R.; and J.W. Lentfer and J.W. Brooks from the U.S.A. The Danish scientist, C. Vibe, was unfortunately unable to attend. The Chair was to have been taken by the eminent British ecologist, F. Fraser Darling, but at the last moment he was prevented by illness from attending. His place was taken by J.S. Tener, Deputy Director of the Canadian Wildlife Service. Also attending were R.A. Cooley from the U.S.A., who acted as secretary; and C.W. Holloway and N.M. Simon of the IUCN staff at Morges.

In the official opening remarks presented on IUCN's behalf by D.J. Kuenen, Vice-President of the Union, a statement from F. Fraser Darling to the participants was read which set the tone of the meeting:

*Our meeting is an exceptionally important one, primarily for our human obligation to conserve this unique species, the polar bear; secondly, the International Union has taken the initiative very proper to its standing of calling a committee meeting of scientists from the interested countries to talk over their work in a way which can lead ultimately to the end we all so earnestly desire, that of effective conservation. I feel that to some extent national identities will become less sharp as the meeting progresses, because common experience of research in a harsh environment establishes its own brotherhood.*

*Perhaps we are fortunate in that only five nations are concerned, although you will understand that many others are deeply anxious about the Arctic fauna. It is easier for us to get talking with only five nations, and because the men here are those who have worked on the polar bear, the success of this meeting will justify the initiative of the Union and may lead to further ventures of similar kind for other creatures in other parts of the world. This is a working party of men who know; and in the spirit of science you will give and take.*

The meeting proved to be a valuable experiment in international cooperation. The atmosphere was relaxed, participants were frank, and a wide variety of scientific data was freely exchanged. Significant agreements were reached on standardizing research procedures; setting

priorities to meet critical research needs; assigning certain areas of research to individual scientists from the five nations; and establishing methods for continued contact and exchange of scientific information and, to a limited extent, exchange of scientific personnel. The polar bear was of concern to the scientists not only in its own right but also as an element of the delicate Arctic biota and of the high latitude ecosystem. This broad approach to the problem prevailed throughout the discussions. Consideration was also given to the polar bear as a natural resource and its cultural and economic values to indigenous peoples.

## Research Activities

Present and future research programs of each of the nations were reviewed and discussed during the first two days of the meeting. Some of the major findings are summarized below.

**U.S.S.R.** The objectives of Soviet research were described by Professor Bannikov in a working paper *On the Conservation of the Polar Bear*. Soviet scientists believe that polar bear stocks have been greatly reduced since the 1930's, and as a result the government has prohibited all hunting of the polar bear since 1956. The only harvest is a few cubs taken for zoos. Other Arctic fauna are also protected more than formerly, and disadvantaged Eskimos are compensated by being paid higher prices for other furs and through social welfare measures. Wrangel Island, an important denning area for polar bears, is being considered for a national park which would give bears there permanent protection. Speaking on the need for mutual efforts by all countries to preserve the polar bear from extinction, Professor Bannikov concluded, "It is high time to raise a question about the protection of the Arctic ecosystem as a whole, as a specific complex which functions in extreme conditions and can be easily destroyed by man". The polar bear, he said, must be considered along with the broader problem of the protection of the entire Arctic environment.

Dr. Uspensky reported on his studies, particularly on the abundance of polar bears on sea-ice and at denning areas in the Soviet Arctic. Data on abundance and distribution are obtained by counting bears from aircraft surveying ice conditions, and through the counting of dens in the spring when females are emerging with new cubs. Uspensky's method of counting polar bears, which he has developed to a high degree during the last decade, was of great interest to scientists from other nations. Other research by Soviet scientists discussed by Dr. Uspensky included craniometric work which shows a marked uniformity in skull measurements throughout the Soviet Arctic; and parasitological studies which indicate that trichinosis in polar bear is of a different type from that identified in other mammals. In the future, Soviet scientists plan to undertake a tagging program to determine migratory movements, and to continue existing studies on den surveys. Interest was also shown in cooperation with scientists of other nations in studies on age determination, morphological and serological taxonomy, ecology and parasitology.

