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Proceedings of the Fifth Working Meeting of the
Polar Bear Specialist Group

Organized by the Survival Service Commission of IUCN
and held at Le Manoir, St. Prex, Switzerland,

3 - 5 December 1974

International Union

for Conservation of Nature and Natural Resources

1110 Morges, Switzerland

September, 1976

FIFTH WORKING MEETING OF POLAR BEAR SPECIALISTS

C O N T E N T S

FOREWORD

The International Union for Conservation of Nature and Natural Resources places emphasis on the timely identification of threats to plant and animal species and the invitation of measures to prevent their extinction. Responsibility for this is vested in the Union's Survival Service Commission.

A meeting of the arctic nations at Fairbanks, Alaska, in 1965 to consider the conservation status of the polar bear drew up a Statement of Accord which suggested that IUCN might act as the receiving and coordinating agency for international exchange of information. IUCN accepted this function and extended it to include the organisation of working meetings of polar bear specialists. At the first of these meetings, held in Morges in 1968, the delegates agreed to form themselves into a Polar Bear Group under the aegis of the Survival Service Commission, its principal objective being to expedite the collection and exchange of data on the polar bear's natural history as a basis for management of the species. The Group has since met on a regular basis.

Because the Group represents both informed scientific opinion and the interests of the arctic nations, its meetings have been able to develop significant actions concerning polar bear management, the most notable being the elaboration, at the 4th Meeting, of a protocol and draft Convention for the protection and management of polar bears.

The 5th Meeting, of which this volume comprises the proceedings, was held by kind permission of Dr. O. Forel, in his delightful house at Le Manoir at St. Prex, near Morges.

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SUMMARY OF THE MEETING

Welcome and Introductory Address

The 5th Meeting of the IUCN Polar Bear Group was convened by Dr. John Tener, Chairman, on 3 December 1974, at Le Manoir, St. Prex, near Morges. Dr. Gerardo Budowski, Director General of IUCN, welcomed the delegates to Morges and the meeting, noting that the Polar Bear Group had achieved a great number of its goals since 1968, and wishing the Group continued success. He further remarked that the Group had gained a considerable reputation for getting things accomplished, and had, in some ways, become a model for the other SSC Groups. The Polar Bear Agreement was an excellent example, but the co-operative research programmes too were evidence of the progress made.

Mr. Frank G. Nicholls, Deputy Director General, likewise welcomed the Group, and offered the full services of IUCN during the session. He further offered his own time should any matters arise in which he was particularly proficient, especially in such items as the Agreement.

2. Election of Rapporteurs

Mr. George Kolenosky was elected rapporteur for the session, and Dr. Charles Jonkel was appointed by Dr. Tener to assist. Mr. Tony Mence, Executive officer of IUCN/SSC, was asked to provide the Secretariat for final production of the minutes and papers. Preparation of the various resolutions was to be undertaken as topics arose.

3. Unfinished Business of the 3rd Meeting, Morges, 1972.

The 4th Meeting, Banff, Alberta, had been brief and covered limited topics, requiring in turn that unfinished business from early 1972 be completed. Several topics from the 3rd Meeting were pertinent.

Mr. Lentfer raised the issue of tags and collars which were to be investigated by the Standing Committee (Mr. Lentfer, Drs. Jonkel and Uspenski). He demonstrated a plastic collar developed for Alaskan brown bears which has been used the past 6-8 months, and which shows considerable promise.

Mr. Larsen asked the USA and Canada to summarise their radio telemetry programmes, and urged the Group to pursue this topic vigorously. Dr. Jonkel noted that Canada had attached 18 radio collars, but had achieved only limited success. At least one bear had been observed removing

its collar by swinging its head from side to side, with the collar riding forward through centrifugal force. Mr. Lentfer said they had discontinued their programme because of the limited return of data.

Dr. Uspenski said that development of a radio tracking capability was a serious problem for the USSR, and wondered if the Group could produce a collar suitable for all countries.

Mr. Larsen noted that Mr. Lentfer had developed a prototype teflon ear tag for the Group, but that this tag had proved too expensive for other members of the Group.

Dr. Jonkel raised a point on ringed seals because the 1972 minutes requested IUCN to solicit world-wide information on their distribution and density from the Seal Group. Mr. Mence did not know what contact had been made with the Seal Group, but agreed to investigate the matter and report to the Polar Bear Group.

Dr. Jonkel further noted that the Banff minutes refer to an accelerated programme for denning studies, that Canada and Norway had responded to this call, but that the other nations had not. He asked if it was still the intent of the Group to encourage these studies, and if so, whether the other national programmes were still planning to respond. The Group concurred that such studies were still required.

4. Unfinished Business arising from the 4th Meeting, Banff, Alberta 1972.

Mr. Lentfer asked what progress had been made on the pesticides studies undertaken after Banff by Canada. Dr. Jonkel replied that the Canadian-Alaskan specimens had been analysed and would probably be published in the Proceedings of the third meeting of the Bear Biology Group (in press: Journal of the Fisheries Research Board of Canada). The remaining specimens from Norway, Denmark and the USSR had been analysed, but were not yet ready for publication. Drafts of the information would be circulated shortly.

Dr. Jonkel raised the point that the Banff minutes require action to invite other nations with interests in the Arctic as subscribers to the Agreement. Mr. Mence replied that IUCN would respond to any request from the Group. Mr. Larsen introduced a letter from a correspondent in Iceland noting that bears do arrive in that land periodically, and that the IUCN Polar Bear Group could perhaps arrange for the bears to be safely removed before they are killed. In the discussion which followed, the following points were made:

1. Iceland is not a member of IUCN (incorrect; Iceland is a State Member (MF.9.4.1975)).

2. Iceland is probably not yet a signatory to the Endangered Species Convention.

3. A letter should go from IUCN to the Icelandic Government notifying that Government of the Agreement and Convention.

4. A draft letter should perhaps be prepared for the purpose of dealing with any similar suggestions which are received by members of the Group in future correspondence.

5. A resolution should be prepared asking IUCN to contact all nations with an interest in the Arctic to subscribe to the Agreement on Polar Bear conservation in some appropriate manner.

The problem of how to cope with actual bears arriving on the Icelandic north coast was not resolved. Presumably, if Iceland subscribes to the Agreement in an appropriate manner, its Government could make proper arrangements to cope with the periodic arrival of bears in whatever way they deemed feasible.

The matter of the proposed book on the Polar Bear Group by Dr. R. Cooley was raised by Mr. Larsen. Ms. Moira Warland could feasibly prepare such a book if Dr. Cooley no longer had such plans. Mr. Lentfer offered to discuss the matter with Dr. Cooley; Dr. Jonkel offered to discuss the matter with Ms. Warland.

The 1972 Meeting item referring to a proposed publication by IUCN on the general status of polar bears of the world (to be edited by Mr. Joe Lucas) was raised by Dr. Jonkel. As a general map of polar bear range, density and denning (Item 7 below) was to be part of such a publication, a decision on the publication was essential. A letter from Ms. Warland indicated that she would complete this paper if Mr. Lucas had ceased work on it. Dr. Jonkel agreed to discuss this matter with Ms. Warland as well, and with Mr. Lucas at his position in Toronto.

The proposal had been made at Banff for Norwegian-USSR cooperative research in the Barents Sea. Mr. Larsen and Dr. Uspenski reported that discussions on this matter were proceeding, and that they would jointly report on their progress to the Group.

A final proposal during the Banff Meeting called for completion of the morphometric studies undertaken by Mr. T.H. Manning. Dr. Jonkel reported that the project was moribund, at present, and not likely to be revived. Mr. Manning had other interests at this time and unless a very favourable proposal were made for Mr. Manning to personally collect such measurements, the Canadian effort was not likely to be completed.

5. Research Progress reports by countries, 1972-1974

Canada - progress reported by Jonkel, Stirling, Kolenosky, Miller and Robertson.

Research by the Canadian Wildlife Service continued in the western and eastern Arctic, and several territorial and provincial jurisdictions had initiated important research programmes. Efforts in most areas concentrated on denning, productivity and capture-recapture programmes. Tagging returns continued to indicate the existence of discrete sub-populations of bears throughout the Canadian Arctic and the Hudson and James bay areas. Dr. Stirling reported on the use of a labrador dog to locate seal birth lairs in the western Canadian Arctic. The dog was able to detect birth lairs through 2 m of snow from a distance of 400 m.

Returns of tagged bears indicated very little exchange of bears between Canada and Alaska. Behavioural studies of an undisturbed population were conducted on Devon Island and a paper was published by Dr. Stirling. Work on snowtypes and seal populations was being conducted in conjunction with Dr. T. Smith of the Fisheries Research Board of Canada. During the spring, bears concentrated on the younger age classes of seals. Dr. Jonkel requested all workers to collect lower jaws of bear-killed seals to determine predation selectivity. Studies on marine ecosystems in the Beaufort Sea continued to be investigated in advance of possible future developments of other resources in the area.

Denmark - progress reviewed by Vibe - five papers were circulated and discussed.

Expeditions to investigate productivity and capture and mark bears were carried out in north-east Greenland in 1973 and 1974. In the first year, two planes and two snow scooters were employed for den searches and capture purposes. No dens were located from the air, but by using the snow scooters 24 bears were captured and marked. A tooth for aging purposes, blood samples and standard body measurements were taken from each bear. In 1974, a plane, a helicopter and two snow scooters were used during the early spring months. Twenty-nine bears, including 10 previously marked, were captured. In 1974, polar bears were out on the drift ice hunting seals, in contrast to 1973 when most stayed in the fjords. The distribution of bears is contingent upon the distribution of seals which are dependent in turn upon snow conditions for the construction of birth lairs. Considerable discussion ensued on bear-seal relationships, and the different sex and age classes of the latter preyed upon most frequently. The killing of 3 muskoxen by polar bears, and the adoption of tagged cubs (yearlings) by an untagged female with two untagged yearlings were reported.

Norway - progress reported by Larsen

Recent research attention focussed on den surveys, since few recoveries of marked bears can be expected due to the moratorium on hunting introduced in 1973. Because Svalbard is relatively small, change in den numbers can be determined with reasonable accuracy. Peak of emergence occurred around mid-March. For maximum efficiency in locating dens, both air and ground surveys are required. The group felt that den numbers may provide a reasonably accurate assessment of productivity in specific areas, such as the Manitoba coast of Hudson Bay, but were generally difficult to obtain in exposed areas where den openings were soon obliterated by drifting snow. However, knowledge of den locations is useful for delineating possible protected areas.

Dr. Stirling felt that complete cessation of hunting, such as exists in Norway, may increase bear-man conflicts. Dr. Reimers replied that the careful harvesting of polar bears was probably desirable, but the total ban now in effect was largely an emotional and political decision rather than a biological one. Last year four bears were killed in self-defence.

U.S.S.R. - Uspenski outlined recent work and submitted a paper by Uspenski and Belikov.

Work on Wrangel Island continued during the period 1972-74. A total of 82 bears have been tagged since 1969, with the majority marked during the last 2 years. To date there have been no recoveries. This was attributed to the small sample size and the possible loss of the metal ear tags. Birth dates of cubs were established on the basis of cub weights. Questionnaires sent to hunters and personnel at weather stations are also used by the Soviets to provide additional information on den distribution and numbers. Prof. Ozeretskovskaya requested samples of meat from polar bears to investigate the possible occurrence of trichinella.

A discussion on the fidelity of females to specific den sites followed. Dr. Uspenski indicated that specific sites were often used more than once. Dr. Jonkel said there was a tendency for dens to be clustered, but the degree of fidelity to specific sites remains unknown.

Alaska - Lentfer

Since the passage of the Marine Mammal Protection Act in 1972, the management of polar bears no longer resides with the state, but is a federal responsibility. Research work now involves four aspects: (a) marking and recapture of free-ranging bears; (b) studies of den ecology; (c) physiological telemetry with Øritsland and CWS; and

(d) satellite tracking. Over 650 bears have been marked, with approximately 100 recoveries, 1 to 6 years later. The capture of small cubs on the drift ice considerable distances from land suggested they were born there. Tagging returns indicated that eastern and western populations in Alaska are relatively discrete. Studies were being initiated on gas pipeline development as related to the polar bear studies; the effects of the pipeline on the environment; and the behaviour of bears in response to seismic and construction activities especially. The studies also indicate a strong movement of bears south towards St. Lawrence Island with the drift ice, then back to the north in March. The northern bears move eastward along the coast in March, probably with the seals.

6. Conservation Progress Reports by Countries 1972-1974.

Delegates from each country reported on management changes since the last Group meeting.

Canada - Stirling

All provinces, or territories with polar bears, except Manitoba, require all pelts to be sealed before they can be legally marketed. The allowable kill of polar bears in the various areas continues to be determined by the Federal-Provincial Technical Committee using the latest biological information available. Settlement quotas are administered by the people in each settlement. As more data becomes available, management will be based on sub-populations rather than on the general management zones now being used. Due to recent increases in hide prices (Paper 6 refers), the sport hunting of polar bears appears to be decreasing. In 1973, only 3 were taken in this manner. The use of posters and a booklet informing people about bears and situations to be avoided when travelling in bear country were also presented.

Denmark - Vibe

The establishment of the 700,000 km^2 National Park in east Greenland provides a vast area where many species, including polar bears, are completely protected. The existence of such a sanctuary is very important in Greenland since approximately 10,000 people are almost wholly dependent upon hunting for survival. Presently, attempts are being made to establish a game preserve in north-west Greenland which will include an important denning area. Because most polar bears are killed incidentally during other hunting activities, it is preferable to establish reserves for the maintenance of populations rather than establish a quota system. A Polar Bear Act (by the Greenland Parliament) restricts the hunting to local native people, and whites

do not like the Act. Hunting from snowmobiles or by using set guns is prohibited, as is the shooting of females with cubs (up to 2 years). A closed season is in effect from 12 June through August 31.

Reserves are established to provide a breeding reservoir for bears and seals. No one is allowed to trespass except scientists who must have permission. People will be allowed into the Park, but only for viewing or photography purposes; hunting is completely prohibited.

Native Greenlanders wished to convey their thanks to the IUCN for their conservation efforts. Tony Mence indicated that the definition of conservation as adopted by the IUCN and which includes provision for the benefit of mankind, is not by any means solely restricted to preservation.

Norway - Reimers

Responsibility for management of polar bears was transferred from the Ministry of Agriculture to the Ministry of Environment in 1972. On 1 July 1973, three national parks and two nature reserves, encompassing more than one-third of the Svalbard area were established. Regulations prohibit hunting and trapping and ban the operation of most vehicles, including aircraft, but residents of Svalbard are allowed to hunt ptarmigan and operate snow machines along specific routes. The killing of polar bears is permitted only for self-defence in sealing areas and at weather stations. The conduct of research by scientists, especially the capture and tagging of bears, has engendered considerable opposition among the local people and required intensified public relations to combat adverse criticism and publicity.

USSR - Uspenski

The prohibition on hunting of polar bears in effect since 1956, has continued. Cubs may be captured for zoos subject to the acquisition of a special licence. Approximately 10-12 were taken last year. The population, in general, appears to be stable. Consideration is being given to the establishment of a refuge on Wrangel Island and part of the surrounding water area. Very few bears are killed in self-defence, perhaps 5 in the last 10 years. Hunting, even for local people is not likely to be introduced, since none of the people are entirely dependent upon hunting as a means of livelihood. The cultural need to hunt is perhaps not as great for these people as it is for the Eskimos in Greenland and northern Canada, as Soviet native peoples are primarily seal hunters and reindeer farmers.

USA - Lentfer

Since the passage of the Marine Mammal Protection Act, the taking of bears is prohibited to all except native peoples. At the present time the management of bears is under Federal control, but it could revert back to the state if the state-proposed management plans meets the intent of the Act. Presently, there is considerable opposition to the return of bears to state control, on the part of a consortium of protectionist oriented groups. Positive aspects of the Act include: a) provision of funds for research; b) investigation of the porpoise-tuna problem; and c) review of facilities for capturing and maintaining marine mammals in zoos and aquariums.

7. Polar Bear Range and Habitat Map

Dr. Jonkel and Mr. Larsen had prepared a preliminary map and circulated it to all members, as well as to the Polar Bear Technical Committee members in Canada, with a request for new information and suggestions. Little feed-back had been received so a new draft of the map was not prepared.

Mr. Larsen asked that the map provide more information, such as migration routes, levels of density, and seasonal changes of distribution, density, etc.

Mr. Kolenosky said that such a map would soon become too complicated, and that perhaps two kinds of maps were required. One kind would show general information for the casual reader, and a second would illustrate the many types of data from our research progress. He suggested that first we must clarify the particular target audience in our own minds.

Drs. Tener and Uspenski suggested a Series 1 map with a simple presentation of polar bear activities and function, for use in the IUCN general paper on polar bear status, and a later Series 2 map with more specific information. Mr. Lentfer asked that denning be recorded as high or low density, perhaps by use of two colours. Mr. Reimers suggested that the incompleteness of the map should be indicated since many areas have not yet been studied. Dr. P. Hunkeler said that the legend required more explanatory detail.

The Series 2 map will require extensive input on specific topics (such as seal distribution and density, pupping areas, ice types, bear and seal migration routes, dens, currents, bear density, etc.), with different individuals working on their speciality. Those working on the map should consider overlays, standardized symbols and words, etc. and should correspond on the matter frequently, or try to meet during the Arctic Ecology Symposium, September 1975, in Ottawa.

Mr. Larsen suggested the Canadian Arctic Ecology Map Series as a source of ideas on symbols, and observed that the work by the group could provide a prototype for the Arctic Ecology Group.

Dr. Jonkel agreed to check with Ms. M. Warland and Mr. J. Lucas for their interest in the IUCN popular article on the status of bears and use of the Series 1 map therein.

8. Research Programmes by Special Delegates to the Group

Chairman Larsen explained the events leading to changing the scope of the Polar Bear Group. The matter had been discussed at Banff and it was agreed that non-government members should be invited in the future. After the signing of the Agreement (during the Oslo Conference), Mr. Larsen had polled members of the Group as to their views on changing the Group's role to one emphasizing pure research goals and expanding the membership to include non-government polar bear specialists. The response had been favourable (except for no response by Mr. J. Brooks), so IUCN had issued invitations.

Polar Bear Physiology

Drs. Nils Øritsland and Jonkel reported on the physiological work proceeding at Churchill, Manitoba (see Paper No. 3 in this volume), and emphasized that information of this nature was essential in order to understand polar bear biology and ecology, and could supply guidelines and techniques for comparable studies on other bears and other arctic species. There is a direct physiological relationship, leading from energy requirements for survival and gain in weight, to the status of a population. The same physiological techniques will be used on each animal to measure the effectiveness of various deterrents, followed by field tests where free-ranging bears can be observed or monitored.

In polar bears, five levels of energy consumption have now been identified and measured. This aspect will be studied further in terms of oxygen consumption, and related eventually to the bears' activity in the natural environment.

Work is also proceeding on the use of ultra-violet light to detect and photograph polar bears (and possibly polar bear dens), thermal scanners, polar bear vision, and the effects of oil pollution on fur. The physiological work is also leading directly into the need for models describing polar bear population parameters, food requirements, etc. Dr. Øritsland further stressed that development of such models is basic to the overall comprehension of the problems we face, and he noted that organizations such as the S.S.C. Groups do not sufficiently recognize this.

A discussion followed regarding the application of physiological and other parameters to polar bear biology through the use of models. The development of a descriptive model was held to be an important means of providing further insight into critical areas of research and of stimulating further questions on information required. Physiological work is an essential aspect of any such model and, therefore, should be continued.

Mr. Lentfer said that he fully agreed with this view and the IUCN Group should adopt a recommendation in support of such physiological work, because it would benefit all five nations concerned and assist similar investigations on other species.

Drs. Stirling and Tener stressed the need for a definite statement on our requirements and expectations with respect to the physiological work. For example, once the basic techniques are perfected, physiological data could be collected along with the radio-tracking programme or in conjunction with the behavioural work in an area such as Radstock Bay. Dr. Stirling was asked to prepare the recommendation, accordingly, and it was subsequently drafted and accepted unanimously. Dr. Uspenski added that the Resolution should meet Dr. Øritsland's needs and also the broader requirements of each country.

Radio-tracking

Mr. Larsen noted that the Group had discussed radio-tracking of bears since 1968 and had indeed radio-tracked some bears. Recently reports had come to hand of the re-transmittal of physiological data, and of the possibility of tracking bears via the satellite programme. He enquired about the current state of the art and, in particular, asked for the comments of the Canadian and U.S.A. representatives.

Dr. Jonkel noted that radio-tracking is very expensive and should be undertaken with this in mind. Canada had obtained useful information from the programme at Cape Churchill, but had not radio-tracked bears in recent years. He suggested that the east Baffin Coast was suitable for tracking bears by satellite because of its extent and the additional possibility of extensive movements of bears with the drift ice. He also remarked that many new radio-tracking devices were now available from commercial sources, often at a greatly reduced cost.

Mr. Lentfer added that radio-tracking over water required twin-engined aircraft and was therefore expensive. The Alaskan work had been discontinued because the returns in data did not warrant the expense. But the NASA programme of tracking animals via the Nimbus F Satellite now offers a new possibility, and a proposal he had made to NASA was recently approved. NASA will, however, only provide reception facilities, so Mr. Hugh Martin had been contracted to design and build the radio transmitters. The estimated cost of initial development was $15 - 20,000, and each subsequent unit $5,000.

Nimbus F is scheduled to be put in orbit in March or June, 1975, guaranteed to function for one year and capable of handling ± 30 animals. Dr. Jonkel noted that although NASA will not help develop the transmitters, the service they could provide would cost millions of dollars any other way. He also noted that any device to carry the transmitters (such as the harness suggested by Mr. Lentfer) could cause icing problems for the bears in the High Arctic.

Dr. Stirling told of a New York firm (Buechers), which has developed a small transmitter operated by a self generator (from the movements of the animal). Dr. Øritsland said that nuclear batteries (with very long life) were now available. Mr. Larsen drew attention to the telemetry seminar to be held in Sweden in 1975. All participants agreed to write briefs on the various items they had mentioned and any new developments, and to circulate them to the Group.

Productivity

Dr. Jonkel noted that Dr. J. Craighead had been invited by IUCN to attend the 5th Session of the Polar Bear Group but had been unable to attend because of a conflict with his computer programming commitments. However, one of the matters he wished to discuss was the productivity of brown bears and the implications of this brown bear data for polar bear management. The Yellowstone studies have provided detailed reproductive information for individual bears for 12 years and, therefore, include data of a kind which will be difficult to obtain for the polar bear. One of the most significant points in the data to keep in mind is that because of the late age of sexual maturity and the tendency of females to skip 2, 3 and even 4 years between litters, the average individual female produces only 0.5 cubs annually and only about 5 young in a lifetime.