**Canada:** Four provinces and the Yukon and Northwest Territories have management responsibilities for polar bears in Canada. More bears are taken each year in Canada than elsewhere in the Arctic and most of this harvest occurs in the Northwest Territories where only Eskimos are allowed to hunt them. The federal Canadian Wildlife Service is concerned primarily with research rather than management. Dr. Macpherson described the

\* For a full discussion on the results of this first meeting see: *Proceedings of the First International Scientific Conference on the Polar Bear*, Fairbanks, Alaska, September 6-10, 1965, U. S. Dept. of the Interior (Government Printing Office, 1966) 72 pp.

federal-provincial-territorial committee established to bring together management and research on polar bears. In 1967, the Northwest Territories adopted a quota system in an effort to reduce the take of bears by each Eskimo village. The intention is to reduce the harvest to 386 animals, or approximately one hundred below the average of the past 10 years. Enforcement of the quota is difficult and regulations are made effective mainly through persuasion. Trophy hunting is completely prohibited in Canada but commercial interests are attempting to have this restriction modified. In recent years the use of mechanized snowmobiles by Eskimos to hunt polar bears has greatly increased the pressure on the resource in certain regions. Human populations are increasing in the Canadian Arctic and this will bring additional pressures on the wildlife resources. Use of set guns is strictly prohibited throughout Canada.

Dr. Jonkel of the Canadian Wildlife Service reported on current research dealing with the life history, biology and ecology of polar bears in Canada. Basic biological data are being sought to guide management agencies in maintaining the present number and distribution of bears while still allowing an annual kill by Eskimo hunters. To this end the Service has undertaken to capture and mark bears in the various Arctic regions of Canada; to collect skeletal, reproductive, and tissue specimens from bears killed by Eskimos; to experiment with census techniques; and to coordinate polar bear research with Canadian and international agencies. Annual movements, reproductive rates, and latitudinal differences in polar bear populations are receiving special emphasis. The provinces of Ontario, Manitoba and Quebec are cooperating with the Canadian Wildlife Service in this research. A technique for capturing polar bear by foot snare has been developed and used for tagging and marking animals. Twenty bears were tagged by the end of 1967, and experimental work is underway on radio tracking. Dr. Jonkel reviewed the important taxonomic work of T.H. Manning, conducted under contract with the Canadian Wildlife Service, which suggest racial differences in bears from Greenland, Canada, and Alaska. Scientists from the other nations indicated interest in this work and in cooperating to provide Manning with skulls from other Arctic regions for analysis. Dr. Jonkel also noted that a major paper by C.R. Harington, on polar bear denning in Canada was soon to be published. Canada plans to concentrate future research in areas where bears may be in danger of extinction. Present work will be continued, and an evaluation of potential parks or reserves will be undertaken.

**Norway:** All of Norway's bears are in the vicinity of the Spitzbergen Islands. Kong Karl's Land, the most easterly of the islands, is a known denning area and was established as a polar bear preserve in 1939. Mr. Norderhaug pointed out that the average annual harvest during the last few years has been about three hundred bears, most of which are taken by professional hunters and others using set guns. The harvest of bears by sealers has declined in the last few years owing to a reduction in sealing effort in these waters. About forty bears a year are taken by trophy hunters in the summer from boats cruising along the edge of the ice pack. Trophy hunters may take only one bear a year and are not permitted to take cubs or sows with cubs, while professional hunters, meteorological crews and other wintering parties are not restricted by regulation. According to Norderhaug, work is currently being done on extensive revision of regulatory policies aimed at better protection of the Arctic fauna in the Spitzbergen Islands. Mr. Larsen reported on the polar bear research activities of Norwegian scientists. Summer expeditions were carried out in 1966 and 1967. Techniques were developed to capture and mark bears by working from a small vessel along the edge of the ice