9. Planning and Co-ordination of Research

The AIDJEX programme is to begin in 1975 and continue through June 1976. Because the IUCN Group did not respond favourably, Canada and the U.S.A. will begin the studies on a bilateral basis. An attempt will be made to obtain denning information in the spring of 1975 and acquire capture-recapture data during June and July. They (the Canadian and U.S.A. investigators) will report as soon as possible on the results and will inform the other members and IUCN if any additional funds or staff are required for subsequent work.

Mr. Lentfer noted that one of the purposes of the original suggestion for undertaking the AIDJEX work on a joint basis by the Group as a whole had been the creation of a possible precedent for IUCN/SSC monitoring and conduct of research in areas outside the jurisdiction of any State.

Dr. Jonkel remarked that for economically important species there was no particular need for such IUCN/SSC intervention, as nations usually cooperated voluntarily, but unobtrusive, food-chain-type species were neglected and some international agency such as IUCN should take responsibility for research on them and for monitoring their status.

Labrador Coast

Dr. Jonkel asked whether Norway could provide past records on bears killed off the Labrador and Newfoundland coasts, and whether information about such kills could in future be provided annually to Canada. Mr. Larsen agreed to investigate the procedure, and felt sure that it would involve no problem. T. Øritsland had been collecting the data in recent years.

Barents Sea and Chukchi Sea

Mr. Larsen reported that Norway and the U.S.S.R. were conducting bilateral discussions and Mr. Lentfer reported that the U.S.A. and U.S.S.R. were pursuing bilateral cooperative programmes under the Scientific Exchange Programme.

Skulls

The morphometric studies by Mr. T. Manning were discussed and Mr. Lentfer wondered if Mr. Manning was going to continue the original plan to study Soviet skulls as well as the ones on which he had already completed his work. Mr. D. Wilson, U.S.F.W.S., Washington, is studying Mr. Manning's published data and new data from Alaska, and would expand his studies if other people were no longer interested. Dr. Jonkel agreed to discuss the matter with Mr. Manning.

Food Habits, Pesticides and Behaviour

Mr. Larsen said that Norway now had about 150 winter scats and Dr. Jonkel said that Canada had about an equivalent number from the High Arctic, collected since R.H. Russell's study had been completed. It was agreed by the Group that a suitable Master's degree student should be located to analyze jointly all new food habits material.

Dr. Jonkel reported that the pesticides analyses of specimens from Canada and the U.S.A. were to be published in a paper by Bowes and himself; the specimens from the U.S.S.R., Greenland, and Norway were analyzed and would be reported on shortly.

Dr. Stirling and Mr. Larsen discussed the possibility of a cooperative behavioural study of bears in the Canadian and Norwegian High Arctic. Dr. Stirling said that one of his present assistants, Mr. Paul Lacour, was proving very adept in this field and could perhaps undertake such a graduate programme in about one year.

Arctic Ecology Problems

Dr. Vibe recounted the Danish plans to float by ship with the drift ice (and presumably with the bears) southwards along the east Greenland Coast in 1975. He was still concerned with the cyclic differences in the winds, currents and ice, and how this affected not only the bears but other species as well.

Mr. Larsen noted that the Arctic Ecology Group could provide such information if it ever became actively functional and that perhaps the Polar Bear Group should ask IUCN to seek action, especially by the U.S.S.R.

Dr. Uspenski suggested that perhaps the Polar Bear Group could in some way be joined to the Arctic Ecology Group and thereby stimulate action on topics for which we require better data. Dr. Stirling noted that such an approach could lead to "passing the buck". If we (the Polar Bear Group) want certain data, we should go out to get it.

Dr. Vibe said that the sea bottom, currents, upwellings and high pressure areas were probably most important since they affect climatic changes in any area and, in turn, the species.

Drs. Jonkel and Stirling suggested that the ecological attributes of the ice itself were important to animal species and that despite the many studies of ice types, drift, ice formation, etc., no one was studying ice in relation to its importance to species. Ice pans, their inferior and superior surfaces, pressure ridges, polynias, the density of pans, glacial run-off, etc., all have habitat values which are almost completely unknown.

Drs. Vibe and Jonkel were asked to prepare proposals relating to the required studies and report back to the Group.

Dr. Jonkel enquired about the Cominco mining operation north of Disko Island which is reportedly dumping mine wastes and effluent into the sea. Dr. Vibe said that he had no information on this matter, but would check on it and report.

10. Future Activities of the Polar Bear Group, 1975-77

Considerable discussion on future activities of the Group revolved around the advisability of organizing a workshop to discuss field techniques and population models. It was generally agreed that entrance into the field of computer modelling was a logical and desired function at the present state of research advancement. The development of discrete sub-models represented the most feasible initial approach, since the construction of an all-inclusive model was probably an impossibility. It was suggested that a workshop focusing on models might be realistically planned for 1976. Suggested locations included Churchill, Manitoba and the University of British Columbia. Dr. Tener said that Canada would fund the cost of such a workshop (or most of it), should the group decide for it. Dr. Stirling agreed to investigate the possibility of a preliminary workshop in conjunction with the September meeting in Ottawa. Whoever could attend the September meeting could constitute the sub-committee to report back.

The structure of the Polar Bear Group and whether it should remain as an entity, or be incorporated into other bear groups, evoked considerable discussion. All members lauded the excellent international cooperation and effectiveness of the Group and proposed that it remain intact. The efforts involved in preparing initial and revised drafts of the Polar Bear Agreement, leading eventually to its signing in 1973, counted as one of the Group's most obvious accomplishments. Several members mentioned the usefulness of the Group as an international presence when requesting funds from their respective governments. Mr. Mence stated that the IUCN view was to ensure rational conservation of a species, and if an effective mech nism existed for this purpose, it would be detrimental to dilute it in any manner.

The membership of the Group was confirmed as it stood, but experts who could help solve specific problems would be invited to attend from time to time. To simplify attendance by non-members, persons wishing to participate in scheduled meetings must submit their requests to the Chairman at least 3 months in advance. The Chairman would then inform all Members and, if none of them objected, the applicant would be informed that he could attend. Formerly, it had been necessary for an observer to receive positive approval by all Members before his attendance was permitted.

A general discussion on the advisability of preparing a handbook on methodology or techniques employed in field studies, was initiated by Dr. Uspenski. Earlier attempts to adopt a standard form for collecting field data had been only marginally successful. Dr. Stirling indicated that he had already prepared a pamphlet outlining procedures to be followed by his field researchers. It was agreed that he would send a copy to Mr. Larsen for comments and revisions.

11. Other Business

The question of continuing a newsletter on a regular basis was discussed and rejected. Mr. Lentfer indicated that polar bear information could be included in a general bear newsletter that he prepares periodically. If information was to be disseminated it could be done at the initiative of any member who would submit it to IUCN for circulation.

Mr. Larsen requested pictures for a book on polar bears which he was preparing for general sale. To be written in German, French and English, the book will be published by the WWF, Switzerland; all profits will be returned to the WWF for the support of additional research.

The preparation of a further Policy Statement was considered unnecessary at this time. Since the signing of the Polar Bear Agreement in 1973, Group efforts have concentrated on research, which in many instances appears less exciting and newsworthy than some of the earlier activities. A report on the meeting would, however, be published in the IUCN Bulletin for January 1975.

12. Mr. Jack Lentfer, U.S.A., was unanimously elected Chairman for the period 1975-1977. The next meeting was tentatively fixed for December, 1976.

Vote of Thanks

Dr. J. Tener, Chairman of the meeting, expressed the Group's appreciation to the IUCN for its assistance and cooperation in providing a meeting place and paid tribute to the retiring Group Chairman, Mr. Thor Larsen of Norway.

The incoming Chairman, Mr. Jack Lentfer, thanked Dr. Tener, the meeting Chairman for his contribution to the success of the meeting and to the past achievements of the Group.

Recommendations

Two recommendations were adopted by the Group on 5th December 1974:-

The Polar Bear Specialist Group of the IUCN

recognising that the completion of current physiological research on the metabolic requirements of polar bears, free-roaming and in maternity dens, requires field application of a telemetry system to retransmit signals from implanted sensors;

Recognising that an extremely valuable aspect of the conservation and management of polar bears will be facilitated by modelling physiological and ecological parameters;

Recognising also that such a model would provide the basis for quantitative scientific assessment of the physiological stresses being experienced by denning and free ranging polar bears as a result of vehicle harrassment and industrial exploration and development activities;

Recognising also that the data are now available on the other parameters necessary to construct an ecophysiological model, such as the age structure of wild polar bear populations, caloric value of prey species, utilization of prey species, metabolic efficiency of polar bears, and the behaviour of wild polar bears;

Recognising also that the development of this physiological expertise in polar bears will facilitate similar studies on this and other species by other nations at considerably less cost;

Recognising also that the necessary facilities for such research are now in existence at Churchill, Manitoba, and that the baseline physiological research has now been completed,

Recommends most strongly, that completion of this metabolic physiology research by Dr. Nils Øritsland be made possible by assured adequate study for a three year period.

Whereas the Oslo Agreement on Conservation of Polar Bears, when ratified by the five polar bear nations - Canada, Denmark, Norway, United States, and USSR - will protect polar bears from hunting throughout much of their range, and control traffic and trade in polar bear skins, and

Whereas polar bear skins are now so valuable that there may be incentive for nationals of countries not a party to the Agreement to harvest polar bears in areas where they will be protected by Agreement or by means prohibited by the Agreement, or to deal illegally in traffic and trade of polar bear skins, and

Whereas the Polar Bear Group is concerned that such harvesting and traffic and trade in skins could be detrimental to polar bear populations,

Now, therefore the Polar Bear Group recommends IUCN, after the Agreement is in effect, to take necessary steps to contact governments whose nationals might have an interest and capability in harvesting polar bears and dealing in the trade of skins, in particular, Britain, France, the Federal Republic of Germany, the German Democratic Republic, Iceland, Japan, Netherlands, Portugal, and Sweden; inform them of the Agreement; and request that they take necessary steps to ensure that their nationals abide by provisions of the Agreement relating to harvesting of polar bears and traffic and trade in polar bear skins.

Polar Bear Specialists
Fifth Meeting
Paper No. 1

POLAR BEAR RESEARCH IN CANADA, 1972 - 1974

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Ontario Ministry of Natural Resources;
Sam Miller
Northwest Territories Game Management Service; and
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Manitoba Wildlife Branch.

INTRODUCTION

Our progress in research through 1974 has been partially reported in a series of published papers (Bowes and Jonkel 1972; Stirling and Jonkel 1972; Anderka et al. 1973; Knudsen 1973; Broughton, Jonkel and Stirling 1974; Jonkel and Stirling 1974; Smith and Jonkel 1974; Stirling 1974, 1975a and 1975b) and reports (Jonkel, Miller and Juniper 1974a). This paper gives a résumé of further work completed or initiated since the 1972 report to IUCN, and an outline of work planned.

CURRENT RESEARCH (1972-74)

Several provincial and territorial game agencies have undertaken significant research since 1972, adding to the Canadian effort.

Capture-recapture Program

Northwest Territories Game Management Service. During 1972-1973, 38 bears were tagged in Hadley Bay and M'Clintock Channel (both along northern Victoria Island), and 2 bears were found dead, apparently from natural causes. The abundance of bears and tracks in the two areas indicated a larger number of bears than was previously known for the region. The areas are hunted very little because of their remoteness from any Inuit (Eskimo) settlements.

During the 1974 field season from 20 March to 1 May, a total of 35 polar bears were successfully captured and tagged. Of those 35 bears, 6 were

recaptures from the 1972-1973 field season. Four were recaptured in Hadley Bay where 11 bears were tagged in 1973.

The field activity of 1974 was mainly in the areas of: (1) Hadley Bay, (2) Wynniatt Bay, (3) Glenelg Bay, (4) North Stefansson Island, (5) Gateshead Island, (6) North King William, and (7) Royal Geographical Society Island, all in the Central High Arctic. In 1974, the ice conditions preferred by the bears were located farther to the east and north than in 1973 (in the area of Franklin Strait).

Fixed-wing aerial patrols were made along the west coast of Prince of Wales Island, north of Minto Head, but only a few bear tracks were noted. A short patrol along the east shore of Stefansson Island was also made with a fixed-wing aircraft, and a female with 2 cubs and 3 single bears were observed approximately one mile off shore. All bears captured during 1974 seemed to be in good condition.

Manitoba Department of Mines, Resources, and Environmental Management. During 1972, 23 bears were tagged or recaptured in co-operation with the CWS. The capture program is related to the bear control program which must be undertaken each autumn to exclude bears from the Churchill townsites. The capture and tagging experience deters some bears from remaining in the townsite areas, and repeated offenders (bears which return to the townsites as nuisances) are either held in culvert traps until the ice forms on Hudson Bay, or are killed or disposed of to zoos. Aerial surveys of the coast and denning areas were continued.

During 1973, denning area studies were repeated during February-March, and coastal surveys were conducted south of the Churchill River at approximately one-week intervals August through November. Some results were presented by Jonkel, Stirling and Robertson (1974b). Additional data are in the files of the Department of Mines, Resources, and Environmental Management, The Pas. In the autumn coastal survey 161 bears were observed.

The annual program to kill or capture and remove bears causing problems was conducted September 27 - November 27, 1973. Sixteen problem bears were processed, 4 of which were killed, and the remainder held or removed from the area. This work was detailed in a report by Cross (1974a).

A capture-recapture program operated October 1 - November 17, 1974 in co-operation with CWS. Twenty-two bears were captured, of which 13 were recaptures from previous years. Two bears were held for 2 and 3 months, respectively, for physiological studies and then released. The physiological studies were joint efforts by the University of Guelph, CWS, and the Manitoba Department of Mines, Resources, and Environmental Management, and will be reported in a separate paper.

Two recaptures of Churchill bears have occurred in distant areas; Southampton Island, NWT, and the Ungava Peninsula, Quebec. They represent straight line movements of 880 km and 1040 km respectively. Both bears were young males. Most of the Hudson Bay data, however, indicate a local Cape Churchill population that returns annually to certain portions of the west coast of Hudson Bay.

Ontario Ministry of Natural Resources. The annual aerial surveys along the Hudson Bay coast of Ontario were conducted in late August 1972 and 1974, and in early September 1973. Numbers and distribution of bears during each year were not significantly different than during former years. Litter sizes were similar to earlier years, but in 1973 the observation of a female with 4 cubs was recorded for the first time. No other bears were noted in the area, but the possibility of adoption exists, especially since adoption has been noted among brown bears on the McNeil River in Alaska (Erickson and Miller 1963) and in Yellowstone Park (Hornocker 1962). Data from all the surveys are in the Fish and Wildlife Research Branch files and are currently being used in the formulation of new research proposals.

Approximately 30 skulls have been collected from Indian hunters.

Newfoundland Department of Tourism. Cooperative tagging studies by Newfoundland and CWS were attempted from 21 to 26 May 1974, along the north Labrador coast. Three bears were observed and one bear was tagged. Extensive notes on bear distribution, ice and snow conditions, and seals were recorded. An estimated 10-15 bears were in the area, based on the numbers of tracks (Øritsland et al. 1974).

Ministère du Tourisme, de la Chasse et de la Pêche. Joint CWS - NWT - Quebec studies of James Bay - Belcher Islands bears, and CWS - Quebec - Newfoundland studies were begun in 1974. During August, tagging on Akpatok Island resulted in 11 captures, one of which was a recapture of the only bear marked in May 1974 along the northern Labrador coast.

Canadian Wildlife Service. In the Western Arctic, 95 bears were tagged from July 1972 through June 1973. Three bears marked originally in Alaska were recaptured, and several tagged bears were recovered by Inuit hunters. Quantitative data on bear hunting success and seal kills were recorded, and specimens were collected from ringed seals (Phoca hispida) killed by bears. Bears of the Amundsen Gulf area appear to be contiguous with those of the eastern Beaufort Sea.

During the 1974 spring program, 73 polar bears were captured, including 7 recaptures. Ten tagged polar bears were shot by Eskimo hunters, including one adult female with newborn cubs that was illegally shot in the Yukon by a hunter from Aklavik.

During the winter of 1973-74, the Western Arctic experienced almost continual west (= onshore) winds and very little snow. As a result, the ice was very compacted and few open leads developed. The reduced

snowfall resulted in an inadequate supply of drifts suitable for seals to excavate their subnivean lairs. Consequently, both the numbers and productivity of seals was low. This affected polar bears in two ways: 1) there were fewer bears (in Amundsen Gulf in particular); and 2) many thin bears were found. Two thin adult females which had lost their cubs were found, as well as an adult female with cubs probably too undernourished to live.

Lentfer captured 125 polar bears off Point Barrow in 1974, none of which had been tagged in Canada. Similarly, no Alaska-tagged bears were caught in Canada during 1974.

In the Eastern Arctic, work was distributed over a wider area and is partially reported in the Quebec, Newfoundland and Manitoba sections. Additional studies were as follows:

1. High Arctic. Through spring 1973, 108 bears had been marked in the Resolute area, the greatest number in Barrow Strait and Lancaster Sound. In our latest work we therefore concentrated on capturing previously marked animals, and many unmarked bears (25 in one day during May 1974) were passed by.

   The Barrow Strait - Lancaster Sound studies continued to indicate a resident population, one male having been recaptured each of the past 4 years within 64 km of Cunningham Inlet, Somerset Island. An adult male of approximately 900 lbs. (405 kg) was recaptured in 1973 within 16 km of where he was first captured in 1972, along the south coast of Baillie-Hamilton Island.

   Recaptures and data on tagged animals shot by hunters indicated a large population of bears centered in the eastern end of Barrow Strait between Somerset and Devon Islands and in Prince Regent Inlet. The high density continues into Wellington Channel and Peel, Lancaster and Viscount Melville sounds, but individual bears tend to remain in their portions of the area. They avoid Resolute Bay, however, where hunting activities are concentrated, and some individuals move west or north-west as the sea ice melts during August through September.

   Steady 30-40 MPH winds from the north during August 1973, apparently carried many bears on ice floes far to the south of their normal summer habitat. An unusually large amount of open water during winter kept the bears south of Barrow Strait so that areas such as Maxwell Bay on Devon Island had few bears in early spring, 1974. Undoubtedly, the extensive open water influenced the return of bears and also seal dispersion, which in turn may have further affected bear distribution.

To the north, in Norwegian Bay and associated waters, preliminary studies indicated a lower density of bears and more pronounced seasonal movements. The density of bears dropped to near zero north of a line bisecting the Sverdrup Islands.

Recaptures in Norwegian Bay of 3 bears first marked in Prince Alfred Bay, and tracks of several bears followed from Jones Sound to Norwegian Bay through the Goose Fiord pass, indicated frequent movement of bears overland between the large bodies of water in the High Arctic.

Attempts to mark bears in Jones Sound were largely unsuccessful. Tracks were observed only occasionally throughout the Sound, and few bears were found. The low capture success, general observations, denning area productivity studies (see below) and interviews with Inuit hunters, all indicate a rapidly declining population in the area.

Several captured bears in very poor condition, and one bear found dead in Norwegian Bay, indicated that certain bears suffered adverse effects from the unusually cooler climatic conditions of 1972.

The summer distribution of bears in the High Arctic was found to be quite different from winter, and the lack of land-fast ice appeared to be the dominant cause. Large ice pans, although used by many seals, harboured few bears.

As the ice cleared from main channels, large adult males made dens in sheltered drifts on headlands and in draws, or climbed up to ice caps, apparently to keep cool. Family groups and some of the adult females moved into bays and fiords, wherever the ice remained, and continued to hunt ringed seals.

Few sub-adults were found in the Barrow Strait - Lancaster Sound area during summer, and we believe that they and some other bears of this sub-population moved farther to the west and north, staying on the heaviest ice as the flow edge melted or broke back. Recaptures to the west and north-west of Resolute Bay during August are therefore required to complete the Barrow Strait - Lancaster Sound studies.

2. Foxe Basin - Committee Bay. These studies were initiated to obtain better data for setting settlement quotas and in anticipation of an Arctic Island gas pipeline proposal. Field work was conducted during August and September 1973, and 19 bears were tagged. High densities of bears were

found in central Foxe Basin, Committee Bay, and along the north coast of Southampton Island. It was not possible to continue these studies in 1974, but fuel caching has been completed for studies in 1975 or 1976.

3. Baffin Island. These studies were begun because of the increase in shipping and at the urgent request of the Baffin Island settlements where the hunters believe higher quotas are justified. The field work in 1974 was directed to areas where high densities of bears were noted earlier on the eastern coasts of the Cumberland, Hall, and Meta Incognita peninsulas. Six bears were marked, and bear density, seal density, and floe edge data were recorded.

4. Strathcona Sound. These studies were initiated in 1974 to provide baseline information relative to the environmental impact of the lead-zinc mining development in Admiralty Inlet, north Baffin Island. Six bears were captured and marked, and extensive observations on floe edges, pan movement, break-up, and seals and whales, were recorded.

5. James Bay - Belcher Islands. The number of bears on Twin Island was down in 1972, presumably because of the unusual climatic conditions and persistent ice. Only one bear was captured, and few marked bears were seen.

Extensive capture-recapture studies were undertaken from March through May 1973, to obtain new data for an assessment of the potential environmental impact of the James Bay hydroelectric power development. Bear tracks seemed scarce as compared to numbers seen during similar studies from 1967-1970. However, snow conditions were generally unfavorable for tracking. Thirteen bears were marked, and considerable information was collected on litter size and distribution of bears of different ages. A 28-page typewritten report, including preliminary recommendations, was prepared using existing data (Jonkel et al. 1974a).

A bear tagged west of Wiegand Island (Belcher group) in 1973 was shot north of Port Harrison (Inoucdjouac) in 1974, and an abnormally high kill (6) for the Port Harrison area during the winter of 1973-74 indicated an unusual movement of bears during that time.

Denning Area and Productivity Studies

Denning studies must be conducted during a very short period in late March and early April. In the Hudson and James bay areas, bears reach

the peak of emergence around March 20, but in the Resolute Bay area the peak is about April 5 to 10. These peaks vary slightly, perhaps with weather conditions. To obtain maximum data, however, one must stay in the field both before and after the peak. For example, on 14 May 1974, a female with 2 very small cubs came from a maternity den to the sea ice off south-west Devon Island, more than a month after the normal period for that latitude. Flights should be made during the peak of emergence to search for newly exited bears, and the resulting data should be augmented by observations made during capture operations in April and May.