pack. Fifty-five bears had been marked by the end of 1967 in a program in which American biologists participated. All were captured with syringe guns using tranquilizing drugs (primarily Sernylan or M99). Comparative studies of blood serum collected from bears in Spitzbergen, Canada and Alaska have been undertaken by Mr. Larsen, using an electrophoresis technique, and preliminary results indicate possible racial differences between Alaska and Spitzbergen bears. This work will be continued with more refined tests being employed. Scientists from the other nations agreed to provide additional blood samples from across the Arctic. Other work includes physiological research by N. Øritsland on thermo-regulating mechanisms in bears, the physiological effects of immobilizing drugs, and studies by O. Lønø on hunting methods and statistics, reproduction, food, age determination, and radioactivity. Most of the research is directed toward improving management regulations.

Norwegian scientists plan to continue their efforts in the summer of 1968, and to establish a wintering party on Edge Island to conduct additional ecological and physiological investigations, including den counts and abundance surveys by dog team. Tagging efforts will continue, and additional experimental work with radio telemetry may be undertaken, perhaps with the cooperation of scientists from Denmark and the U.S.S.R.

**Denmark:** Although Dr. C. Vibe was unable to attend, copies of his working paper were distributed and discussed. The killing of polar bears in Greenland is prohibited except by residents. Since the majority of the population of Greenland is Eskimo, this policy has had almost the identical effect as that of Canada in keeping the resource predominantly for aboriginal use. Motor boat hunting in certain areas is outlawed, and mothers and cubs are protected in important denning areas. Pressure on the polar bear resource other than to meet local needs has not been great, and the total harvest is estimated to be only about one hundred a year. Denmark recognizes, however, that this may not be true in the years immediately ahead, and additional regulations undoubtedly will be necessary.

Very little research on the polar bear has been carried out in Greenland during the last few years. There is no indication that there will be any change in the immediate future. This is apparently the result of budgetary limitations and the urgency of other problems requiring research. At the close of the meeting the working group passed a resolution requesting IUCN to inform the Government of Denmark of its regrets at the absence of a Danish participant. The resolution also pointed out the importance of obtaining further knowledge of the polar bear in Greenland and pledged the cooperation of all members to this end.

**U.S.A.:** A unique situation exists in Alaska with respect to the harvesting of polar bear. Until 1940 the main harvest was by Eskimos for subsistence purposes, much as occurs in Greenland and Canada today. During the last two decades, however, almost a complete shift has occurred from Eskimo hunting by dog teams to white trophy hunters using aircraft to search out and kill the bears on the offshore ice pack. Most of the hunters are affluent non-resident sportsmen who are able to spend several thousand dollars for the hunt.

Regulation of hunting, which is under the jurisdiction of the Alaska Government, has been made increasingly restrictive during recent years. Each trophy hunter is now limited to one polar bear every four years. There is a summer close season, and no cubs or females with cubs can be taken throughout the year. Moreover, no guide can service more than six hunters a year. Since the total number of guides is controlled by rigorous exami-

nations conducted by the state government, this tends to reduce or at least set a limit on the size of the annual harvests by trophy hunters. Harvests have fluctuated widely from year to year but have averaged around 300 in recent years. The annual income to Alaska from this kind of hunting amounts to about a quarter of a million dollars and this tends to make additional restrictions on hunting difficult, even though public opinion in the U.S.A. may favor more stringent conservation measures.

Most of the research on the polar bear in Alaska is being conducted by the state government under the direction of J. Lentfer. Priority is given to investigating abundance and migrations of polar bear, discreteness of local populations, and productivity in relation to harvests. Lentfer has developed highly successful techniques for immobilizing and marking polar bears. During the last two years approximately one hundred animals have been tagged and released in connection with migration studies. Mr. Lentfer reported on experimental flights over sea-ice using various census survey techniques to determine abundance and distribution. He also discussed age determination studies based on analysis of tooth cementum layering; parasitological investigations; and other phases of harvest assessment aimed at improving management decisions. Beginning in 1968, the U.S. Fish and Wildlife Service will initiate a cooperative research program with the state government. According to Mr. Brooks, the Service will undertake experimental telemetry work employing newly designed transponding transmitters having a wide range for tracking and a long battery life. It is expected that several of these devices will be attached to bears in the spring of 1968 in an effort to improve knowledge of circumpolar migrations. The federal agency also plans to develop and test various aerial census techniques, including the use of remote sensing equipment, to determine more precisely the number of polar bears in Alaska waters and their movements. The state agency will continue its present programs, as well as cooperative studies with other countries.

### Research Agreements

While much valuable research is being conducted on the polar bear, members of the working committee agreed that unnecessary duplication of research existed in many areas; that standardized research methods should be developed where possible so that data from the various countries will be comparable; that certain important areas of research were being wholly neglected; that priorities should be established to focus scientific research more directly on the critical problems relating to international conservation of the species; and that closer coordination was needed in order to increase the effectiveness of these research efforts.

Top on the list of research priorities is the urgent need for more precise knowledge about the size of the world's polar bear population, the regional distribution, and the dynamics of reproduction. Wide disagreement exists among polar bear specialists as to the actual status of the species, and this has led to international controversy over issues of national conservation policy. It was agreed that concerted international aerial surveys of the Polar Basin must await development of more sophisticated techniques, such as heat-sensors on fast aircraft, but meanwhile each nation should continue its present census programs and report results of experimental techniques to other nations to avoid duplication of effort. The aerial census work in Alaska, the denning studies

in the Soviet Union, and the age, sex and reproductive studies in Canada, Norway and Alaska were singled out as especially important areas of research, and agreement was reached to exchange specimens, materials and raw data among the nations. At the suggestion of Dr. Uspensky, investigators agreed to attempt to locate and evaluate denning areas within their national boundaries and make these findings available to other workers.

High priority was also given to the study of migration. Without precise information on the movements and habits of polar bear, it is impossible to determine the extent to which it is truly an international circumpolar species. Do all bears move in the same clockwise pattern throughout the Arctic, or are these discrete populations? The scientists agreed to conduct a cooperative capturing and marking program on a standardized basis so that the origin of all tagged bears could be determined by workers in all parts of the Arctic. Uniform tags, tattoos and serial numbers were designated, and each nation agreed to publicize the marking program among its nationals, to return each other's tags with all available data, and to record the information on standard punch card forms in three languages for use by all scientists. It was also agreed that taxonomic research to determine possible racial differences by skull comparisons should be the joint responsibility of scientists in Canada and the U.S.S.R., who have done this work previously, and that all other investigators will make skulls available to them. Related studies of food habits, behaviour, physiology, diseases and parasites should continue with full exchange of raw data among cooperating scientists.

A far-reaching outcome of the meeting was the formation of a permanent international committee of scientists engaged in polar bear research. The delegates at the meeting agreed there was need for continuing scientific communication and collaboration, and they voted unanimously to request the establishment of such an organization under IUCN's Survival Service Commission. The proposal was subsequently approved by the SSC. The principal objective of the newly established "Polar Bear Group" is to expedite the collection of scientific data on the animal as a basis for future management and conservation. It will attempt to ascertain the scientific problems and geographical regions in which international research is desirable; determine research priorities and stimulate national and international interest in polar bear research; as well as serve as a general forum for exchange of ideas and information on this and related high Arctic fauna.

The group is composed of two members nominated by responsible federal ministries in the respective countries. However, the members act as scientists at meetings rather than as officials of their respective governments. Dr. S. M. Uspensky of the Soviet Union was unanimously elected first chairman of the group. A periodic newsletter will be published and distributed to a broad audience. The group will attempt to meet and discuss research progress at yearly intervals. Should scientific evidence indicate the need for concerted international regulations to protect the animal, the group can request the IUCN Executive Board to organize a high level international conference to consider conservation and management measures.

Action in calling this special meeting has not only advanced conservation of the species but has helped create a broader understanding of the Arctic environment. It may also serve as a new approach to ecological situations elsewhere in the world which can be satisfactorily resolved only through international scientific cooperation.