1. Jones Sound. Work in this area extended through 18 April 1973. Productivity for the area was low in 1973, with a possible maximum of only 10 families and 16 cubs compared with 12 families (22 cubs) recorded during a partial study in 1971, and 27 families (46 cubs) in 1972. Sverdrup Inlet, which appeared to produce most of the cubs in 1971 and 1972, seemed almost devoid of activity in 1973. Even adults and breeding pairs appeared very scarce in this area.

   As in 1971, a few maternity dens were found near the shore, but snow conditions generally precluded tracking wherever the terrain was steep. Family groups, including yearlings and 2-year-olds, appeared in generally poor condition during the studies, suggesting that the survival rates of young in Jones Sound may be lower than elsewhere.

2. Other High Arctic areas. Preliminary searches for, and evaluation of, other denning areas were conducted 1972 through 1974. In northern Norwegian Bay, 3 families totalling 6 cubs emerged from the Cape Southwest area (Ellesmere Island) in 1973, and moved to the area bounded by Graham Island, Eureka Sound and Baumann Fiord. The area that includes Bjorne Peninsula-north Graham Island, southern Axel Heiberg Island, and the Raanes Peninsula, appears to be an important denning and rearing area for Norwegian Bay.

   In south-eastern Norwegian Bay, 4 families totalling 6 cubs were noted along coasts of Devon and south-west Ellesmere Islands, but no area with a high density of dens was located. Between Table Island and Grinnell Peninsula, one family with 2 cubs was noted; the area deserves more attention.

   On northern Cornwallis Island, a family emerged during April 1972, and a female with 1 cub was located inland from Domville Point, western Devon Island in 1973. The entire northern portion of this region did not appear to be important for denning, but scattered dens were found.

However, on southern Bathurst Island and north-western Prince of Wales Island, 5 females with a total of 7 cubs were located. It appears to be an important denning area and should receive considerable attention in the future.

More intensive studies in 1974, indicated an additional small denning area along the east coast of Prince of Wales, but productivity appeared to be low. The importance of this entire area to Resolute Bay hunters, and the proposed gas pipeline through the area add urgency to the study.

On Victoria Island, 3 sets of females with a total of 5 new cubs were captured in Hadley Bay. Preliminary observations suggest that Storkerson Peninsula may be used as a denning area. This Peninsula is transversed by numerous ravines, which may provide the necessary snow depth for denning.

Data from various sources indicated denning on the south coast of Melville Island, Weatherall Bay (northern Melville Island), western Bathurst Island, the Penny Strait area, Baumann Fiord, Kane Basin, Maxwell Bay, and the Peel Sound area, but no systematic studies have yet been undertaken.

3. Baffin Island. N.W.T. officials have stressed for several years that the east coast of Baffin Island is an important hunting area, and that increased shipping and offshore drilling pose a major threat to the area. Until 1973, a lack of funds and staff precluded research in this region. In 1973 and 1974, N.W.T. Game Management Officers and CWS personnel co-operated to conduct ground and aerial studies during late March to early April. The 1973 data were too incomplete to be meaningful, but the productivity of south-eastern Baffin Island was estimated at 100-200 cubs in 1974. The main centers of productivity were the eastern ends of the Meta Incognita, Hall and Cumberland peninsulas. Preliminary studies indicate scattered denning on Foxe Peninsula, the Agu Bay area, and in northern Foxe Basin, but no centers have yet been identified. The Baffin Island coast is very extensive, but the current combined aerial and ground surveys by CWS and NWT research and management personnel appear to be a feasible method of obtaining the necessary data.

4. The Ungava Bay - northern Labrador area. This appears to be the most critical in terms of low numbers of bears, and now faces a potential for increased disturbance because of shipping and the diversion of rivers for hydroelectric power. Three denning areas have been tentatively noted; northern Akpatok Island, northern Labrador north of Nachvak Fiord, and the Quebec coast between Payne Bay and Koartak.

This region apparently contains no extensive denning areas, but Akpatok Island is no doubt important in certain years. In 1974, the tracks of two females, each with one cub, and a possible maternity den were found on Akpatok Island and in northern Labrador, but the total productivity of the area appears to have been low. There was no evidence to suggest that denning occurred in the Payne Bay - Koartak area as in other years. North-west Ungava Peninsula most certainly contains a maternity denning area, based on kill data from hunters, but no field studies have yet been done there.

5. James Bay - Belcher Islands. A major denning area for this region has not yet been located. From limited previous studies, the western portions of the Belcher Islands were suspected as a maternity denning area. A preliminary search of the area was conducted by CWS and the NWT Game Management Service during 1973-1974. Two females (1 cub and 2 cubs respectively) were recorded, confirming that some denning occurs.

   During a partial survey of the entire area in 1973, 4 females were observed with 8 young. Though not yet completed, these studies indicate 3 areas of productivity - the south-west end of Flaherty Island, the southern end of Kugong Island, and the Twin Islands.

   Scattered denning also occurs on the Quebec coast of James Bay, south-east Hudson Bay, and on the smaller islands, but is probably not significant. The Ontario coast of James Bay may be the main denning area for this region, but likewise, detailed studies have not yet been completed (see report below).

6. Manitoba Coast. Denning studies continued along the Manitoba coast in early 1974 and an estimated 89 females with 168 cubs (for an average litter size of 1.89) came out of the Churchill-Nelson Denning Area. There was more bear movement out of the denning area in the latter part of February and early March than in former years (Jonkel et al. 1970), but movement patterns along creeks and rivers were comparable to other years (Cross 1974b).

7. Ontario Coast. Previous studies had indicated widespread maternity denning east of the Winisk River, extending in an arc 5-30 miles (8-48 km) inland along the Hudson and James Bay coasts. Extensive denning area studies were conducted from 12 to 21 March 1974. The entire Ontario coastline, from Lake River to north of Fort Severn, was searched systematically by fixed-wing aircraft during March. The locations and movements of 20 family groups

were noted (minimum of 40 cubs), and 5 suspected winter dens were observed. Maternity denning in 1974 occurred across the entire northern coast of Ontario, with no specific denning area yet evident (Kolenosky 1974). Lack of ground and/or helicopter work in specific areas limited the back-tracking of family groups, and undoubtedly resulted in certain dens and tracks in hard-packed areas along the coast being missed. Some family groups may also have left the area before or after the survey. Earlier preliminary studies had indicated a relationship between the Ontario coast bears and the James Bay - Belcher Island bears, but the degree of association during 1974 was less than originally suspected.

Behavioral Studies

A study of polar bear behavior on the Twin Islands in James Bay was reported by Knudsen (1973). The time and mode of arrival of bears on the islands and capes of James Bay for summer sanctuary are still obscure. The first bears arrive in July of most years, but bears reach their maximum density in late September-November. Late July 1973 and late October 1974 fixed-wing surveys to locate ice remnants (with bears) or swimming bears were unproductive. Weather conditions at that time of year made the surveys extremely difficult. It still appears that bears swim long distances from remnant ice fields in Hudson Bay, but no conclusive evidence has been obtained.

In the High Arctic, an observation cabin was established in 1973 on Caswall Tower, Radstock Bay, Devon Island, in an area known to have a large number of breeding pairs during late April-May, and family hunting groups during the spring and early summer. The main purposes were to study breeding behavior, hunting behavior, and family and social interactions. In July 1973, a first attempt to study the behavior of these High Arctic bears was made. Bears were kept under continuous observation for as long as 5 days (Stirling 1974). A very unusual extension of the North Water (a permanently open body of water in northern Baffin Bay and adjacent sounds) westward to Griffith Island, disrupted observations during April 1974, and studies of breeding and hunting behavior were not initiated in May as had been planned. Summer studies were very successful, however, and the results will be compiled and reported soon.

Feeding Areas and Polar Bear - Ringed Seal Studies

Relatively little progress has been made on the study of feeding areas, despite a request by the IUCN group and the importance of this research.

In co-operation with the Fisheries and Marine Service (FMS), Department of Environment, we have been making specimen collections from seals killed by polar bears. We have obtained 45 specimens since 1973, and from these, data on the sex and age class, circumstance of the kill, portions eaten, secondary use of kills, and seal habitat, are being analyzed.

Twelve ringed seals collected in 1972 have been analyzed for their body composition and the caloric values of their component parts. As bears usually consume only certain portions of seals, four more ringed seals were collected in 1974, and the caloric value of four typical categories was determined. The results of the study are being related to the ecology and hunting behavior of the bears.

In 1974, CWS collected specimens from ringed and bearded seals (Erignathus barbatus) on the offshore ice of the Western Arctic to obtain data on their reproductive status and age structure. An aerial survey to determine seal distribution and abundance was also conducted and will be repeated in 1975.

A joint FMS - CWS survey of Hudson and James Bay seals was conducted during May and June, 1974. A series of survey lines was flown in areas which we determined would represent the seal resource of these waters, and which gave special emphasis to areas known to have high polar bear use.

A new study designed to quantify bearded seal dispersion and density, the use of bearded seals by bears, and the possible relationship of bearded seal and polar bear trichina infections will be undertaken in co-operation with McGill University and FMS.

Specimen Collection Program. This program has expanded greatly with the increased publicity on polar bear research and through better co-operation with game management officers of the provinces and territories.

A large collection of skulls with data is now assembled, but as morphometric studies are of necessity based on large numbers of adult specimens from all regions, collections are not yet complete. Reproductive tracts and samples of diseased tissue are also being collected. Age determination by examination of dental cement is under way, priority being given to specimens from James Bay and the Central Arctic. The teeth of bears from the western Arctic and the Churchill area have been examined, and no pathological conditions were found. Premolar incidence appears to vary between the two populations, with a slightly higher total dentition in Hudson Bay bears.

Studies of toxic chemicals in polar bear tissue have resulted in the publication of one major paper on the situation in Canada (Bowes and Jonkel 1972). Levels are expected to vary regionally, and specimens have now been received from Norway, east Greenland, the U.S.S.R., and

the U.S.A., for measurements of levels of toxic chemicals. Preliminary results also indicate variation by age class. Pesticide compounds, PCBs, petroleum derivatives, and metals are all to be quantified, and compounds such as chlorine hydrocarbons will be studied in the near future. A tissue bank for study of toxic chemicals found in the future is growing. We now have a large number of samples of meat, fat, brain, heart, kidney, liver and diaphragm, wrapped in aluminum foil, labelled, and frozen for future comparative studies of toxic chemicals, heavy metals, etc.

A growth found on the back of an adult female polar bear along the Manitoba coast was found to be a fibrous papilloma (Broughton et al. 1974), similar to specimens found commonly on deer and moose. A similar extensive growth covering the back of an adult female captured in Barrow Strait is being analyzed.

RESEARCH PLANNED

A major study of the Beaufort Sea is continuing, including research on polar bears and seals. Field work on polar bear movement and abundance, seal distribution and abundance, and polar bear behavior, are receiving main emphasis.

Further study of polar bear biology, behavior, movements and productivity will be continued in the Eastern Arctic, possibly with the aid of tracking by satellite. The east coast of Baffin Island, the proposed Arctic Islands Pipeline route (Gulf of Boothia, Committee Bay, Peel Sound and Prince Regent Inlet) and the Strathcona Sound area of Baffin Island will be studied because of the needs of Inuit hunters and the potential for habitat disturbances by developers. A capture program is planned for 1975 in the southern Hudson Bay area to complete the James Bay - Belcher Islands study. The deming areas of East Baffin, Ontario mainland, western Ungava Peninsula and several smaller areas, are all due to be studied as well.

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Polar Bear Specialists
Fifth Meeting
Paper No. 2

CAPTURE AND INVESTIGATION OF 42 POLAR BEARS IN NORTH EAST GREENLAND, APRIL-MAY 1974

Erik Eriksen

The purpose of the operations described in this paper was the capture and marking of polar bears on the north-east coast of Greenland between 72°N and 78°N. Mestersvig, Daneborg and Danmarkshavn were the bases used for the operations.

Equipment and instruments

The reconnaissance flights and observation of the bears were carried out with a Cessna plane, model 185; for the capture of the bears use was made of a helicopter, model Hughes 500. The injection weapon employed was a Palmer Cap-Chur powder gun (extra long range (powder) projector) and darts designed to contain 5 ml, equipped with hypodermic needles of the types NC2 or NC3 with the original barbs. The gun was charged with Cap-Chur cartridges with green muzzle loads (low loads) and a range of about 18-35 metres. The darts were mounted with detonators of the type Cap-Chur charges for 4 cc - 10 cc. The equipment was supplied by Parker-Hale Ltd. G.m.b.H., 3 Hannover Linden, Postfach 20854, W. Germany.

Marking equipment

Red and blue plastic ear tags with white numbers incised and "Zoolog Mus KBH Denmark" in print. Ordinary leather-work punch pliers were used for cutting holes in the ears for tags. The mounting of the tags was made with a pair of specially designed pliers.

The tattooing of the number in the upper lip was made with tattoo tongs equipped with interchangeable numerals and letters (intended for age marking of horses) and Hauptner tattoo paste (as supplied by Carl F. Mortensen A/S, Bülowsvej 5, DK-1870 Copenhagen V). Hair dyes: Nyanza Hair Colour (supplied by Nyanza Inc., 49 Blanchard Street, Lawrena, Mass. 01842, U.S.A.) and Gentian Violet. Brush to apply dye. Tape

measure, stethoscope, and clinical thermometer. Tooth elevator and dental forceps with angle bent jaws for extraction of p.m.l. Mouth dilator consisting of a thick rubber tube (approx. 5 cm diameter) to be fixed by means of a nylon string. Curved scissors for cutting hair samples. Disposable injection syringes, sizes 2 ml, 5 ml, 10 ml, and 60 ml. Disposable hypodermic needles model Yall Microlance, sizes 30/6 - 40/11 and 1.4 x 50 mm. Blood test tubes and plastic bags.

Drugs: Sernylan ® (Phencyclidine hydrochloride) manufactured by Bio-Centic Laboratories Inc., St. Joseph, Miss. 64502, U.S.A. The preparation is available from the supplier in 10 ml capped vials containing 20 mg or 100 mg Phencyclidine hydrochloride per ml. Owing to the limited capacity of the darts, only the latter concentration was in the event used.

Acepromazine maleate (Plegicil ®). A 5% solution had been prepared especially for the purpose. It was available in 20 ml capped vials (prepared by the Dispensary of the Royal Veterinary and Agricultural University, Copenhagen) with the following contents:

Acepromazine maleate		1 g
Aethanolum		5 g
Aqua sterilisata	ad	20 ml

Injectable streptocillin ® vet. 10.000 i.e./ml penicillin 250 mg/ml dihydrostreptomycin in 40 ml capped vials. Injectable prednisoni 1% KVL 10 mg/ml in 10 ml capped vials. Pitupartin ® vet. in 20 ml capped vials containing 10 units of oxytocin NFN per ml. Topicin powder for wound treatment. Aqua sterilisata in 50 ml capped vials (for filling the darts if necessary). Alcohol 96% and ether for cleaning and disinfection of the darts.

Procedure

Reconnaissance flights of the Cessna, with one or two observers, over the areas where the capturing took place, spotted 40 of the bears which were later captured. When a bear had been spotted the base would be notified straight away by radio, and the helicopter would take off from the base at once with the capture team on board, and go directly to the position stated, where as a rule the Cessna would have kept the bear under observation. The helicopter was not used for reconnaissance, but a further two bears only (Nos. 5 and 26) were first spotted by the capture team during flights between base and capturing area.

When bears were found in surroundings where it would be difficult or impossible to immobilize them (steep hills, icebergs or the like), the helicopter was used in an attempt to move them to a more convenient

place, most often out on the ice field. This operation was normally fairly easily carried out. In two cases, however, the bears hid in snow dens, and only in one of them (No. 35) could be driven out by means of a smoke bomb. There was also one instance in which a bear hid in a cave before the capturing team arrived and could not be driven out.

The size of the bears, their body weight, general condition and, for cubs, their age, were estimated on basis of observations made at the closest possible range, from the air and from the ground. The most reliable estimates were obtained if the bear could be observed at close range from the side; examination of the bear's track proved of little value. The dose of immobilizer was calculated for each individual on basis of these observations. A normal dose would be approx. 1.5 mg Sernylan and approx. 0.3 - 0.5 mg Acepromazine maleate per kg body weight. In case of doubt the dose would always be made on the low side, and consequently some of the bears had to be given one or two additional injections as indicated in Table 1. The darts had been mounted in advance with rubber pistons, detonators and stabilizers; they were made ready just before use. Hypodermic needles of the type NC3 were used for adults, while NC2 needles were used for cubs 1½ and 2½ years old.

Before the hunt started the helicopter's right front door was taken off and stowed away in the back of the cabin, to allow the marksman seated on the right front seat a free shot. With great skill the helicopter was manoeuvered in such a way that it followed the bear almost like a shadow, while at the same time the marksman was assured of an unhampered shot. The bear was shot at ranges varying from about 4-5 m to about 12-15 m, and the gun was charged only with Cap-Chur cartridges with green muzzle load.

The following table shows the position in which the dart struck the bear, in each of the 50 shots fired at 39 bears (in some cases two or three darts had to be fired at the same bear):

TABLE 1

Part of body	Number
Right thigh	10
Left thigh	20
Lumbar region	7
Tailhead	7
Flank	5
Shoulder	1
Total	50

Note. 3 of the darts shown as hitting the left and right thighs did so very high up. One dart hit the back of the right thigh.

We tried always to hit the bears right in the middle of the side of the thigh. Due to the large amount of muscle in this region, it is considered to be the optimal target for injection. If a marksman is immediately alongside a bear at a range of 12-15 m, he will have very little difficulty in hitting this target. If the range is reduced to 6-8 m, however, the bear will be in a position where, due to the difference of height, it cannot easily be hit on the side of the thigh; instead the dart tends to hit the upper thigh or even the lumbar region. The result may well be that the injection is administered subcutaneously, or that the needle hits bone tissue and becomes blocked, or that the dart bounces off and is lost (see the case records). If this happens, the effect of the drugs will be insufficient. Further, when fired at a short range, the impact of the dart will be so severe that the dart or needle may become damaged, or the dart may go right through the skin and muscle. Furthermore, it is very difficult or even impossible for the pilot to follow the bear at such close range, because it may be in "dead ground" under the helicopter. Hence shooting at less than 15 m range must be avoided.

As soon as the bear was hit, the helicopter turned away and landed nearby, and the animal was left in total peace until the immobilization had set in (the 'latent period'). During this period the bear was chased only in special cases, as when, for instance, it was feared that it would climb to an inaccessible place or hide in a cave. All chasing of bears both before and after they have been hit must in all circumstances be restricted to an absolute minimum, in particular when the ground is covered with deep snow. Exhausted animals are far more sensitive to the immobilization drugs, and this has to be taken into account when deciding on the dosage The risk of shock and convulsions during narcosis is increased in stressed and exhausted animals.

When the helicopter approached, the bears would normally take flight. The flight reaction was most typical of young bears and females, but the females with cubs would always wait for them and would in some cases protect them. The mother bears were always immobilized first, then the cubs. Getting within shot range of the cubs was never very hard; normally they would be lying close to their immobilized mother and pressing up to her. Cubs Nos. 7, 12, 13 and 28 were shot on foot at a distance of 10-15 m, all the other cubs from the helicopter. Cubs less than six months old were not immobilized, being easy to catch by hand.

The reaction of older male bears would generally be more indifferent. In some cases they practically did not move even though the helicopter came very close up to them. A few bears showed moderately aggressive behaviour during the chase and struck with their forepaws or snatched in the direction of the helicopter before they fled. In the cases in which a female was accompanied by a male (during courtship), the female would be immobilized first, since males were less inclined to leave the females than the other way round.

When hit, the bears would most often turn round and snatch at the dart, but in no instance did they make any attempt to tear or bite it away. The flight which they had begun merely picked up added speed. The speed at which they fled and the distance covered until immobilization set in, depended on individual temperament, condition and degree of fatigue, and the state of the ground in the capture area. The distance covered varied from a few hundred metres to several kilometres. The bear would, of course, also have been running for some time after being first spotted until the helicopter arrived. Hence some of the animals had covered a considerable distance before they became immobilized (up to 15-20 km), and were consequently very tired and out of breath.

The bears were kept under observation during the whole of the latent period, and their reactions recorded. The first symptoms would normally be observed after 5-6 minutes; they would slow down, their movements would become sluggish and without strength, and their walk reeling and irregular; most prominent was the lack of coordination in the hind part of the body. The staggering and unsteady movements became more and more pronounced during the next 5-10 minutes; the bear would stop several times or sit down on its tail like a dog, or tumble over. At first, it would quickly get to its feet again and carry on, but gradually all movements would become so discoordinated that it was no longer able to keep on its feet. Some bears tried half sitting, half lying to drag themselves forward by their forepaws, but eventually they would lie down in the sternally recumbent position. They would still continue to raise head and neck, looking about in all directions, as if observing imaginary objects in the air. Gradually the head and neck were lowered and movement would become restricted mainly to turning the head from side to side. At last it stopped altogether and the head and the neck reposed on the snow between the forepaws. In some cases, early in the latent period the bear was seen to make licking movements with its tongue, eating or biting the snow. Immobilization generally occurred within 20 minutes of the bear being hit. If after 20 minutes the bear was still able to keep on its feet, or if it was insufficiently immobilized for marking and sample taking, another dose was injected in the thigh musculature either by syringe or by Cap-Chur gun. The dose and the injection method depended on the condition of the bear.

In each case the degree of immobilization was ascertained by pricking the bear with a spear between the pads of his hind paws, and by striking him lightly in the parietal region. Totally immobilized bears showed hardly any reaction to such irritants, whereas partly immobilized animals showed more or less strong reflexes of pain or defence, such as raising and turning their heads or growling. None of the bears, with the exception of No. 41 (see records), were capable of getting up or offering any resistance worth mentioning. With the drugs as here administered, immobilization sets in last and ceases first in head and neck. When ascertaining the degree of immobilization it is therefore most important to watch reactions in this region. Throughout narcosis the palpebral and swallowing reflexes remained intact, the eyes were kept open, and there was moderate nystagmus (involuntary oscillation

of the eyeballs). With animals in deep narcosis, the tongue became paralysed and hung from the mouth, and the tonus of the masticator muscle was totally relaxed. If the tongue of less heavily drugged animals was palpated, licking movements and defence reactions were observed. Tonus of the masticator muscle varied considerably: in certain cases it would be so strong that it was hard to open the mouth. Occasionally weak chewing movements were observed.

All male bears showed a moderate degree of penis prolapse, the glans penis prominating through the preputial opening (influence of Acepromazine). In some instances universal muscle tremor resembling shivering occurred, and two animals displayed weak signs of opisthotonus. Twelve bears had one, two or at most three universal epileptiform convulsions, during which pronounced tremor and strongly increased muscle tonus were observed. The animals would double up, the rigidly tetanic limbs made trotting movements occasionally accelerating into gallop. The mouth was kept open early in the spasm, but towards the end signs of masticatory myoclonus were seen. The average duration of the convulsions was 1 minute (varying from 20-30 seconds to about 90 seconds); then the animal would take 5-10 deep breaths, and respiration would become normal. Convulsions of this kind occurred nearly always with bears who had been through a long and exhausting chase prior to immobilization.

Post treatment: All the bears immobilized were treated with injectable Streptocillin ® in doses of 10 ml for adults and 5 ml for cubs between 1½ and 2½ years old, and with injectable Prednisoni KVL in doses of 100 mg and 40 mg, respectively. When the dart had penetrated the musculature, the wound was treated with Topicin powder.

As soon as possible after immobilization, measurements of temperature, heart rate and respiration were made in a large number of cases, and variations between the following values were established (see also records).

Temperature	36.5° - 40.8°
Heart rate	96 - 160 per minute
Respiration	10 - 68 per minute

The maximum values were found in animals which had been through a lot of strain prior to the immobilization. This was especially distinct in the case of respiration measurements, which showed all variations from normal deep and quiet breathing to more or less exhausted, forced, puffing, snoring, or superficial and baying respiration. Renewed measurements by the end of the observation period always gave values within the normal range.

It was not possible to supervise the bears until the end of the immobilization period. However, all were kept under observation until

they showed apparent signs of consciousness and it was found that they could safely be left to themselves. Before they were left, the bears were positioned to rest in sternal recumbancy, the head between the front paws, to enable them to breathe freely. Cubs were placed close to their mothers to prevent them getting cold. In cases where an adult male and a female with cubs had been immobilized at the same time and on the same site, the narcosis of the male bear was prolonged by injection of an extra dose of Sernylan, thus eliminating any danger of the male injuring the cubs.

No deaths or serious accidents occurred in connection with the immobilization, nor in connection with the work with the bears. There was no specific intention of reestablishing contact with the bears, but during subsequent reconnaissance flights, 14 marked bears were observed. All were completely restored and showed normal behaviour.

Marking

All bears caught for the first time were provided with numbered plastic ear tags, with the same number in both ears. Bears Nos. 2 and 3 got blue ear tags, the others red. Further they were tattooed on the right upper lip with the letter D and the same number as on the ear tags. Cubs less than six months old were provided with ear tags only. In the case of all the adults, p.m.l was extracted from one of the jaws (for age determination).

Recaptured bears marked in 1973 had their ear tags and tattoos controlled. If the tags had been lost or the tattoo become illegible, new marking was made. So as to enable bears to be identified from the air, all adults and cubs of more than 2½ years of age had a cross painted on the back. Two different dyestuffs were used for the purpose, Gentian Violet and black hair dye. Both materials were dissolved in a mixture of water and alcohol. Gentian Violet was applied on 11, black hair dye on 20 bears. The remaining 11 bears were not marked with dyestuff. The marking with hair dye proved most durable, the black cross being clearly recognizable during later observations, whereas a bear marked with Gentian Violet who was observed 4 weeks later had practically lost all traces of the dye applied on his back.

Sample collection

10-15 g hair was cut off for mercury determination, wrapped in a plastic bag, and marked with the number of the bear. Lactating females received an intramusculatory injection of 1 ml pitupartin ® vet., and about 10 minutes later a milk sample was taken. With a 60 ml disposable syringe and a hypodermic needle about 50 ml blood was drawn from Venae femoralis (proximally in canalis femoralis) and distributed in

4 blood sample vials containing heparin. Blood and heparin were mixed, and the samples were kept unexposed to frost until arrival at the base, where 3 samples were frozen at once and the fourth was centrifuged to separate corpuscles from plasma, the plasma being decanted into a blood sample vial. Into the vial containing the blood corpuscles was poured the same amount by volume of ethylene glycol citrate, and both samples were frozen. Hair samples, milk samples, and the 3 first mentioned blood samples were sent to the Department of Pharmacology and Toxicology of the Royal Veterinary and Agricultural University, Copenhagen. The second and third of these categories of samples were handed over to Professor Ove Frydenberg, Institute of Genetics, the University of Aarhus.

Measurements

With a measuring tape the following measurements were taken. Zoological measurements: Length from nose to tip of tail, measuring tape following spinal column. Straight line: Length measured in a straight line from nose to tip of tail, head and tail stretched out. Chest: The measurement was taken immediately behind the forelimbs (tight measurement). Length of hind foot: Length from heel to front edge of front pad.

On basis of dental wear and tartar deposit on teeth, the age of the bears was estimated. Also their state of nutrition and general condition were recorded. Claws and paws were examined, and colour of claws noted. Any wounds, scars, hairless spots and other anomalies were examined and recorded (see records).

Table 2 shows the sex distribution and estimated age of all the bears caught. It will be seen that among the cubs the sex distribution is 8 males to 9 females, whereas among the adults it is 9 males to 16 females. It is further shown that 17 of the bears were between ½ and 2½ years old, whereas 25 bears were estimated to be from abt. 3½ to 12 years old (Tables 3-4).

Apart from a few slight defects such as small wounds and scratches, hairless spots or a fractured canine tooth, none of the bears showed signs of diseases or defects. Moreover, with two or three exceptions, all were in a good state of nutrition. In consequence, the bears' condition of health must be considered to be, in general, excellent.

With the age and sex distribution and the good health and state of nutrition found among the bears, the prospects of preserving the bear population in the areas investigated are, from a veterinary point of view, excellent.

Table 2

Age and sex distribution of all bears caught.

AGE estimated years	BASE						TOTAL	
	Mestersvig		Daneborg		Danmarkshavn			
	male	female	male	female	male	female	male	female
1/2	0	2	0	1	0	0	0	3
1 1/2	6	2	0	0	0	1	6	3
2 1/2	1	2	1	0	0	1	2	3
3 1/2	0	0	0	2	0	0	0	2
4 - 7	2	4	1	2	1	4	4	10
8 - 10	2	3	0	0	3	0	5	3
11 - 12	0	0	0	1	0	0	0	1
	11	13	2	6	4	6	17	25

Table 3

Bears grouped in cubs and adults.

Age group	Mestersvig		Daneborg		Danmarkshavn		TOTAL	
	male	female	male	female	male	female	males	females
Cubs	7	6	1	1	0	2	8	9
Adults	4	7	1	5	4	4	9	16
Total	11	13	2	6	4	6	17	25

Table 4

Age and sex distribution of recaptured bears.

Age estimated years	male	female
1 1/2	1	1
2 1/2	0	3
6 - 7	1	2
8 -10	1	1
Total	3	7

Of the bears caught from Mestersvig, 10 had been caught and marked in 1973, namely serial Nos. 1*, 4, 9, 11, 13, 16, 17, 18, 37, and 42.

*Note: in 1974 No. 1 had two half-year old cubs

Table 5

Records of Polar Bears captured in 1974, on the Second Danish Polar Bear Expedition to NE Greenland.

No.	Earmark	Sex	Age in years	Date	Place of capture
1	120	female	6 - 7	6/4	Tværdalen i Vegasund
2	135	"	½	"	Tværdalen i Vegasund
3	146	"	½	"	Tværdalen i Vegasund
4	138	male	2½	8/4	Cap Palander Vegasund
5	155	female	8 - 9	"	Bjørnedal Mount Norrisfj.
6	161	"	5	9/4	Ymers Ø. Dusens Fjord
7	159	male	1½	9/4	Ymers Ø. Dusens Fjord
8	160	"	1½	9/4	Ymers Ø. Dusens Fjord
9	122	female	6	10/4	Mundingen af Vegasund
10	151	"	1½	10/4	Mundingen af Vegasund
11	124	male	1½	10/4	Mundingen af Vegasund
12	150	"	1½	10/4	Mundingen af Vegasund
13	123	female	1½	10/4	Mundingen af Vegasund
14	163	male	5 - 6	10/4	Mundingen af Vegasund
15	191	"	9 - 10	11/4	Geografical Society Ø.
16	102/103	female	8 - 9	11/4	Geografical Society Ø.
17	107/106	"	2½	11/4	Geografical Society Ø.
18	105/104	"	2½	11/4	Geografical Society Ø.
19	162	male	5	14/4	Kuhns Ø.
20	192	female	12	15/4	Mackenzie Bugten
21	193	male	2½	15/4	Mackenzie Bugten
22	153	female	6	15/4	Kap Bennet

23	154	female	½	15/4	Kap Bennet
24	168	"	3½	17/4	Sofia Sund (Borg Ø.)
25	197	"	2½ - 3½	19/4	Bessels Fjord
26	190	"	6 - 7	19/4	Bessels Fjord
27	165	"	6	22/4	Dove Bugt
28	196	"	1½	22/4	Dove Bugt
29	170	male	5 - 6	23/4	Dove Bugt
30	174	female	6 - 7	23/4	Dove Bugt
31	198	female	6	23/4	Fanger Sund
32	194	male	8 - 9	23/4	A. Stillingssund
33	180	female	10	26/4	Påskenæsset i Dove Bugt
34	167	"	2½	27/4	Skærfjorden
35	156	"	7	27/4	Skærfjorden
36	179	male	10	28/4	Dove Bugt
37	188/145	"	7	5/5	Kong Oscars Fjord
38	189	female	9	9/5	Læsø i Vegasund
39	176	male	1½	9/5	Læsø i Vegasund
40	181	"	1½	9/5	Læsø i Vegasund
41	166	female	4 - 5	9/5	Kap MacClintock Vegasund
42	169	male	10	10/5	Læsø i Vegasund

No. 1 is mother of No. 2 & 3
" 6 " " " " 7 & 8
" 9 " " " " 11 & 13
" 10 " " " " 17 & 18
" 20 " " " " 21

No. 22 is mother of No. 23
" 26 " " " " 25?
" 27 " " " " 28
" 35 " " " " 34?
" 38 " " " " 39 & 40

The following numbers were recaptures from 1973: 1, 4, 9, 11, 13, 16, 17, 18, 37 and 42.

Polar Bear Specialists
Fifth Meeting
Paper No. 3

PHYSIOLOGICAL STUDIES ON POLAR BEARS AT CHURCHILL, MANITOBA

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Charles J. Jonkel
Canadian Wildlife Service; and
Robin Best and Keith Ronald
University of Guelph, Ontario

INTRODUCTION

These physiological studies are designed to yield information of immediate significance to problems of polar bear management, as well as the bears' relationship to seals, man, and the non-living environment. They were initially begun at Point Barrow, Alaska, in co-operation with Jack Lentfer, U.S. Fish and Wildlife Service (Øritsland, Lentfer & Ronald 1974), but were moved to the more suitable Cape Churchill site in 1972. The Cape Churchill studies have been a co-operative effort by the Province of Manitoba, Canadian Wildlife Service (CWS) and the University of Guelph, with additional funding by the World Wildlife Fund, NATO, the Canadian National Sportsmens' Show, and the Canadian Fisheries and Marine Service (FMS).

RESULTS

Since the start of the experimental work in late 1972, we have progressed in several sub-projects, the titles of which are outlined below:

1. Energetics and behaviour:
   a) energy cost of locomotion
   b) energy balance
   c) weather index
   d) computer modelling
2. Blood properties

3. Remote sensing

4. Effect of oil pollution on marine mammal furs

5. Polar bear vision

The results of the earlier work have been published or are in manuscript form (see list at end) and some of the more recent work is summarized here.

1. Energetics and behaviour

a) Energy cost of locomotion.

A prototype respiration chamber for exercising polar bears was tested in spring 1974, and a complete respiration laboratory has been set up. The measurements of oxygen consumption will be continued in a chamber made of sheet steel mounted over the treadmill. We believe that with the prototype we have solved the problems of air-tightness and training procedure.

b) Energy balance.

During the past two winters Robin Best, Masters Degree candidate, has conducted experiments on polar bears to investigate their physiological response to certain environmental parameters. The 1972-73 field season was primarily concerned with experimental design and improving techniques, although some data were collected. During 1973-74, 250 hours of physiological data were collected from two bears under varying conditions of air temperature and windspeed.

The data on the thermoregulatory response to work, cold ambient temperatures and wind, will be used to generate a predictive formula that can be used to interpret physiological data from the proposed long-range telemetry field program. It appears that polar bears conserve energy under extreme cold conditions by allowing their skin and core temperatures to drop, thus reducing the heat flow out of the animal by increasing their insulation through vasoconstriction.

Heat loss through thermal radiation was measured during the study. This may be used in conjunction with measurements on the physical properties of the fur to estimate the total heat loss of the animal under different environmental conditions (such as low temperatures and wind).

Although metabolic data are lacking, it may be possible to estimate the actual cost of walking, from the increment in heat storage within the animal. Characteristically, a change in the rate of heat storage can be detected within five minutes of the onset of exercise, and after

reaching a maximum it trails off towards zero as the animal's temperature equilibrates. The maximum rate of heat storage is thus a measure of the intensity of the exercise and, as such, is an estimate of the energy cost.

In summary, the 1973-74 season was successful. Both bears used during that period were released in the Churchill region at the completion of their test series and apparently have re-adapted to life on the sea ice.

c) Weather index.

Both polar bear energetics and behaviour depend on climate and weather conditions. A new method has been developed for reducing the ambient complexities to a unified expression related to the thermoregulatory and behavioural response of mammals to different weather conditions. Thermal properties of the winter fur have been examined and a windchill and solar radiation index specific for the polar bear has been calculated. Examination of summer fur was begun in 1974 and will be continued in the coming winter. Funds allowing, the experimental set-up will be improved with respect to a better wind-tunnel and more sensitive instrumentation for the heat-flow measurements.

d) Computer modelling.

We are participating in the IUCN efforts towards producing an ecological model for the polar bear and have contributed to the clarification of polar bear-seal relationships. Our physiological work provides information on polar bear energy requirements, i.e. the need for food, and is kept in perspective to the ecological model.

2. Blood properties

Blood samples from 9 polar bears in the Churchill area have been analyzed successfully for 25 blood constituents and physical parameters. The analyses of blood samples will continue along with monitoring health of captive animals and in a search for circannial changes in free-roaming polar bears.

3. Remote sensing

Significant progress has been made in methods for detecting polar bears (and seals). Lavigne and Øritsland (1974) found that detection with ultra-violet radiation (UV) gives good contrast between polar bears and ice or snow. UV can be used both in photography and in direct observation with the help of image intensifiers.

We can now predict the heat signal from polar bears under various weather conditions and thus define when thermal infrared detection devices will be useful for detecting polar bears. We do not plan any major further work on remote sensing techniques within the present economic frame of the polar bear project.

4. Oil pollution

Comparative examinations of the transmission of light through hairs suggest that oil on the skins of ringed seals Phoca hispida will affect the haul out and moulting pattern. Polar bear thermoregulation would also be affected by oil on the fur. Quantitative measurements of the effects of oil on seal and polar bear fur will be performed in co-operation with FMS and CWS.

5. Polar Bear vision

F. Sivak, University of Waterloo, Ontario, and D.F. Piggins, University of Guelph, have examined the optical properties of the polar bear eye. It seems likely that the polar bear has a poor ability to form clear images of objects in water, but normal ability (human standard) in air, with a possibility for especially good night vision. Further examination of polar bear eyes is planned during the winter (1974-75).

FUTURE WORK

While we are utilizing research equipment, valued at about $40,000, and a $100,000 building provided for CWS by DPW (Canadian Department of Public Works), further progress is dependent on the operational budget. We are especially concerned with getting a similar study of denning polar bears underway.

This work has been unsatisfactory to date due to combinations of bad weather and unexpected polar bear behaviour. A combined experimental and field approach has been planned, but is dependent on funding. Studies of the effects of oil pollution, as requested by the Canadian Federal Provincial Polar Bear Technical and Administrative Committees, are dependent on further financing. Adequate studies of chemical, acoustical and other deterrents are continuing, but are also dependent on further funding.

The ideas and methods developed during the polar bear work are applicable to other mammals and homeotherms. For example, an artificial den for polar bears can be used for black bears and grizzly bears. The Province of Alberta and the State of Montana have agreed to provide a

grizzly bear for the 1974-75 comparative studies, and both Manitoba and Ontario have offered to contribute a black bear. The telemetric and direct metabolic methods used in this study will also yield detailed energetic-behavioural information when applied to other large mammals. The construction of species-specific weather indices could be initiated for animals like black bear, caribou and muskox. The Northwest Territories has agreed to make a muskox available whenever a suitable animal is obtained. The rate of progress is directly related to financial support. We hope it will be increased during the coming years.

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Polar Bear Specialists
Fifth Meeting
Paper No. 4

POLAR BEAR MANAGEMENT AND RESEARCH IN ALASKA, 1972-74

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MANAGEMENT

Three major actions affecting polar bear management in Alaska have occurred during the past 3 years: 1) prohibition of aircraft hunting and regulations to encourage guided hunting from the ground by the State of Alaska; 2) the Federal Marine Mammal Protection Act of 1972; and 3) the Oslo Agreement on Conservation of Polar Bears. Lentfer (1974b) discusses these in detail. Because the Marine Mammal Act has had such an impact on management it is also discussed in some detail in this report.

From the early 1950's through 1972, guided trophy hunters using aircraft took 85-90 percent of the Alaskan polar bear harvest. The State of Alaska assumed management jurisdiction in 1960, after statehood, and put more restrictive hunting regulations into effect during the following years as pilot-guides became more proficient in taking bears and more people desired to hunt. As the demand for skins increased, both by trophy hunters and as a saleable item, some guides started taking bears illegally. Because these were not entered in harvest statistics there was no way to assess the effect of the illegal take on the population, and there was a possibility of overharvest. This illegal hunting with aircraft and possible overharvest could not be controlled without a complete ban on hunting with aircraft. The need for control of aircraft hunting, public feeling against use of aircraft for hunting, and the fact that hunting with aircraft could be replaced by the much more acceptable method of hunting from the ground caused the State of Alaska to prohibit the use of aircraft for hunting after 30 June 1972.

As a replacement for hunting with aircraft, Alaska adopted regulations effective 1 July 1972, designed to promote recreational hunting from the ground. Natives with dog teams and snowmachines were encouraged to start guiding trophy hunters. The regulations permitted hunting during late fall, winter and spring after pregnant females were in winter dens. Hunting pressure, degree of success, and the total harvest were anticipated to be much lower than when aircraft were used, but it was believed that most hunters that participated in a hunt from

the ground would obtain a more satisfying hunting experience than when an airplane was used. Hunters would be less selective, and would take a higher ratio of females. However, with the reduced hunting pressure, the total number of females harvested would be smaller. From an economic standpoint, guided ground hunting could benefit Arctic coastal villages more than airplane hunting because guide fees would remain in the villages. Because the new regulations were in effect only from 1 July to 21 December 1972, when they were superseded by the Federal Marine Mammal Protection Act of 1972, the recreational ground hunting program did not become established.

Prior to passage of the Marine Mammal Act some 20 bills and resolutions were introduced in the United States Congress for protection of ocean mammals. Polar bears, although not generally considered a marine mammal, were included in these. The general feeling among legislators who introduced original ocean mammal protection bills was that marine mammals should be completely protected without provision for management programs and utilization. Preservationist organizations, well represented in Washington, D.C., exerted considerable influence to have all hunting of marine mammals, including polar bears, stopped. The Marine Mammal Protection Act of 1972 (Public Law 92-522) as passed placed a moratorium of unspecified length on the hunting of all marine mammals. Compromises reached before passage exempted Alaska Natives from provisions of the moratorium and provided for waivers of the moratorium and management programs under certain conditions.

The Department of Commerce is responsible for implementing the Act for certain species and the Department of Interior for the others, including polar bear. Regulations pertaining to polar bears are included in Interior Department regulations for the entire Act (U.S. Department of Interior, 1974).

The Marine Mammal Act prohibits interstate commerce in skins taken by Natives, and regulations to implement the Act prohibit transfer and sale of skins by Natives to non-Natives. Also, as an aid in controlling illegal traffic in hides, a regulation published in February 1974 requires tanneries to be registered before they can tan polar bear skins. Thus far only one tannery has asked to be registered and has not yet received final approval. Few or no Natives have started manufacturing traditional Native articles for sale from polar bear skins. Because of this and because skins cannot be sold or transferred to non-Natives or yet tanned commercially, some have been handled poorly, others have spoiled, and some now in storage may also spoil. Skins from bears taken in the future may also be wasted.

The Act allows Alaskan coastal Eskimos to take polar bears at any time for subsistence or to obtain skins for manufacture into traditional items of handicraft or clothing without restrictions on the number, sex, age, or method of taking. Current regulations are more liberal in this regard than the previous State regulations which allowed subsistence hunters to take only three bears a year and did not permit taking of

young and females with young. State regulations had also allowed any Alaskan resident to hunt for subsistence, rather than only Natives.

Allowing young and females with young to be taken is not in accordance with recommendations of the International Polar Bear Specialist Group that young and females with young be protected throughout their range. It also causes Alaskan Natives to question the credibility of game regulations and managing agencies. The Alaska Department of Fish and Game for a number of years said that it was necessary from a conservation standpoint to protect young and females with young. The Act now allows these bears to be hunted by Natives. One might argue that before and during part of the aircraft hunting era, Natives took bears without restriction and in greater numbers than today, probably without harm to the population. Earlier periods and the present are not comparable, however, because oil and gas development along Alaska's north coast could now be disturbing bears in denning areas and lowering population productivity. If so, young and females with young should be completely protected. Cubs and females with cubs may receive some protection now because not all Natives yet realize they can be hunted. This is tenuous protection, however, and should not be relied on for the long term.

The Act has international implications. Management agencies in other countries are concerned that passage of the Marine Mammal Act could generate support for similar acts in their countries. They feel they now have the authority and the ability to effectively manage their bears without the constraints imposed by legislation similar to the Marine Mammal Act. In addition, United States nationals cannot import into the United States skins of bears taken legally in other countries. This could affect fur markets and possibly guided hunting in other countries.

The Marine Mammal Act provides for waivers of moratoriums and enactment of State management programs compatible with the Act. The State of Alaska has applied for management authority for species it formerly managed, including polar bears in territorial waters. Alaska's proposed management plan is basically the same as the management program in effect after airplane hunting was stopped and before the Marine Mammal Act was enacted; i.e., recreational and subsistence hunting from the ground.

An Environmental Impact Statement as provided for in the National Environmental Policy Act is being prepared on effects of waiving the moratorium and returning management jurisdiction to the State of Alaska. The application and impact statement will be reviewed by the public and the Marine Mammal Commission and its Scientific Advisory Committee created by the Act. Preservationist groups are expected to strongly oppose waiver of the moratorium and return of management authority to the State. The final outcome is difficult to predict.

The Marine Mammal Act has sharply reduced the number of bears harvested. Seven were taken in 1973, and 40-50 in 1974. All were taken by Natives,

and most were taken incidental to other activities because a former major incentive for hunting, obtaining skins for sale, no longer exists.

There were more bears along the Alaska coast during the winter of 1973-74 than during recent past winters, possibly because the Marine Mammal Act had sharply reduced harvests for two seasons. Some residents are now concerned that polar bears may become numerous enough to be a nuisance or hazard in some areas.

Another significant action affecting polar bear management is the Oslo Agreement on Conservation of Polar Bears. The Agreement should be presented to the United States Senate for ratification in the near future. If the Marine Mammal Act moratorium were waived, the management program that was in effect immediately preceding the Marine Mammal Act could be reinstated under terms of the Oslo Agreement; i.e. recreational and subsistence hunting from the ground.

RESEARCH

Polar bear research in Alaska was in a state of transition after passage of the Marine Mammal Act. The Federal government broadened its research program as it assumed management responsibility for marine mammals, and the State of Alaska reduced its research program when it no longer had management responsibility. Research may be benefited ultimately because the Marine Mammal Act is making increased research funds available. The Act has had a negative effect because involved procedures for issuing a permit required for research have caused delays and caused preservationist groups to attempt to have research stopped through court action. Research during 1972-74 consisted mainly of population studies emphasizing identity of subpopulations and of denning and productivity studies.

The major effort to determine population discreteness of polar bears off the Alaska coast has been by mark and recovery. Recovery of marked bears in the past has been by hunting and by recapture by tagging crews. The Marine Mammal Act has greatly reduced the number of bears harvested, and tag recovery at present is mainly by recapture. A recapture and tagging program was conducted from Barrow in 1972 and 1974. Bears were not captured in 1973. Lentfer (1974a) presents an analysis of tag recovery data through 1972.

In 1974, bears were captured with the aid of an FH-1100 helicopter and Cessna 180 fixed-wing aircraft. Methods for capturing and marking were as described by Lentfer (1968, 1969). Weather for flying in 1974 for the most part was excellent. The helicopter was flown 231 hours and the fixed-wing plane was flown 226 hours between 21 March and 2 May. Numbers of bears captured were: previously tagged --23; immobilized and tagged for first time --102; cubs of year tagged

without drugging --17. The total number of bears tagged off the Alaska coast is now 654. The number of animals recovered 1 to 6 years after tagging is 93. Recoveries of tagged animals in 1974 support earlier conclusions (Lentfer 1974a), that bears to the west of Alaska and bears to the north of Alaska form essentially discrete populations with only a limited amount of movement between them. The number of new cubs tagged (17 cubs of 142 total bears tagged or 12 percent) suggests that a significant part of the recruitment to the Alaska North population is from the Alaska sector of the polar basin.

No reports were received of Canadian hunters killing bears with Alaskan tags in 1974, and the Canadian Wildlife Service which captured 74 animals in north-western Canada in the spring of 1974 did not find any with Alaskan tags.

Recapture efforts in 1975 will be in the Barter Island area to better work out movement patterns of bears from the Pt. Barrow area eastward, and the relationship between Alaskan and Canadian bears. Recapture and marking will also be done in cooperation with the Canadian Wildlife Service from the AIDJEX drifting ice station as it moves to the west from its original location approximately 420 nautical miles north of the Alaska-Canada border. It is hoped that cooperative studies with the Russians can start in the spring of 1976, to determine relationships between bears occurring on Russia's Wrangel Island and bears occurring to the west of Alaska. The first step has been taken by having such a study written into the U.S.-U.S.S.R. Environmental Protection Agreement.

Discreteness of populations was also studied by examining the extent and kind of geographic variation in Alaskan polar bear skulls. A variety of multivariate analyses were conducted on Manning's (1971) data and on additional specimens obtained since the completion of Manning's work (Wilson 1974). Wilson's general conclusions are that the generally clinal nature of the variation originally pointed out by Manning is verified. There are definite steps in the cline at the extremes, such that the East Greenland population and the Alaska South population can be separated readily from an interior group extending from West Greenland to Ft. Lay, Alaska. There is a large collection of skulls in Russia which have not yet been measured by Manning's standards. If Manning and Tchernavsky do not measure these skulls and include them in an analysis of all available specimens as was recommended by the Polar Bear Specialist Group in 1968, United States biologists would like to be able to measure them so as to extend their data base.

Denning studies were conducted between Pt. Barrow and the Canadian border in 1973 and 1974. Flights were made along the coast in late October and November to try to locate areas where bears were concentrated and to follow tracks of single bears inland to denning sites. A $50 payment was offered in 1973 and a $200 payment in 1974, to persons who had located and could lead project personnel to an overwintering maternity den. Flights were made in late March and the first half of

April to find dens. Age and location of new cubs tagged on drifting ice was evaluated to judge if they had most likely been born on drifting ice or could have traveled from denning sites on land.

Adverse weather, short periods of daylight, and poor tracking snow hampered aerial search for dens in the fall, and none were located then. In the fall of 1973, polar bear tracks were particularly numerous in Camden Bay along the western portion of the Arctic National Wildlife Range. Few tracks were seen in 1974. This may have been in part because of high winds shortly before and during the period when flights were made.

Table 1 presents data on location of dens examined in the spring. Relatively few dens were found. Possibly others were overlooked. Dens can be overlooked because drifting snow covers exit holes, and snow is so hard packed that animals do not leave tracks after leaving dens.

Table 1. Dens of different polar bear females with new cubs examined between Colville River Delta and Demarcation Point, Alaska, 1973-74.

Reference No.	Date	Den Type	Habitat Type and Location
108	3/28/73	Maternal	Stream bed - 26 miles inland - Oliktok Pt.
109	4/7/73	Maternal	Cutbank of offshore island - Flaxman Island
110	4/10/73	Maternal	Stream bed - 10 miles inland - Colville Delta
104	3/2/74	Temporary	Coast - Prudhoe Bay
105	4/3/74	Maternal	River bank - 4 miles inland - Camden Bay
106	4/4/74	Maternal	River bank - 10 miles inland - Camden Bay
107	4/5/74	Temporary	Island in Sagavanirktok Delta - Prudhoe Bay

Ten litters of new cubs were tagged on drifting ice north of Pt. Barrow (Table 2). An overwintering maternity den of one of these litters was located 91 nautical miles from shore and is the first thoroughly documented instance of a maternity den on drifting ice (Lentfer 1975). One other litter (No. 112, Table 2) was probably born on drifting ice. Cubs in other litters were large enough or so close to shore that they could have traveled from a den on land or landfast ice to the tagging site, and thus it was not possible to judge if they had been born on land, landfast ice, or drifting ice.

New data relating to polar bear denning were obtained from H.R. Helmericks, a polar bear hunting guide and long-time resident of the Colville

Delta. Between 1956 and 1972, Mr. Helmericks found 30 maternity dens or litters of new cubs, most on shorefast ice between the Colville Delta and Flaxman Island. One den however was 80 nautical miles offshore on drifting ice.

Table 2. Location of new polar bear cubs tagged in Pt. Barrow area, Alaska, 1974.

Reference No.	Date Tagged	Litter Size	Nautical Miles From Shore	Comments
111	3/23	1	31	1
112	3/31	2	69	2
113	4/2	1	88	3
115	4/19	2	27	1
116	4/20	2	56	1
117	4/21	2	22	1
118	4/22	1	61	1
119	4/27	2	36	1
120	4/29	2	80	1
121	4/30	2	21	1

1 No basis for judging whether born on land, landfast ice, or drifting ice.

2 Probably born on drifting ice.

3 Maternal den for this litter located on drifting ice 91 nautical miles from shore.

As more data accumulate on occurrence of dens and new cubs along Alaska's coast and on the ice north of Alaska, the hypothesis that recruitment to the north Alaska population is from elsewhere becomes less valid, and denning and production of cubs in the Alaska sector becomes more important. Of particular concern are possible adverse effects to denning and productivity caused by oil and gas exploration and development along the north Alaska coast and on the Beaufort Sea outer continental shelf. Most of the primary route for a proposed 48-inch gas pipeline from Prudhoe Bay east to the MacKenzie Delta is 10-25 miles inland from the coast. Disturbance associated with construction, operation and maintenance of such a pipeline could cause bears to den at other than preferred inland denning sites. Of particular concern would be port facilities, material stockpile areas, headquarter sites, and extremely noisy compressor stations at Camden Bay and Demarcation Point, two areas which seem to be more preferred by bears than other areas. Specific development proposals have not yet been made for the Beaufort

Sea outer continental shelf, which only recently was designated as being of prime interest for oil and gas exploration and development.

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Polar Bear Specialists
Fifth Meeting
Paper No. 5

POLAR BEAR MANAGEMENT CHANGES IN CANADA

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Since the 1972 IUCN meeting of Polar Bear Specialists, several legislative changes have been made by the provinces and territories which have polar bears. These changes represent an increasing awareness of the need for proper scientific management of polar bears, increased participation by provinces and territories in polar bear research, and the need for standardization of internal legislation to permit Canada to become a signatory to the Polar Bear Agreement. Table 1 summarizes regulations in all jurisdictions up to 30 November 1974. Of particular importance is the standardization, in jurisdictions which have polar bears, of the requirement for the hides to be sealed.

After a polar bear has been skinned, but before the hide enters the fur market, a self-locking metal seal is attached to it. The seals are consecutively numbered and are labelled with the province or territory of origin. No tagging system exists in Manitoba, although one has been proposed. In Quebec and Ontario hide-tagging programs have begun, but residual problems with the issue of tags and recording of kill data continue.

Within our budget limitations, research is continuing on the population dynamics, productivity, distribution, movements and abundance of polar bears in all areas where harvesting takes place. The intensity of the research effort varies from area to area, depending on its priority. This priority is determined by the relative importance of polar bear hunting to native people in each area, and by what industrial exploration and development projects are in progress in the various areas.

The Federal-Provincial Technical and Administrative Committees for Polar Bear Research and Management continued to meet in 1973 and 1974, to discuss research results and management recommendations. The research initiatives arising from these meetings are discussed by Jonkel et al. (1974) in Paper No. 1 above. Management changes are summarized in Table 1.

On the basis of completed, but as yet unpublished data, it appeared that Polar Bear Management Zone A contained three relatively discrete

Table 1. Summary of regulations covering polar bear management in Canada as of 30 November, 1974

CATEGORY	JURISDICTION					
	MANITOBA	NFLD./LAB	N.W.T.	ONTARIO	QUEBEC	YUKON
Hunting season	-closed	-closed	-1 October to 31 May	-none	-open	-1 October to 31 May
Who can hunt	-natives of coastal region for food; sale of hide prohibited	-protection only	-native Eskimos residents or non-residents with special licence	-killing legal for protection only -permissible kill by native Indians on licence	-Eskimos and Indians	-Yukon resident Eskimo families, or those traditionally hunting on Yukon coast
Quota	-maximum of 35 annually (not in force at present)	-nil	-quota by settlement -1945-75 limit equals 477	-permissible kill of 30 (by restricting the sales over 30)	-unspecified	-2 bears/family total quota equals 6
Females and protected cubs	-yes, under general hunting prohibition	-yes	-only females with cubs under 54"	-no	-no	-yes (probably as "bears")
Bears in dens protected	-yes, under general hunting prohibition	-yes	-yes	-no, but dens are.	-no	-no (maybe in 1975).
Proof of origin of untanned bear	-pelt seal proposed; not yet approved	-verbal proof (seal to be implemented by end of 1974)	-seal on hide and/or export permit from area of origin	-seal on hide -proof of origin required on imported hides	-seal on hide	-seal on hide
Export permit required and cost	-not applicable	-required -no cost	-export permit required by N.W.T., $1.00	-required -no cost	-required -no cost	-required -$5.00

Scientific Licences	-discretion of Minister	-discretion of Minister	-at discretion of Superintendent of Game	-discretion of Deputy Minister	-discretion of Minister	at discretion of Commissioner
Selling of hide by hunter	-prohibited; skins of nuisance bears sold by Manitoba Govt. through sealed tender (under revision)	-not if killed in Nfld/Lab. -can if legally obtained elsewhere.	-yes, but must have seal on it	-must be sealed by Dept. staff - sale at North Bay Fur Sales	-$5.00 Royalty fee -must be sealed	-if out of territory, permit required from Director of Game -uncontrolled within Y.T.
Basis of Regulation	-Wildlife Act 1970	-Wildlife Act 1971	-Game Ordinance amendments 1970, 72. 1960 Order-in-Council (Endangered Species)	-Fish and Game Act 1970	-Wildlife Conservation Act, 1969 -Order-in-Council No. 3234, 1971	-Game Ordinance 1971
Fur Dealer authority	-Wildlife Act Licences $10 restricted $25 general $25 travelling	-Wildlife Act Licence for each store $2.50, travelling $2.50	-Game Ordinance Trading and Trafficking Licence $10.00	-Fish and Game Act ($10.00 licence)	-$50.00 licence (one location) -$100.00 licence (ambulant)	-Game Ordinance
Taxidermy	-Wildlife Act Licence $5.00	-legislation in preparation	-nil	-Fish and Game Act		-not applicable
Tanner's authority	-Licence $10.00	-legislation in preparation	-nil	-Fish and Game Act (fee under review)	-$50.00 tanner's licence	-not applicable
Live Animals Capture	-Ministerial permit	-illegal	-scientific licence and/or permit to export live big game	-Ministerial authority only	-No restrictions	-special licence
Export	-Ministerial permit	-illegal	-special licence	-Ministerial authority only	-No restrictions	-special licence

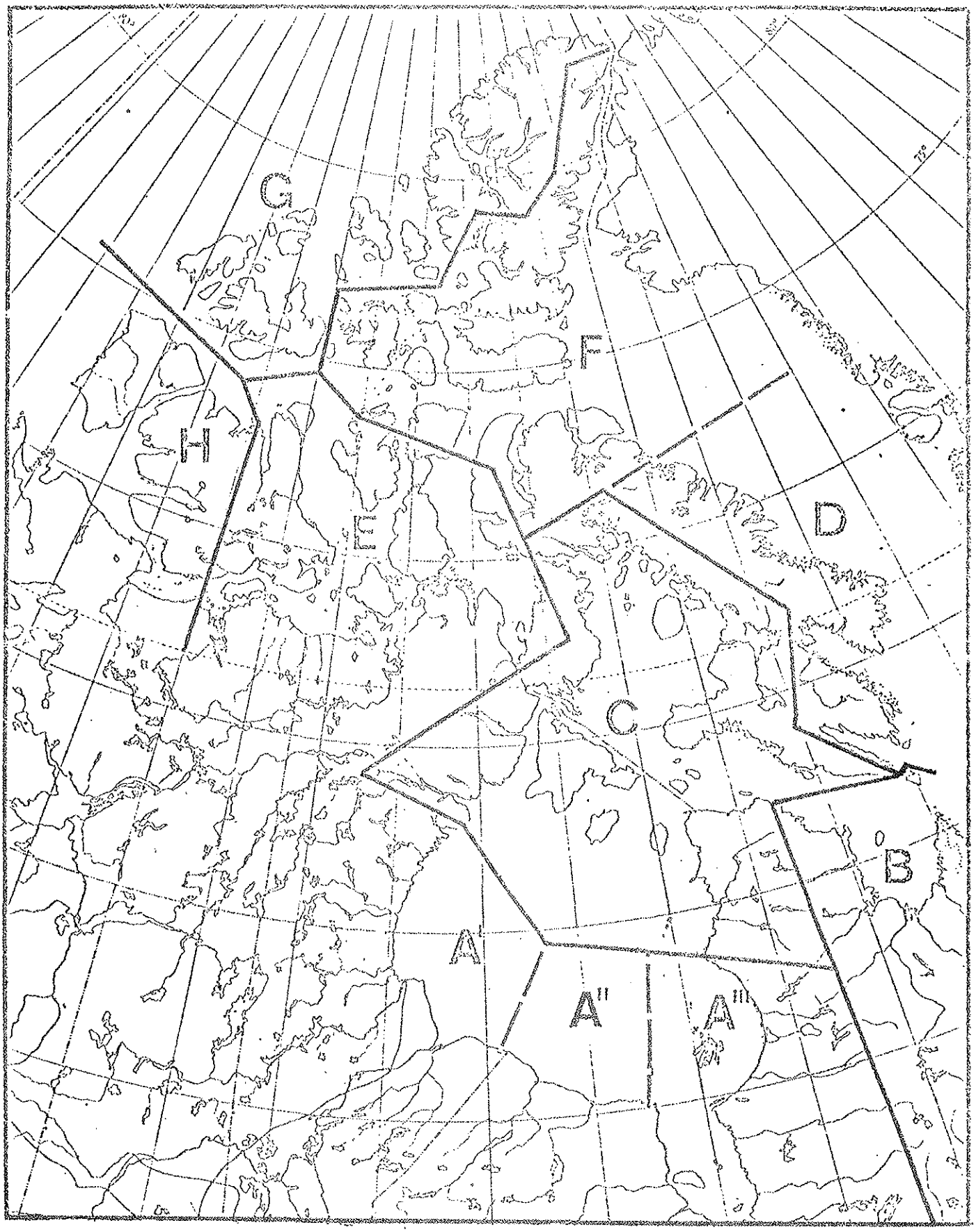

Figure 1. Present polar bear management zones in Canada.

subpopulations as opposed to one. Thus, the western boundary of Zone A was changed to a line between Rankin and Chesterfield inlets, and the zone was subdivided into A', A'', and A''' (Figure 1). The allowable kill for Zone A' was raised to 75, and the Zone C quota was reduced accordingly.

The polar bear kill quotas recommended by the Federal-Provincial Polar Bear Committees and the numbers of polar bears killed or captured in Canada in 1971-72, 1972-73, and 1973-74 are summarized in Table 2.

In the N.W.T. and Yukon, over-hunting of the polar bear population is prevented through the administration of the quota systems. The N.W.T. Government increased the total quota for native hunters by 26, for the 1973-74 season (the hunting season extends from 1 October to 31 May in the following year). Eight settlements exceeded their quotas and will receive equivalent reductions in their quotas in 1974-75.

Newfoundland, Manitoba and Ontario have adequate safeguards to prevent over exploitation of the bear population. In Newfoundland, the closed season established 30 December 1970, even for native people, is still in effect. Manitoba allows only native people to hunt polar bears for their own use, but prohibits the sale of the hide. Few bears are taken. Nuisance bears in the Churchill area are handled by Conservation Officers. Ontario restricts hunting of polar bears to local Indians, who are discouraged from taking bears in excess of the allotted permissible kill. If an overkill does occur the permissible kill for the following year is not amended, as in the case of the N.W.T. quota system. The only deterrent is a delay in payment for the hides of bears taken in excess of the permissible kill. The main problem lies with jurisdiction having little legislative control over the polar bear harvest. A quota system is being proposed by Quebec, and with the co-operation of native groups, it could be implemented by the 1975-76 game management year. The native peoples are now aware of the value of their natural resources. Inuit and Indians are increasingly hunting with the sole purpose of taking polar bear hides.

The limited sport-hunt of polar bears by non-resident hunters has continued. In 1972-73, five settlements allotted 21 tags to the sport-hunt. Of the 16 taken up, 9 were successful. In 1973-74, the hunt was much reduced and only 3 bears were taken (see Smith & Jonkel, 1974, Paper No. 6 below).

With ratification of the Agreement on the Conservation of Polar Bears (1973) by Canada imminent, the provinces and territories are obligated to amend legislation to meet the terms of the Agreement. By early 1975, Canada should also be in a position to ratify the Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973). At that time, provincial or territorial export permits will be required for the export from Canada of any polar bear part or product. Existing legislation (the Export and Import Permits Act, administered by the Department of Industry, Trade and Commerce) requires only slight amendment to accommodate the terms of the Convention. At present, export

Table 2. Known numbers of polar bears killed or captured in Canada, 1971 to 1974.

	1971-72*			1972-73*			1973-74*		
	Suggested quota	No. bears killed	No. bears captured	Suggested quota	No. bears killed	No. bears captured	Suggested quota	No. bears killed	No. bears captured
N.W.T.	422	409	2	451	429	2	477	475	3
Ontario	30+	20	0	30+	12	0	30+	26	0
Manitoba	50	9	1	50	15	2	35	7	1
Newfoundland	0	2	0	0	6	0	0	0	0
Quebec	20	55	1	20	57	2	20	71	5
Yukon	6	6	0	6	4	0	6	4	0
	528	501	4	557	523	6	568	583	9
	Total taken 505			Total taken 529			Total taken 592		

* Game management year extends from 1 July to 30 June the following year.

\+ Permissible kills

permits are required only for transport of skins out of the province or territory of origin and not for out of the country (Smith and Jonkel, in press). The proposed legislation provides for tighter controls on the polar bear harvest and more comprehensive records to be kept on the movement of tagged hides.

A booklet of information about polar bears was prepared and edited by the Technical Committee for use by arctic travellers so that they would be informed about the bears themselves, how best to minimize detrimental encounters, and where to report observations they might make. Blank data sheets are enclosed with the information booklet. A slide show and written talk to explain the goals of the research and management program have been prepared and distributed to the various northern communities. Prototype posters were also prepared for use in the North to provide information about polar bears. These are being produced and will be distributed by CWS in late 1974.

Polar Bear Specialists
Fifth Meeting
Paper No. 6

RESUME OF THE TRADE IN POLAR BEAR HIDES IN CANADA, 1973-74

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Canadian Wildlife Service

The polar bear fur industry, export regulations, and market statistics in Canada for 1972-73 have been summarized previously by Smith and Jonkel (1975). Throughout 1973 the trade in polar bear hides continued to flourish, reaching a peak late in the year with several hides bringing over $3,000 each on the fur market. However, the upward trend in prices during 1973 has not continued into 1974, and there has been a decrease in the prices paid and in the numbers of hides auctioned. The high prices paid on the Canadian fur market during 1973, appeared to have stemmed from the activities of Japanese dealers who were buying most of the skins passing through the auction houses. Because of the competitive bidding by the Japanese, very few skins were bought by Canadian or European buyers. The U.S. market remained closed.

In early 1974, Japanese interest in polar bear hides declined. The reduced demand has resulted in lower prices (Table 1). Skins are now being taken back from auction sales as bidding is too low. In December 1973, all 58 hides in stock were sold by the Hudson's Bay Company (Montreal) in public and private auction sales. However, no polar bear hides were offered at the February and March 1974 sales, and only four of the 51 skins offered at the May sale were sold. In August 1974, 88 skins were offered but only 18 of poor quality were sold. There was a similar trend in Vancouver, where Western Canadian Raw Fur Auction Sales sold only 126 of the 204 skins put up for auction in 1974, and in Winnipeg, where Dominion Soudack Fur Auction Sales sold only 30 of 48. The Manitoba Government did not sell any skins. At the end of the season the Hudson's Bay Company, Western Canadian Raw Fur Auction Sales, and Dominion Soudack Fur Auction Sales had inventories of 70, 78 and 18 skins, respectively, with only 60 per cent turnover of hides in Canada for 1973-74. This is in marked contrast to the previous year when the turnover was 100 per cent. At the present time the auction houses are storing hides until demand recovers. The December 1973 sale by the Royal Greenland Trade Department in Copenhagen, the largest handlers of polar bear skins outside of Canada, is included for comparison (Table 1).

The Hudson's Bay Company obtains polar bear skins from its northern stores, Eskimo (Inuit) co-operatives, and individual hunters. Western

Table 1. Numbers of polar bear skins offered and sold, and the prices in dollars paid at auctions during 1973-74.

Auction house	Date	No. skins	Price range	Average price
Western Canadian, Vancouver	Jan. 1974	66 (115)*	600-2450	1582
	March	10 (87)	1600-2300	1915
	April	14 (87)	1200-1900	1525
	June	18 (90)	500-1900	1297
	September	18 (96)	325-2150	1243
Total sold		126		1513
Hudson's Bay Co., Montreal	Dec. 1973	58 (58)	300-3600	1882
	Feb. 1974	- -		
	March	- -		
	May	4 (51)	300-1500	1088
	August	18 (88)	200-1800	671
Total sold		80		1570
Dominion Soudack, Winnipeg	Jan. 1974	5 (5)	1025-2725	1690
	March	5 (5)	1000-1900	1362
	May	9 (18)	250-1300	839
	September	11 (29)	350- 700	477
Total sold		30		935
Ontario Trappers Assoc., North Bay	Dec. 1973	1	1110	1110
	Apr. 1974	18	200- 525	381
	June	2	415- 480	448
Total sold		21		422
Manitoba Govt., Winnipeg	5 skins - no auction this year.			
Royal Greenland Trade Dept., Copenhagen	Dec. 1973	65	375-2850	1224

* figures in brackets are the numbers of skins put up for auction.

Canadian Raw Fur Auction Sales is supplied by individual hunters, Inuit co-operatives, the N.W.T. Fur Marketing Service, and the N.W.T. government from confiscated hides of nuisance animals. Dominion Soudack Fur Auction Sales is supplied by Inuit co-operatives and individual hunters.

The Manitoba Government did not hold its spring auction in 1974, due to the small number of skins (5) in its possession. In Manitoba, skins of nuisance bears killed by game officers and R.C.M. Police are Crown property and can be sold only by the Manitoba Government through sealed tender.

The Ontario Trappers Association in North Bay is the only official marketing outlet for hides taken by Ontario Indians. All hides put up for auction were sold. However, in 1974, two skins taken above the permissible kill allotted to the Indian settlements are to be held for a year by the auction house before being auctioned. In 1973, eight skins were held over.

The auction houses handled 37 per cent more skins in 1973-74 (430 skins) than in 1972-73 (314). This increase is a reflection of the increased number of skins harvested (583 skins in 1973-74 game management year, 1 July to 30 June, compared to 523 in 1972-73), and an increased interest of the hunters in obtaining a better price. The auction year begins in December or January depending upon the auction house (Table 1) and extends through the following summer.

Between 1972-73 and 1973-74, average prices at the world's major polar bear auction houses showed a net increase in prices received (Table 2). However, during 1973-74, prices declined markedly (Table 1).

Table 2. Comparison of average prices paid for polar bear skins at auctions, 1972-73 to 1973-74.

	Average prices in dollars		
Auction House	1972-1973	1973-1974	% increase
Hudson's Bay C.	1372	1570	34
Western Canadian	1210	1513	25
Royal Greenland Trade Dept.	1011	1224	21

The state of the fur market has a direct but delayed effect on the prices paid to the native hunters. A list of known average prices in 1973-74 is given below (Table 3) along with comparable data for 1972-73. Information is from Canadian Wildlife Service report forms for polar bear kills and the N.W.T. Game Management Service.

Table 3. Average known prices (in dollars) paid to hunters for polar bear skins 1972-73 and 1973-74. Values in brackets are number of skins.

	Average Prices				
Settlement	1972-73		1973-74		% increase
Cape Dorset, N.W.T.			1083	(6)	
Coral Harbour, N.W.T.	881	(37)	1576	(58)	79
Fort Severn, Ontario			419*	(12)	
Frobisher Bay, N.W.T.			1167	(3)	
Igloolik, N.W.T.			600	(4)	
Koartak, Quebec			900	(3)	
Pangnirtung, N.W.T.	884	(8)	1450	(4)	72
Payne Bay, Quebec			533	(6)	
Repulse Bay, N.W.T.	553	(16)	885	(13)	60
Sanikiluaq, N.W.T.			1409	(16)	
Spence Bay, N.W.T.			1420	(8)	
Tuktoyaktuk, N.W.T.			1879	(17)	
Average (all settlements)	845	(149)	1319	(150)	56

* 60 per cent to the hunter, 40 per cent to the Indian Band, minus commission, cleaning charges and membership dues to Ontario Trappers Association.

In 1973-74 as in 1972-73, the hunters selling hides direct to the fur auction houses, e.g. hunters from Sanikiluaq and Tuktoyaktuk, or through the N.W.T. Fur Marketing Service, e.g. hunters from Coral Harbour and Spence Bay, received the highest prices for their hides (Table 3). However, hunters are currently experiencing considerable delays in receiving the full financial return from skins not yet auctioned due to the failure of buyers to meet reserve bids at the auction sales. The N.W.T. Government advances up to 75 per cent of the estimated value of the hide to the hunter and the balance is paid when the hide is auctioned. If delays become too long and/or the prices at auctions continue to fall the hunters may resort to quick local sales at lower prices.

The hunters who received the lowest prices for bear hides were those who sold direct to the local store or co-operative (e.g. at Koartak, Payne Bay and Repulse Bay). The poorer quality of hides of polar bears killed in summer were also partly responsible for the low prices at Payne Bay and Fort Severn. Haphazard methods of skinning and preparation, and incomplete drying and stretching, are also reflected in the low prices obtained for the Fort Severn skins at the North Bay auction sales.

The average prices received by native hunters has increased since 1972-73 much more than the percentage increases received by the auction houses (Table 3 compared to Table 2). Average prices paid to hunters from the relatively remote settlement of Repulse Bay increased considerably (Table 3), but they are still substantially lower than for other less remote settlements like Coral Harbour which has the advantage of a resident Game Management Officer.

The higher fur prices received in 1973-74 probably contributed to reducing the sport-hunt in the N.W.T. Although each sport-hunt, whether successful or not, brings $3500 into the settlement, most native hunters preferred to harvest their quota of bears themselves. Consequently only three settlements offered a sport-hunt and only three bears were taken (Table 4). If the sport-hunt is unsuccessful, the tag allotted to it may not be used later. With lower fur prices the sport-hunt may become more attractive.

Table 4. Number of sport-hunters by settlement 1973-74.

Settlement	No. tags allotted	Sport-hunters	Successful sport-hunters
Holman	4	3	2
Paulatuk	4	-	-
Pond Inlet	6	1	1
	14	4	3

The increased monetary return to the hunter during 1973-74 has provided more incentive to take polar bears. Unlike previous years, many settlements in the N.W.T. had filled their quotas within a few weeks of the opening of the hunting season (1 October to 31 May in N.W.T. and Yukon Territory) and eight settlements exceeded their quotas.

Polar bear hides are unique novelty items purchased mainly for home furnishings or as status symbols and not staple fur items. Consequently the demand and the prices paid can fluctuate very widely due to economic conditions. This fluctuation in the value of hides in turn affects harvest levels slightly and also the time of year bears are killed.

ACKNOWLEDGEMENTS:

We wish to thank R.H. Russell, CWS, and numerous fur auction and

territorial, provincial and federal government personnel, for being extremely helpful in supplying information and comments.

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Polar Bear Specialists
Fifth Meeting
Paper No. 7

PRELIMINARY REPORT ON THE FIRST DANISH POLAR BEAR EXPEDITION TO NORTH EAST GREENLAND, 1973

Christian Vibe

Duration

19 March to 21 May 1973

Operational area

East-North East Greenland between Kap Vedel 68°30'N and Kap Stosh 74°04N, a coastal region of about 650 kilometers. Broadly speaking, work was undertaken at some distance from the fast ice border and up to the glaciers in the interior of the fjords with the exception of Vest Fjord and Gase Fjord which were impossible to reach due to distance and weather conditions. The distance from the fast ice rim to the inner fjord glaciers is 300 kilometers. The operational base was mainly Mestersvig and for a short period Scoresbysund, where extremely bad weather conditions made it possible to operate from an aircraft for a few days only of the originally planned period.

Crew

Ivars Silis, civil engineer, chief of equipment and field operations, was leader of bear capture and marking. Veterinarian Bjarne Clausen was in charge of the veterinary side of work in the field. Thor Larsen, Norway, took part in field work till the 27 April when he left the expedition according to plan. Dr. Chr. Vibe was scientific leader and operational chief of the 'plane team, which carried out a reconnaissance of the whole area and assisted the scooter team in hunting bears and establishing the depots. Henning Thing, student, and Poul Henrichsen, student, assisted the 'plane team as observers and for a time were stationed out in the field. The technical personnel consisted of first pilot Paul Ellingsen, and second pilot Ejvind Ranman and air mechanic Widar Wien.

Material

2 'planes, Cessna 185, and 2 snowscooters, Ockelbo 600.

Expenses

The budget totalled 500,000 kroner, of which 250,000 was granted by the Research Council (Forskningsrådet), 150,000 by the Greenland Ministry and 100,000 by the World Wildlife Fund.

Working method

The expedition members met at Oslo Airport on the 20 March. From here the 'planes, scooters, material and expedition members were transported to Mestersvig via Reykjavik by transport 'plane. The return journey was carried out in the same way. Immediately after arrival, 'planes and scooters were assembled and made ready for duty. The original plan was followed in the main essentials, except for a few changes that weather conditions made necessary.

The scooter team stayed in the field for about eight days at a time, after which its members were replaced. Night shelter was provided by hunting huts or tents. 'Planes and scooters could normally keep contact with each other by radio while working in the field. The main base had, when possible, contact with the scooter team every morning and evening to plan the day's programme and discuss the result of it.

Results

The border between the fast ice and drift ice was investigated and mapped along the coastal limits and patrolled regularly to ascertain the possibility of exchange and roaming of polar bears between the fjords and drift ice.

In the area between 69°N and 72°N, including the Scoresbysund Fjord complex - only a few single tracks of polar bears were seen, none of which belonged to mothers with young; nor were any living bears seen. Most of this area is within range of Scoresbysund hunters. There is nothing strange in the fact that a hunting population and breeding polar bears cannot thrive together.

Frequent tracks were seen south of 69°N, also 4 bears including a mother bear with 2 small cubs. It must be assumed that a breeding area exists from this point southwards to a little beyond Kangerdlugssuaq. The coast further south has such unstable winters, that breeding bears would not be able to protect their young.

TABLE 1

Polar Bears Marked by the First Danish Polar Bear Expedition to North East Greenland, 1973

(Snow scooter catching team: Bjarne Clausen, Thor Larsen, Ivars Silis)

Bear No.	Lip No.	Ear No. right/left	Date	Locality	Sex	Age years	Weight kg
1	D 100	100/101	2/4	K.Palander V.sund	M	4-5	250
2	D 104	105/104	7/4	K.Wykander S.sund	F	1	100
3	D 102	102/103	7/4	K.Wykander S.sund	F	7-8	250
4	D 106	107/106	7/4	K.Wykander S.sund	F	1	100
5	108	108/108	11/4	Fladedal south	F	7-8	
6	110	111/110	11/4	Fladedal south	F	1	
7	112	113/112	11/4	Fladedal south	M	1	
8	D 120	120/120	13/4	Vegas eastern part	F	5-6	250
9	D 118	118/118	13/4	Vegas eastern part	M	6-8	450
10	D 119	119/119	13/4	Vegas eastern part	M	2	75
11	D 11	116/116	14/4	Scot Kelties Øer	F	4-6	250
12	D 117	117/117	14/4	Scot Kelties Øer	F	1	100
13	D 115	115/115	16/4	Scot Kelties Øer	F	3	150
14	D 121	121/121	17/4	Scot Kelties Øer	F	3	150
15	D 122	122/122	20/4	Krista Ø	F		200
16	123	123/123	20/4	Krista Ø	F	½	12
17	124	124/124	20/4	Krista Ø	M	½	12
18	D 137	137/137	22/4	Læsø V.sund	F	7	200
19	D 138	138/138	22/4	Læsø V.sund	M	1	80
20	D 139	139/139	22/4	Læsø V.sund	F	1	80
21	D 148	148/148	29/4	North of K.Wykander	M	7	375
22	D 147	147/147	2/5	Lemming Bugt	F	4-5	250
23	D 136	136/136	2/5	Lemming Bugt	M	5-6	400
24	D 145	145/145	2/5	Lemming Bugt	M	4-5	325

TABLE 2

Bear No.	Serum ml	Hair Tox	Full blood Tox	Milk	Tooth	Sernylan mg total	Ac. prom mg
1	15/x	x	x		x	600	150
2	15/x	x	x		-	140 + 100	100
3	15/x	x	x		x	375 + 100	100
4	/x	x	x		-	140	80
5	15/x	x	x	x	x	375 + 60	100
6	-	-	-		-	150	100
7	10/x	x?	x		-	150	100
8	x/x	x	x	x	x	375 + 50	100
9	x/x	x	x		x	500 + 120 + 50x)	150 + 100
10	x/x	x	x		x	120 + 80x)	100 + 50
11	x/?	x	x	x	x	375 + 50	100
12	x/?	x	x		-	120	50
13	8/x	x	x		x	375	100
14	30/x	x	x		x	200	50
15	30/x	x	x	x	x	375x)	100
16	-	-	-		-	-	-
17	-	-	-		-	-	-
18	15/x	x	x		x	400	100
19	15/x		x		-	120	50
20	15/x	x	x		-	80 + 20x)	100
21	/x	x	x		x	375 + 50 + 50	100
22	/x	x	x		x	705	200
23	/x	x	x		x	480	100
24	x/x	x	x		x	375xx)	100

Convulsions: x) less than 30 sec

xx) less than 60 sec

North of 72°N, there is a well-established breeding ground, where mother bears with small cubs, 1½-year-old young, mating bears and single bears were seen. Mother bears with cubs in varying age groups were only met in the outer straits, fjords and bays bordering the fast ice limits. In the inner fjords only single bears were seen and in certain fjords there was no sign of either bears or tracks.

This geographical distribution of bears is presumably connected with the existence of breeding ringed seal in the areas with the largest and most constant snow deposits. Mother bears with cubs stayed in the snow-covered regions with the presumably dense concentration of breeding ringed seal.

The inner fjords, examined from the air, were remarkably variable as regards snow concentration and existence of seals and bears. In some fjords there were unusually few seals to be seen, in others a relatively dense seal concentration was observed.

There seems to be a connection between wind force from the inland ice and snow deposit. Some fjords are exposed to the hard pressure of severe, north-westerly winds from the inland ice and were polished smooth, whilst other fjords were sheltered and thickly covered with snow.

Summer productivity must, without doubt, be strongly influenced and favoured in the vicinity of the glaciers at the head of fjords by the strong wind from the inland ice, whereas winter conditions for seals and hence winter food supplies must be presumed to be most favourable in fjords subject to an early and insulating ice layer and extensive snow cover, provided that it is not a question of threshold fjords.

Wind conditions play a decisive role everywhere - in fjords, bays and along the coastline. An alternating distribution of wind force and direction between the summer and winter half-years must be presumed to be an essential cause of production fluctuations in North East Greenland.

Three cases were observed of polar bears having killed a musk ox. On one of these occasions, the polar bear was encountered at the carcase of the freshly-killed ox.

Mating bears were observed twice about the 13th of April. In one case, it was an older male bear and a mother bear with a 2½-year-old cub, that was about to be cast out. In another instance, 2 males competed for a female. The first example makes it clear that polar bears with cubs mate again 2½ years after giving birth and thus can only have cubs every third year.

During the expedition there were observed - in all - 52 different polar bears, of which 24 were caught and marked (Table 1), blood samples being taken from the adults (Table 2). A mother bear with two 1½-year-old cubs was re-captured in the same area a fortnight later. The captured bears consisted of fifteen adults, seven 1½-year old cubs and two ½-year-old cubs.

Seventeen of the bears which were captured had been spotted from the 'plane for the scooter team, the rest were discovered by the scooter team itself.

Several bears located by 'plane were out of range of the scooters or escaped to the mountains or inaccessible ice. The work of capture would have been more effective if a helicopter had been used.

A provisional analysis of the blood samples undertaken by Thor Larsen, shows that the East Greenland polar bears are more closely related to the Canadian than to Svalbard's bears. The Atlantic Ocean seems to form a barrier or limit. This was somewhat unexpected, as, for example, seabirds from Svalbard are known to winter in South West Greenland.

Proof of the existence of the massive breeding areas north of King Oscar Fjord has been an important argument for the placing of the National Park's southern limit at this fjord - as agreed and passed at the Provincial Council (Landsradet) in October 1973. Work is now in progress for the preservation of the southern breeding area around Kangerdlugssuaq.

A preliminary comparison of the rather small number of bears found by the expedition in North East Greenland, with the bear-catch at Scoresbysund and Angmagssalik makes it probable that what must, presumably, be a larger population of polar bears exists in other places - perhaps in the drift ice off East Greenland and in the Polar Sea.

Polar Bear Specialists
Fifth Meeting
Paper No. 8

LIVE CAPTURE OF POLAR BEARS BY SNOWSCOOTER DURING THE NORTH EAST GREENLAND EXPEDITION IN SPRING 1973

Ivars Silis

Purpose

As reported in Dr. Vibe's introduction to the expedition of October 1972, the scooter teams' main task was to undertake detailed investigation of the breeding grounds with occasional capture and marking of polar bears.

However, shortly after the arrival of the expedition at the operational area, it became clear that it would be difficult to track down polar bear dens in the extensive coastal regions with potential snowdrifts. It was, however, easy to find mother bears with their cubs after emergence from their dens. Consequently, the scooter teams' efforts were mainly concentrated on the search, capture and marking of bears.

The present report deals exclusively with that part of the polar bear marking directly concerned with the actual capture of bears. The medical side of the marking process has been dealt with elsewhere by Veterinarian Bjarne Clausen.

A report on the background, general progress and ecological conditions, is given by Chr. Vibe (previous paper, No. 7).

Supplies and equipment

The snow scooter team used two Swedish produced snow scooters Ockelbo-600. They are robust machines equipped with two cylinder petrol motors of 400 cc and 26 HP. Each scooter pulled a sizeable glass fibre pulk, Ockelbo-Pulka 80. In spite of a few technical shortcomings the snow scooters functioned satisfactorily under the extreme conditions and can be recommended for similar work in the future.

The pulks were loaded with ready-mixed petrol in jerrycans, spare parts, camping equipment, provisions and veterinary supplies, up to a total weight of between 80 and 200 kilograms on each pulk. Of this, the petrol made up the main part, due to the fact that in hard driving conditions - which were very frequent - and with fully-loaded pulks, the scooter could only run approximately 3 kilometers per litre of petrol.

Throughout the whole operational period the scooter team was able to count on using the hunting cabins and depots which N.E. Greenland is blessed with in such ample quantities. These hunting stations date from the time of Danish and Norwegian hunting operations, and are to a great extent maintained by the sledge patrol and by the existent weather stations. In spite of this, the scooter teams' equipment and provisions were planned with the clear aim of managing and facing independently the harshest Arctic conditions in the field.

In addition to the daily requirements of food and petrol, the scooter team carried emergency supplies for an extra week. As for safety purposes, the team was equipped with 2 military rifles calibre 7.62 and a revolver, calibre 44 magnum, as well as an excellent field radio, Racal Scuadcal, which as far as the atmospheric conditions allowed enabled the team to keep radio contact with headquarters. For security and operational reasons, contact was maintained with Mestersvig and Scoresbysund at least twice a day, morning and evening respectively.

Last, but not least, the scooter team received the greatest possible support from the expedition's two Cessna 185 'planes in that they provided petrol depots and food supplies; attended to replacement of team members; and helped with the tracking of bears. When necessary, the 'planes took an active part in the first phase of capture of bears.

Crew

The scooter team members were always chosen in such a way as to ensure that at least one of the members was familiar with Arctic conditions and survival technique, polar bear behaviour and polar bear marking.

It soon became clear that the team could be more effective working with each man on his own scooter, so we tried to keep this crew arrangement. Crew members, however, regularly replaced each other, and at certain periods a third man, student Poul Henrichsen, took part in order to learn about the hunting and capture of bears.

Furthermore, the scooter team brought with it, during the first period, 1-10 April, a Greenland sledge-dog from the airport in Mestersvig. The dog was carried in a pulk with the intention of helping with the tracking of bears in difficult terrain; its job after unleashing, was

to subdue the escaping bear until the scooters arrived. But when Rasmus the dog demonstrated, on the very first occasion, a complete indifference towards scientific polar bear-marking, it was decided to send him home on the next plane. In spite of this unsuccessful experiment, there is no doubt that a well-trained bear dog will, in certain situations, be very useful. Thus, two bears that evaded capture by escaping to the mountains, would hardly have avoided the blue ear-tags if the team had possessed a dog with the right moral fibre.

Operational period

The scooter team was in the field in the periods mentioned below and the crew members consisted of:

01/4 - 08/4.	T. Larsen and B. Clausen
08/4 - 10/4.	T. Larsen and I. Silis
10/4 - 12/4.	T. Larsen, I. Silis and P. Henrichsen
12/4 - 18/4.	I. Silis, B. Clausen and P. Henrichsen
18/4 - 25/4.	I. Silis and T. Larsen
28/4 - 03/5.	I. Silis and B. Clausen
09/5 - 10/5.	I. Silis and B. Clausen

The scooter team was in the field 33 days, and of these only 4 days were restricted by weather conditions. At this period the leader of the expedition carried out the necessary reconnaissance flights with the assistance of the other team members present.

Operational area (see Fig. 1)

For many reasons the southern part of the expedition's area was given up at an early stage by the scooter team as a field of activity. Amongst some of the reasons that can be mentioned, there is the poor track system south of Mestersvig and chaotic ice conditions along the Liverpool Coast. Flying operations were, however, carried out throughout the whole area (see Paper 7). Instead, the scooter team concentrated on the sea ice in a triangular area north of Mestersvig, with Sofia Sund and Vega Sund as the most important field of operations. The most westerly point of the triangular area was the Ella Island station at 72°50'N, 25°10W. The most southerly point was Kap Simpson 72°07'N, 22°15'W and the most northern point the Kap Franklin station at 73°18'N, 22°04'W.

The area is characterised by two large islands, Geographical Society Island and Trail Island. The islands' irregular coastline is formed

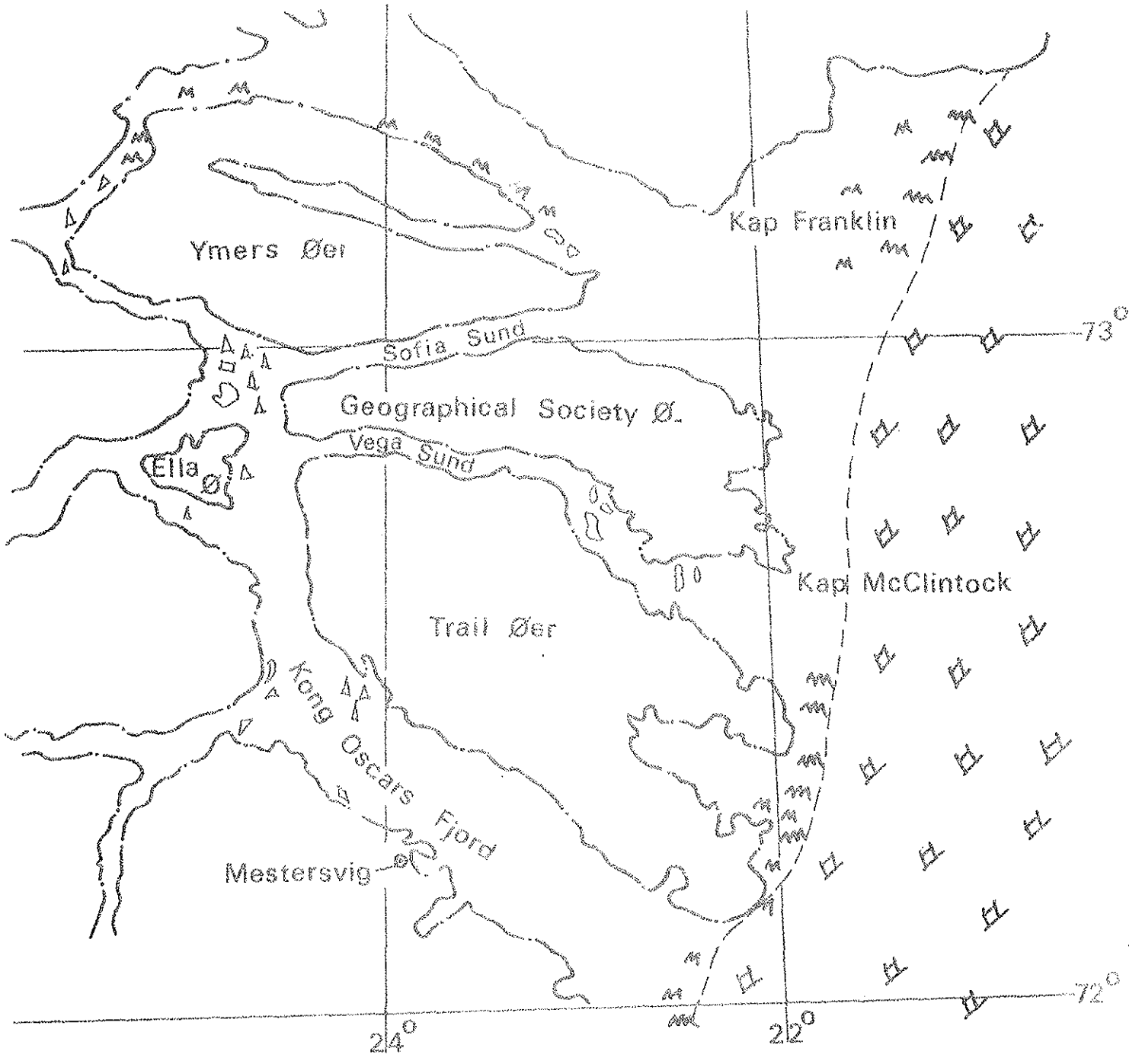

Figure 1

Icebergs
Pack Ice
Heavy Pack Ice
Drift Ice
Ice Edge

by coves, bays and inlets and at certain places, skerries. The archipelago proved to be especially interesting, as polar bears were particularly partial to taking up residence in this locality. The islands are bordered at north, west and south by straits and inlets, and the outlying limit of the coast towards east. The large islands have a mountainous landscape rising to 1500 metres in the west, decreasing in height eastwards and flattening out further at the outer coastal limits of the hilly terrain.

Ice and snow conditions

The ice conditions are shown in the map (Fig. 1). It can be seen that the winter ice from the fjord stretched far out to the outer coastal limits and lay at a distance of between two hundred metres and several kilometres offshore. Alongside the edge of firm ice, the compact drift ice churned in its eternal drift to the south. Banks of icebergs were lying at several places inside the edge of the ice. The winter ice was mainly flat, but with areas of pack ice extending and increasing towards the coastal limits.

During the expedition the scooter team was exposed to very varying conditions, ranging from thigh-deep, loose snow to bone hard, metre-high snow drifts. Moreover, conditions could be quite different from one fjord to the next and, during periods of snowfall and storm, the conditions underwent a complete change.

Although the scooter team operated entirely within the ice edge, i.e. on thick and safe ice, the surface conditions were not always suitable for hunting polar bears. So, the team endeavoured to avoid areas with pack ice, where bear-marking is not be recommended as it involves too great a risk. Moreover, bear hunting had to be completely abandoned in areas with enormous, hard snowdrifts. Here, the bears have fast ground under their paws, and are able to run easily and fast. The scooters, on the other hand, being obliged to maintain constant contact with the ground surface are forced to move at a snail's pace, balancing around and between the snow drifts.

Weather

The weather was normal for the time of the year, throughout the period of the expedition. In April it was cold, quiet and clear for long periods, only interrupted by occasional days with wind and snow. The lowest temperature during the time of the expedition was measured at Mestersvig as -41.6°C.

Along the outer coastal limits the prevailing wind direction was from the north. In the fjords and straits the dominating wind was outward going, that is blowing from west or north-west.

Results

During the entire expedition period, the scooters kept within sight of each other; each scooter covered a total distance of about 3.000 kilometres. The speed of progress depended completely on the ground conditions and could vary between 5 and 50 kilometres an hour. With normal, varying ground conditions, and including look-out for bears and tea breaks, the average speed was about 12 kilometres an hour.

During the whole period 24 polar bears were caught and marked, and a she-bear with a 1½-year-old cub was re-captured. There were fifteen full grown bears in the 'catch', seven 1½-year-old cubs and two ½-year-old cubs.

17 bears were located first for the team by 'plane, and the rest of the bears were discovered by the scooter team.

In the case of 8 bears, the 'plane contributed actively in the first phase of capture. Two full grown bears and a she-bear with two 1½-year-old cubs that the 'plane had located, escaped to the mountains. Several of the bears, located by 'plane, were out of reach of the scooters.

Locating bears for marking

First, it is necessary to distinguish between locating by scooter and by 'plane. The last-mentioned method, based on co-operation between 'plane and scooters, showed itself to be most effective and can be recommended in connection with possible scooter work in the future.

Many bears were, however, first located by scooter, without help from the 'plane, and this became occasional practice throughout the expedition. We used the method here, of having two scooters in action all day - with full field equipment - keeping within visual range of each other in a prospectively good bear terrain. The team stopped regularly at outstanding viewpoints, as for instance, icebergs, islands and headlands, and thoroughly searched the surrounding country through field-glasses. This method meant that a considerable amount of time was unavoidably wasted on following bear tracks that not only zigzagged between floes and along cracks but all too often disappeared in a terrain that was inaccessible for scooters. Added to this was the enormous difficulty of determining the freshness of tracks, especially in the first calm period before the April sun had become powerful. At this time, a several days old track could stand, with sharp edges, and mislead the pursuing team with its apparent freshness.

On the other hand, the method of procedure was different when the team was assisted in observation of the bears by the 'plane. The scooter team received information via radio - at pre-arranged times - or by

sketch map dropped by the 'plane crew. The scooter team assessed the information and, if the bear was within a practicable distance and there were reasonably favorable conditions, set out in pursuit. It is worth noting in this connection that it is not wise to be discouraged by long distances, provided that the bear is deep within the fjord region and looks like staying there. In this way, the scooter team once travelled 90 kilometres, from Kap Humboldt to Ella Island, in pursuit of 3 bears that the 'plane had observed. The trip lasted a whole day, and it was not until the day after, that the team came in contact with the bears, with the help of renewed support from the 'plane.

Bear capture

Although each bear capture distinguished itself from the previous one, there were still certain common aspects in the bears' reactions and these were very relevant to the progress of a hunt; so that a general account of the course of action seems justified.

As soon as the scooter team had caught sight of the bear through field-glasses and observed its behaviour, an immediate plan was made for the next stage of action. First, the petrol tank, a 20-litre jerry can, was replaced with a filled one. Then the hand weapons were distributed. Next, the pulks were almost always unhooked and left behind. After that, it was a question of cutting off the bear from escape to terrain that would be difficult for the scooters to follow, such as hilly, snow-scarce land, pack ice, border-ice, or unmanageable icebergs.

In this early phase the 'planes assisted effectively by, for example, circling at low level over impassable regions, and with their infernal noise preventing the bears from escaping in undesirable directions. The 'planes continued circling until the bear had run out to accessible ice or until the arrival of the scooters and their further participation in the hunt. After this, the presence of the aircraft was only a nuisance as the piercing motor noise of the engine bewildered the bear and interrupted the further progress of the hunt. The bear's first and immediate reaction to the appearance of the scooter was always flight. If the bear's goal was sufficiently far away, it was possible, without too much trouble, to persuade it to give up and make for, instead, another easier direction, either out on the level ice or up a smaller iceberg. But when the bear had come sufficiently close to its escape destination, nothing, not even provocative driving with screeching motors only a dozen metres from its nose, could make it change direction. Yet there was still some individual variation, and especially she-bears with 1½-year-old cubs could seem particularly determined. The team often experienced the familiar situation of an escaping bear that took flight to icebergs of a certain size. Here is a situation where the size of the iceberg plays a decisive role in whether the bear feels in temporary safety or not. But as the scooter team was equipped with both ropes and ice axes, a clearly viewable iceberg was, indeed, not the

worst place for an escaping bear to finish at. Sometimes the bear could be scared into coming down from the iceberg by a rifle shot. But the method was not effective; according to T. Larsen tracer bullets would be more suitable.

With one exception, the bears proved easy to lead to level stretches of ice. They always tried to escape directly away from the scooters. By guiding the bear and circling around it the scooter team tried to tire the bear so that one could come within suitable shooting distance, 15 - 25 metres.

During the bear hunt, the scooter team must never break the rule of not driving directly behind the bear but always parallel to its escape direction, so that the scooters could drive out to the side quickly, should the bear turn and attack.

The next phase was concerned with judging the correct dose of the immobilizer Sernylan; an estimation of the bear's size and weight was taken by studying its tracks and the bear's constitution. After this, the scooter stopped. A suitable dart was chosen from a ready mixed assortment that one of the team members always had in his breast pocket. The dart gun was loaded and the team members assigned their various duties according to circumstances and the driving conditions. With level ground and not too deep snow, the rifleman placed himself behind the other team member and the pursuit was immediately resumed. Before long the bear showed distinct signs of tiredness. It became stiff-legged, faltered, breathed heavily, sunk its nose in the cool snow and sat down or laid itself flat on its stomach. But, long before the bear had reached this stage of tiredness, the marksman had found the opportunity to shoot from the ideal shooting position. This occurred - mostly - with the bear at an angle immediately to the left of the scooter and at a distance of between 15 to 25 metres. In this threatening situation for a bear, there comes, inevitably, a moment when the bear stops and, turning, looks irresolutely at its pursuers.

In deep, loose snow one can obtain the same reaction by guiding the bear to a smaller ice floe or a patch of hard snow. Here, the bear feels hard snow beneath its paws and uses the advantage to take a closer look at his tormentors. This is the moment! Without hesitation, the dart must be fired - so that it hits the part which is usually admirably displayed at this moment - the right thigh. After this, the scooter takes a sharp turn to the right and away from the bear. In order to cause the bear the least disturbance, the scooter stops at a considerable distance away from the bear, although, in doing so, the crew should have just managed to perceive, in a quick glance, the bear snarling with the dart's impact, turning ... and its attempt to snap at the dart. The time of shooting is noted, and through field-glasses, an observant eye is kept on the effect of the tranquilizer. When the bear has received the correct dose it will begin, within 15 minutes, to sway from side to side, pausing often, licking its jaws and finally sitting back heavily on its tail ...

However, the course of events could well be different from that described. In rough driving conditions with many snowdrifts, and deep loose snow, two men on the same scooter will have considerably less manoeuverability and another course of action will have to be chosen. In a situation like this, the marksman can, with advantage, drive his own scooter towards the bear - whilst his colleague follows, keeping him covered with his rifle. The method can only work using reliable scooters, for there is a moment when the marksman has to give up control of the steering on his scooter and concentrate on the dart-gun. Whatever happens the scooter must not fail!

On many occasions the scooter team had their hands full dealing with several bears at the same time - it could be a she-bear with cubs or up to three full-grown bears. When it is a matter of a family of bears, then, of course, they must not be separated in the chase. Normally, this is not a great problem, as the mother bear is the quickest, has the most staying power, and keeps herself directly in front of the cubs. However, attention has to be drawn to the fact that in crust snow the difference in the paw prints can mean that the surface will hold a 1½-year-old cub, but not its mother, who will sink through and lose speed. The cubs can then reach considerably further, taking the lead and may even run in different directions. In a family, the mother bear should always be immobilized first as the cubs will in all probability keep near her and, if they do not, it is an easy matter to guide them back by scooter or on foot.

On the occasions when we had several grown bears at the same time, it was usually a she-bear in heat, accompanied by one or two admirers. Again, in this situation she must be immobilized first, as she is usually in excellent shape compared with her somewhat paunchy lovers. However, the infatuated he-bears are not easily discouraged from their pursuit, they try to keep near to her or within easy distance by following her tracks, which makes it easy for the scooter team to immobilize them too.

Finally, for the sake of completeness, it must be mentioned that in the last phase of the chase, it is important to be sure not to cut off the chances of escape for either the bear or oneself, as this can cause catastrophic results. For the same reason it is irresponsible to attempt bear-marking from a scooter in pack-ice. In the confusion of ice blocks there is a very limited view and one can easily and suddenly arrive at the uncomfortable situation of being face to face with a bear.

Conclusion

In an area of limited extent and with a reasonably dense bear population, with 'plane assistance for tracking bears and with a trained crew and

reliable scooters ..., polar bear marking can be undertaken reliably and with success (which would no doubt be even greater if the scooter team is accompanied by a good bear dog).

However, it must in conclusion be admitted that, on the basis of my earlier experience at James Bay, Canada, a helicopter assisted by a 'plane provides a vastly superior method to the one described in this paper.

Polar Bear Specialists
Fifth Meeting
Paper No. 9

PRELIMINARY REPORT ON THE SECOND DANISH POLAR BEAR EXPEDITION TO NORTH EAST GREENLAND, 1974

Christian Vibe

Duration

1 April to 16 May 1974.

Participants

Ivars Silis, Civil Engineer, leader of the helicopter operations and the bear catching and marking team, and responsible for the equipment.

Erik Eriksen, Veterinary Surgeon, in charge of the veterinary field work.

Christian Vibe, DPhil., scientific leader and head of the reconnaissance team.

John Andersen, Architect, Roland Jacobsen, MSc., and Poul Henrichsen, student of science, assistant observers for the reconnaissance team. Roland Jacobsen and Poul Henrichsen, in addition, made studies of seals and musk oxen, respectively.

The technical personnel consisted of Ejvind Ranman, pilot, Helge Siljeberg, helicopter pilot, and Bryan Croston, helicopter mechanic. All three are Norwegians.

Transport equipment

1 fixwing 'plane, Cessna 185.
1 helicopter, Hughes 500.
2 snow-scooters, Ockelbo 600.

Crew, equipment, snow-scooters, 'plane and helicopter were flown from Oslo to Mestersvig by a SAS transport 'plane. Fuel was shipped to Mestersvig and Daneborg in the summer of 1973, to Danmarkshavn in 1972. The helicopter fuel at Danmarkshavn proved unfit for use, so fuel had to be brought from Daneborg in the Cessna.

Budget

In total 600,000 D.kr.: 250,000 kr. granted by the Danish Research Council (Forskningsrådet), 250,000 kr. by the Ministry for Greenland, and 100,000 kr. by the World Wildlife Fund.

Operational area

North East Greenland, from Reynold Øer, 71°30'N, 21°40'W, to Norske Øer, 79°13'N, 17°45'W. The distance between the two points is 870 km, as the crow flies. Reconnaissance flights were made in this area from the outer border of the shore-fast ice right up to the glaciers at the head of the fjords. All operations were carried out directly from the three main bases, Mestersvig, Daneborg and Danmarkshavn, from which the whole area could be covered by 'plane. The most important areas could also be reached by helicopter.

Weather conditions

Throughout the period of operation, from 6 April to 10 May, the weather remained very stable with sunshine and good visibility; only at the end of the period a few days of fog occurred. Snowfall up to January had been very poor, but a good deal more had fallen after that. As in 1973, the snow had settled in certain fjords and sounds, while others were snow-free because of the strong wind blowing from the Inland Ice.

Snow thickness in the snow-covered fjords and sounds was about 85 cm in the area between Mestersvig and Daneborg, and about 50 cm around the grounded icebergs in Dove Bugt. Ice thickness in the Kong Oscar Fjord and Franz Joseph Fjord area varied from 135-173 cm.

The border between shore-fast ice and drift-ice lay right up to or a little off the headlands and outermost islands. More open water was seen along this border than in 1973, especially in periods with wind from north north-west.

Polar bear tracks often led to the edge of the shore-fast ice and continued along it, and it is possible that there was some polar bear traffic between drift-ice and shore-fast ice during the period of

operation. In the fjords and far from the drift-ice border, open water due to currents was observed in Röhss Fjord, Dusens Fjord and Loch Fyne. Such places were rarely visited by bears.

Working method

The snow-scooters were taken along in reserve in case the helicopter broke down. Both helicopter and 'plane worked perfectly well all the time, so the scooters were used for jobs on the ice and as a means of transport during the musk ox investigations, in the Danmarkshavn and Daneborg areas, carried out by Poul Henrichsen with the assistance of John Andersen and Roland Jacobsen. The latter also collected ringed seal material (blood, meat, blubber, liver, jaws, etc.) at Daneborg, assisted by the personnel of the weather station.

The polar bear work was carried out by two teams, the reconnaissance team in the Cessna 'plane and the catching team in the helicopter. The former consisted of Ejvind Ranman, pilot, and Christian Vibe, reconnaissance leader, seated in the front of the 'plane, and in the left back seat one of the other expedition members as an observer. The catching team consisted of Helge Siljeberg, pilot, and Ivars Silis, catch leader, seated in the front of the helicopter, and in the back seat Erik Eriksen, veterinary surgeon. The work of the catching team has been dealt with in the reports of Erik Eriksen and Ivars Silis (Papers 2, 8 and 10 in these Proceedings).

The daily work of the reconnaissance team began with consideration of the weather situation. The flight route was planned accordingly and marked on a map, and the positions and approximate times for radio contact with the base were also marked. Each pilot and the radio watch (normally Silis) received a duplicate before the 'plane started. The tanks and reserve tanks of the 'plane had been filled the day before. The 'plane carried provisions for each man, and of course their personal outfit and emergency equipment (as specified by Silis, Paper 10).

All reconnaissance flights were made at a height of 100 m. The observations were recorded on a tape recorder, and an observation report was written every night. In addition colour photographs and 16 mm colour films were taken of all important observations, such as landscape, ice border, drift-ice, open water, drifting snow showing prevailing wind direction, track activities and polar bears, including their method of seal catching.

As a rule the track of the bear would be seen first. It would tell whether it was a mother bear with small or big cubs or a lone bear. If the track was considered to be fresh, it was followed until the bear was found, rarely more that ½ - 1 hour later, sometimes less. In some cases it was impossible to see any clear pattern in the tracks, and then

it paid to systematically reconnoitre the area in stripes about 200 m apart - until suddenly the bear would come into view.

As soon as the bear had been spotted, the base was contacted and the catching team took off in the helicopter. At a height of 400 m the 'plane awaited the arrival of the helicopter while keeping an eye on the bear, which appeared to take no notice of the 'plane as long as it maintained an altitude of 400 m or more.

Upon its arrival the helicopter took over the chase, and the 'plane resumed reconnaissance. If the flight was a long one, the 'plane would land on the ice of the fjord to enable the crew to fill the tanks with the reserve fuel (the 'plane carried reserve fuel for the helicopter, too) and eat some sandwiches. 'Plane and helicopter returned to base every day and stayed there overnight.

Results

As in 1973, the southern area between Mount-Norris Fjord and Mackenzie Bugt proved to be fine polar bear country with a permanent bear population comprising all age groups.

None of the 24 bears caught and marked in 1973 in this area had been reported shot or recaptured from other areas during the year which had elapsed, but 10 of them were recaptured by us in 1974 in the same localities as those in which we had marked them in the previous year. This may indicate that very few bears emigrated from the area during the 1973 summer and the 1973-74 winter. The reason is assumed to be stable (?) drift-ice conditions.

During the 1974 operations, 29 bears were caught and marked (including the ten recaptures). Of the 29, four have since been reported shot from Scoresbysund during the summer, i.e. about 250 km further south. (Only two of the tags have yet been received.) This emigration is assumed to be due to unstable (?) drift-ice conditions and in consequence less food for seals and polar bears. The bears have had to take to the drift-ice and have drifted south with the ice.

Another phenomenon observed was a migration into the fjords. A mother bear (No. 120), whom we had marked in 1973 in Vega Sund and recaptured 6 April 1974 near the same position - now with two young cubs (Nos. 135 & 146) -, was observed again with her cubs on 6 May 1974 at the head of Franz Joseph Fjord, about 150 km from the position where she had been marked. Near her another marked bear was observed, which we were unable to identify.

The polar bears marked in 1973 and 1974 in the southern area can be separated into the following age groups:

Age years	Males 1973	1974		Females 1973	1974
abt. ½	1			1	3
- 1½	2	6		5	2
- 2½	1	2			2
over 3	5	4		9	10

It will be noted that 9 of the adult polar bears were males, 19 females.

Turning to the central area, between Kap Broer Ruys (Mackenzie Bugt) and Haystack, it seems that it has no permanent bear population. Only two lone bears were observed - of which one male was caught and marked. We followed his track from the shore-fast ice border east of Shannon, to north of Kuhn Øer, where he was found eating a seal, the second he had caught on the about 80 km-long stretch. The other bear, probably another male, was observed south of Clavering Øer. The whole of the central area had little track activity. Most tracks were found along the shore-fast ice edge; hence it is likely that the bears of the area stayed mainly on the drift-ice and only occasionally visited the shore-fast ice.

Catch in the central district 1974:

Age, years	Males	Females
over 3	1	0

The northern area, between Haystack and Norske Øer, has again become good polar bear country with a permanent population of breeding bears. Tracks of a mother bear with young cubs were observed in Dove Bugt and west of Franske Øer. Members of the sledge patrol "Sirius" further reported observations of several tracks of mother bears with young cubs made in Ingolfs Fjord, slightly south of 81°N.

In the area between Bessel Fjord and Skœrfjorden, a total of 12 bears were marked in 1974.

Age, years	Males	Females
1½	0	1
2½	0	1
over 3	4	6

Both in 1973 and 1974, the majority of the adults caught were females.

The great surplus of females in the captures as a whole, 25 as against 13 males, may be due to the fact that it was easier to find the females

because they are often accompanied by cubs. However, it may also be due to the fact that the males roam about more and are more inclined to migrate onto the drift-ice. This assumption is corroborated by the fact that in the annual take of polar bears in South East Greenland there is a surplus of old males.

Both in 1973 and 1974, it was common to see an old male following at some distance a mother bear with cubs of 1½ years. The male showed no signs of being aggressive nor contributing food to the family. On two occasions the male was seen to leave the family as soon as the group was attacked, and take flight in the opposite direction.

The southern area is characterized by many large fjords and sounds. Strong winds blow from the Inland Ice towards the sea, and some of the fjords and sounds are blown free of snow. Sheltered fjords and sounds, however, have a thick snow layer over the ice; and the bears stayed mainly in these snow-covered sounds near the outer coast.

It is assumed that the winds from the Inland Ice are the driving force in water exchange and thereby contribute to productivity in the fjords. Wintering conditions for bears and seals are, however, more favourable in the adjacent areas where the ice is covered by a thick snow layer serving as insulation against heat loss. The concentration of ringed seals proved to be highest in snow-abundant fjords and lower in the wind-swept fjords or sounds.

In the central area, the winds from the Inland Ice do not seem to have the same effect, and they are not a decisive factor as in the southern area.

The northern area was characterized by tracts open to the winds, the winds coming from north to north-west, hence the snow-free ice or thin snow-cover; but other parts of the country in the lee had a thick snow layer. The area is further characterized by many low and often grounded icebergs surrounded by open tide cracks and high snow drifts. Such iceberg banks were frequently visited by the polar bears, which made their dens in the snow drifts at the foot of the iceberg. Apparently the bears slept in the dens in the middle of the day, since hardly any were seen at that time of day.

On four occasions in Dove Bugt and Skœrfjorden, bears were seen to disappear into such dens when they realised they were being pursued by the 'plane or by the helicopter. In one instance the helicopter team was able to chase the bear out with a smoke bomb, but the three others refused to emerge despite the smoke. Perhaps teargas would be more effective.

Several observations were made from the reconnaissance 'plane, at a height of 400 m, of bears breaking through the roof of a 'seal cave'.

The bear would smell his way to the cave, as a rule near an iceberg, then stand up on his hind feet, throw himself forward with all his weight, striking the snow with his forepaws. If unsuccessful he would try again, up to three times. When he had managed to break through the roof of the seal cave, the bear would often disappear into it and reappear a minute later. We did not witness any instance of a bear actually catching a seal in this way, but we found many bears which had caught a seal or its young.

The highest number of bears we caught at the same time was six on 10 April in Vega Sund. The group comprised a mother bear with no less than 4 cubs, all about 1½-years-old, closely followed by an old male. The mother and two of the cubs proved to be carrying our ear tags from 1973; the two other cubs were not marked. The assumption is that the mother of the two unmarked cubs had been killed in a fight, and that the stronger bear left the field of battle with all four cubs. Some time before, a female with milk in the teats had been found dead by the "Sirius" sledge patrol.

A tooth was extracted from all adult bears for age determination. All 35 teeth (from both years) are now being analysed. Also samples were drawn of blood, milk and hairs (see Erik Eriksen, Paper No. 2). A collection of the analytical results is not yet available.

The operations were carried out without any accidents happening to either bears or men. The Cessna spent 150 flight hours and the helicopter 50, including transport flights.

The musk ox population of North East Greenland is now in a critical state, very few calves having survived the winters of 1972/73 and 1973/74.

Plans for polar bear investigations during 1975

Provided that sufficient funds are granted, it is planned to charter a ship and a helicopter and sail into the drift-ice at the latitude of Shannon Øer, or somewhat further south, following the inner edge of the drift-ice as far south as possible, maybe right to Angmagssalik. On the way, both the coast and the drift-ice border will be searched for summering polar bears, which will be caught and marked with the helicopter.

The expedition is intended to take place in July-August, and the duration will be about 45 days.

Polar Bear Specialists
Fifth Meeting
Paper No. 10

LIVE CATCH OF POLAR BEARS FROM HELICOPTER IN NORTH EAST GREENLAND, APRIL-MAY 1974

Ivars Silis

Introduction

The expedition was based on a teamwork between 'plane and helicopter.

The initial phase, reconnaissance flight and locating, and the concluding phase, marking and sample collecting, have been dealt with in the reports by Christian Vibe and Erik Eriksen (Papers 9 and 2).

The 'plane was used to locate the bear, and the actual catch was carried out from the helicopter.

The present report concerns only the actual catch, i.e. from the moment when the reconnaissance 'plane has spotted the bear and established radio contact with the marking team at the base, until the point when the bear has reached the state of immobilization where it is possible to start marking and sample taking.

Aircraft and equipment

A four-seater helicopter, Hughes 500 from the Norwegian company Helilift and registered in Hamar, was available. The helicopter was equipped with a turbine engine Allison 250 18 C (317 shp derated to 277), skis and loading hook with net. The right front door - next to the co-pilot seat - was easy to unhinge.

A helicopter of this type uses jet fuel. When the tanks are full the carrying capacity is 350 kg, the fuel consumption 110 litres/hour, the cruising speed 105-120 knots and the flight time 2 hours. The range of the aircraft was therefore under the given circumstances no more than 150 km.

Radio communication

The helicopter was equipped with both VHF and HF radio, so that contact could be made with the reconnaissance 'plane (Cessna 185) as well as with Mestersvig airfield and Daneborg and Danmarkshavn weather stations, which alternated as bases for the expedition. 3350 and 4050 kHz frequencies were used mainly.

Emergency equipment and personal outfit

The helicopter carried emergency and field equipment for the three men of the marking team, comprising a.o. emergency rations for three men for 7 days, complete field equipment, personal Arctic outfit, skis, first-aid kit, signalling devices, emergency radio transmitter, extra start batteries, etc. Total weight ca. 90 kg.

Nautical equipment

The helicopter was equipped with common compass, gyro compass, and radio locator, ADF. Each man on board carried maps of the whole operation field in scales of 1 : 1,000,000 and 1 : 250,000, and a list of the many hunting cabins which are still maintained and kept supplied as depots by the sledge patrol "Sirius".

However, the weather conditions were so favourable that the maps sufficed for the helicopter team to find their way.

Veterinary equipment

The veterinary equipment for the field operations consisted of a Cap-Chur injection gun, medicine and marking tools, no more than could be contained in a midwifery bag and a small tool box. Weight ca. 15 kg. For further information, see Mr. Eriksen's paper (No. 2).

Safety equipment

Sporting rifle, cal. 7.62, revolver, cal. 44 magnum, and spear, length 2.5 m.

Fuel depots

Mestersvig, 25 drums of thurbo fuel delivered in the summer of 1973.
Daneborg, 45 drums of thurbo fuel delivered in the summer of 1973.
Danmarkshavn, 25 drums of thurbo fuel delivered in the summer of 1972.

Unfortunately, and contrary to what the experts had maintained, analyses of samples of the Danmarkshavn jet fuel proved it to be unfit for use. The Cessna had to freight the necessary jet fuel from Daneborg to Danmarkshavn, the most northerly base.

Crew

Bryan Croston, helicopter mechanic, was stationed at the base and kept the helicopter in constant working order.

The team of all the marking flights consisted of -

Helge Siljeberg, pilot,
Erik Eriksen, veterinary surgeon, and
Ivars Silis, catch leader and head of helicopter operations.

Period and field of activities

The expedition was in North East Greenland from 2 April to 15 May 1974, during which time Mestersvig, Daneborg and Danmarkshavn alternated as bases for the polar bear marking operations within the border of the shorefast ice (Fig. 1).

Period	Base	Effective marking days	Helicopter hours for marking	Polar bears
2.4-12.4	Mestersvig	5	10 h 25 min	18
12.4-21.4	Daneborg	4	10 h 20 min	8
21.4- 2.5	Danmarkshavn	6	12 h 40 min	10
2.5- 3.5	Daneborg	0	nil	0
3.5-15.5	Mestersvig	4	7 h 40 min	6
2.4-15.5	NE Greenl.	19	41 h 05 min	42

Southernmost reconnaissance locality: Reynold Øer 71°30'N, 21°40'W.
Northernmost reconnaissance locality: Kap Nansen, 79°13'N, 17°45'W.
Aerial distance between the two localities: Approx 860 km.
Most southern bear marked in Bjørnedalen, 72°21'N, 22°42'W
Most northern bear marked in Skœr Fjord, 77°27'N, 19°00'W.
Aerial distance between the two localities: Approx. 570 km.

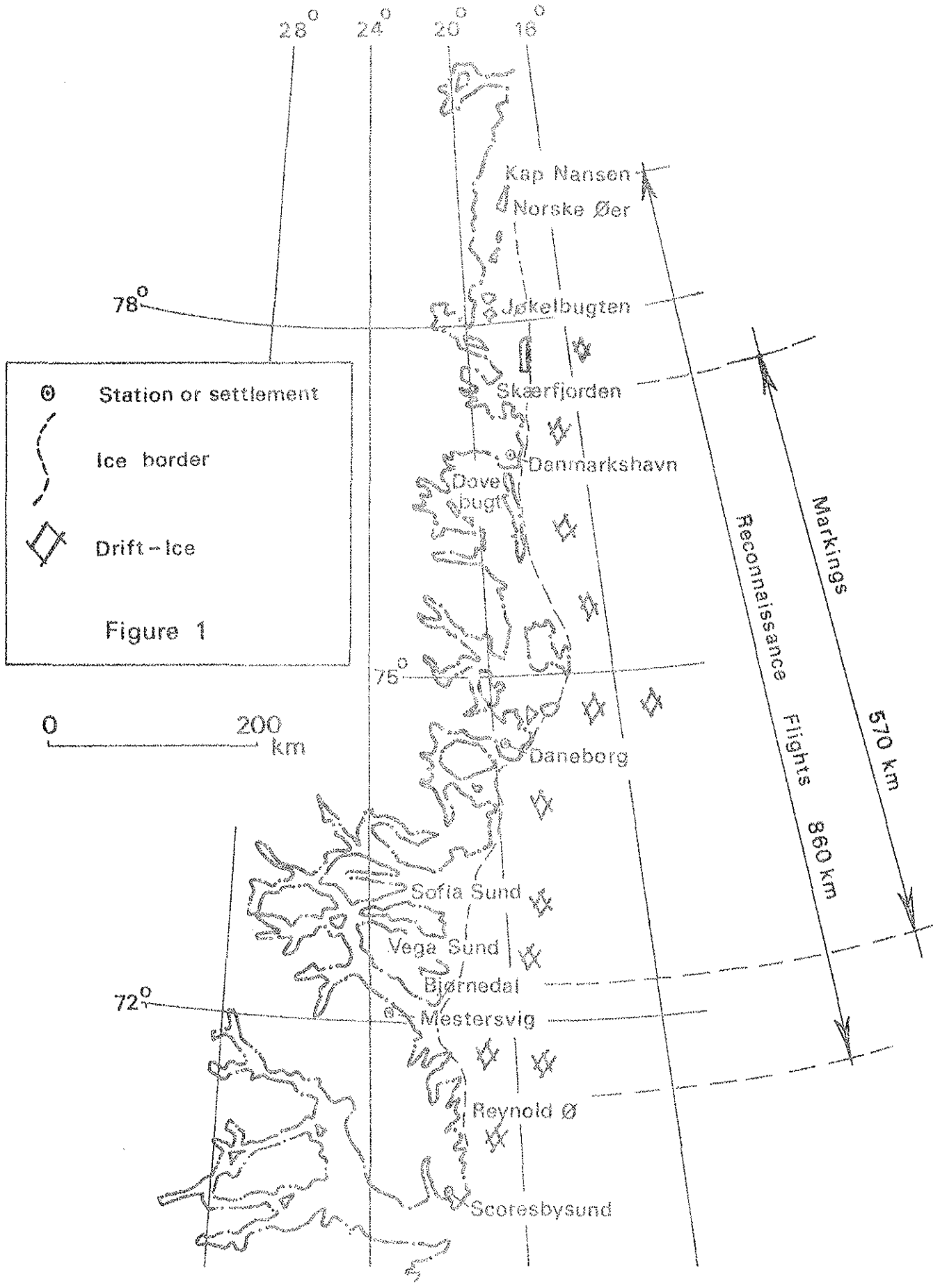
28°
24°
20°
16°
78°
75°
72°
Kap Nansen
Norske Øer
Jøkelbugten
Skærfjorden
Danmarkshavn
Dove Bugt
Daneborg
Sofia Sund
Vega Sund
Bjørnedal
Mestersvig
Reynold Ø
Scoresbysund
Station or settlement
Ice border
Drift-Ice
0
200
km
Markings
570 km
Reconnaissance Flights
860 km

Figure 1

Results

In total the team was called in to mark 46 polar bears and 42 of them were successfully marked. Two escaped marking having sought refuge in inaccessible snow dens along icebergs before the arrival of the helicopter and two had to be abandoned because of fuel shortage.

Of the 42 polar bears marked, 30 were adults (including 2½-year-old bears accompanying their mothers), 9 were cubs of 1½ years, and 3 cubs of ½ year in age. 10 were recaptures from the previous year's expedition.

116 hours reconnaissance flight and 41 helicopter hours were spent to obtain this result. Hence it may be roughly concluded, as a guide for marking polar bears in North East Greenland, that about 3 hours are spent reconnoitering and 1 hour capturing per bear marked.

The number of polar bears marked in relation to the total cost of the expedition, gives a price of D.kr. 14,000 for each bear. (In 1973 it was about D.kr. 21,000 per bear.)

Catching from helicopter

The experience the catch leader had gained when participating in the Canadian Wildlife Service Expedition to James Bay in 1970 became very useful here, and the catching of bears from helicopter soon became a routine job. A description of a typical catch will therefore suffice.

While the 'plane was reconnoitering, the marking team was on stand-by at the base. The catch leader kept watch on the respective radio stations.

As soon as a bear was reported and the position stated, the marking team and the helicopter mechanic were called in, and 10 to 20 minutes later the team had taken off. Then the helicopter shaped its course directly for the bear position stated, maintaining frequent radio contact with the reconnaissance 'plane which stayed near the bear so as not to lose sight of it. Often the ground would be so irregular that it was impossible to see the bear, so the reconnaissance 'plane had to guide the helicopter to the site.

When the marking team had established visual contact with the bear, the 'plane retired at once in order not to interfere and disturb the hunt. The reconnaissance flight was resumed, or the 'plane stayed some distance away taking photographs of the hunt.

The helicopter then made a dive towards the bear to enable the catch leader to survey the ground and assess the bear's flight chances. Steep hills, and open water due to currents, were undesirable. Soon a plan for the conduct of the chase had been made, so that the bear could be led in the right direction from the start and the hunt would last the shortest possible time.

In the meantime the helicopter had come quite close to the bear, and the veterinarian and the capture-team leader concentrated on estimating size, weight, age, constitution, and degree of fatigue (the latter being strongly dependent on the air temperature) - factors that are decisive when calculating the right dose of the drug Sernylan. (The team preferred to work with lightly drugged bears - 1-2 mg Sernylan per kg body weight - as light immobilization is the best guarantee for a troublefree and quick awakening.) This done, the helicopter landed near the bear. The veterinarian and the catch leader jumped to the ground, examined the tracks of the fugitive, and observed him in their field glasses, in order to check and correct their first estimate of his physique. When they had agreed upon the right dose of Sernylan, they entered the helicopter and continued the chase. While the veterinarian was filling up the darts with the amount of Sernylan and tranquillizer judged necessary, the catch leader made sure that the bear was being kept in suitable surroundings. This was easily done as the bears would always - apart from a single case of a couple of obstinate old males - run away from the airborne monster.

Having reestablished contact with the bear, the helicopter landed again, this time very close. The door by the co-pilot seat, i.e. next to the catch leader/marksman, was quickly unhinged and stowed away among the equipment in the back of the cabin. As soon as the injection gun was loaded the helicopter steered right towards the bear. With brilliant flight technique and within two or three minutes, the pilot would have managed to put the marksman in the desired shooting position, i.e. with the bear to the right of the helicopter and a little ahead, and the range not more than 15 meters. The next moment the bear resumed flight in a cloud of snow raised by the propellers, an injection dart dangling from a muscular part of his hindquarters. From the moment when the marking team had first seen the bear until it was hit, normally less than 10 minutes would have elapsed.

Now the helicopter landed at a suitable distance to leave the bear in peace. The effect of the drugs was observed in field glasses; as a rule the bear would have come to rest and lain down after 15 minutes. Then the helicopter approached and landed about 40 m away from and behind the bear.

The veterinarian and catch leader then approached the bear on foot, the former, when about 20 m away from the bear, putting his haversack down and standing to one side in order to cover the catch leader with his

rifle. Shouting at the bear the catch leader approached, spear in hand and his revolver holster open, halting 10 meters away to throw ice at the bear. If the bear did not get up but continued to lie there quietly, the catch leader approached close enough to the bear to be able to reach out with his spear and prick the bear on the pads of his paws and in his rump. Provided the bear still showed no reaction worth mentioning, he was considered to be sufficiently immobilized to allow the veterinarian to begin the job of marking, a phase in the operation that has been dealt with by Mr. Eriksen (Paper No. 2).

It should be pointed out that although the above safety measures may seem over-cautious, their necessity has been proved in several critical situations, including one occasion on this expedition. Briefly, the behaviour of bear No. 41 was misjudged; he had lain down 15 minutes after the injection and was believed to be fully immobilized, but as it turned out he was really just exhausted and only slightly tranquillized. We realized our mistake the moment the bear felt the prick of the spear in his hind paws, when he spun round and attacked quick as lightning. Fortunately the bear changed his mind after chasing the spearman for about 5 meters, the latter having had a bad fright and started running immediately.

Many times we were facing several bears at a time, even up to six. In such cases the course of the hunt and the order in which the bears are immobilized, have to be decided not only upon a basis of topography, but also very much on the basis of the polar bear group's composition. Thus the mother bear of a family is always to be immobilized first, as the cubs will normally stay with their dormant mother and may be injected from the ground. On the other hand, if a male bear is around and cannot be chased away from the family, he should be immobilized first. However, if the bears in question are a female in heat and her suitor, it will definitely be an advantage to immobilize the female first, as she is likely to have a stronger constitution.

Conclusion

Reconnaissance 'plane and marking helicopter proved to be a strong combination, and the teamwork between them was highly successful. The results of the expedition certainly came up to expectations, and future marking expeditions to Greenland if they are working under climatic and topographical conditions resembling those found in the North East, are certainly recommended to follow the same lines.

However, the financial aspects of such a venture should be taken into consideration, too, and in this connection I would point out that the transportation of the aircraft to Greenland and back is one of the

biggest items in the budget. The possibilities of cooperation with other institutions working in Greenland, such as the Greenland Geological Investigation, the Geodetic Institute and the National Museum, should be very seriously considered when enterprises of this kind are planned.

It is further my opinion that provided that a suitable helicopter is available locally, and provided that fuel depots are laid out in good bear districts such as those north of Mestersvig and Angmagssalik, excellent marking results can be obtained for less money by working like the Canadians with just two men plus pilot and mechanic. Such an enterprise implies the use of the helicopter for bear spotting as well as for bear marking, and however expensive a helicopter may be to run, the fact is that many hours' helicopter flight can be covered for the cost of maintaining a separate reconnaissance 'plane and crew.

Finally, two minor comments:

A helicopter with a sliding door by the co-pilot seat would greatly ease the work of the marksman;

A choice of harmless fireworks should be available for chasing bears out of dens.

The International Union for Conservation of Nature and Natural Resources (IUCN) is an independent international body, formed in 1948, which has its headquarters in Morges, Switzerland. It is a Union of sovereign states, government agencies and non-governmental organizations concerned with the initiation and promotion of scientifically based action that will ensure perpetuation of the living world - man's natural environment - and the natural resources on which all living things depend, not only for their intrinsic cultural or scientific values but also for the long-term economic and social welfare of mankind.

This objective can be achieved through active conservation programmes for the wise use of natural resources in areas where the flora and fauna are of particular importance and where the landscape is especially beautiful or striking, or of historical, cultural or scientific significance. IUCN believes that its aims can be achieved most effectively by international effort in co-operation with other international agencies, such as UNESCO, UNEP and FAO.

The World Wildlife Fund (WWF) is an international charitable organization dedicated to saving the world's wildlife and wild places, carrying out the wide variety of programmes and actions that this entails. WWF was established in 1961 under Swiss law, with headquarters also in Morges.

Since 1961, IUCN has enjoyed a symbiotic relationship with its sister organization, the World Wildlife Fund, with which it works closely throughout the world on projects of mutual interest. IUCN and WWF now jointly operate the various projects originated by, or submitted to them.

The projects cover a very wide range, from education, ecological studies and surveys, to the establishment and management of areas as national parks and reserves and emergency programmes for the safeguarding of animal and plant species threatened with extinction, as well as support for certain key international conservation bodies.

WWF fund-raising and publicity activities are mainly carried out by National Appeals in a number of countries, and its international governing body is made up of prominent personalities in many fields.