P O L A R B E A R S

Proceedings of the Seventh Working Meeting of the
IUCN Polar Bear Specialist Group

Held at the Arktisk Institut, Copenhagen, Denmark
30 January - 1 February 1979

and

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IUCN Polar Bear Specialist Group

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SEVENTH WORKING MEETING OF POLAR BEAR SPECIALISTS

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SIXTH WORKING MEETING OF POLAR BEAR SPECIALISTS

LIST OF PARTICIPANTS

Chairman

Dr. John S. Tener
Executive Director
Arctic Institute of North America
2920 - 24th Avenue N.W.
Calgary
Alberta
Canada, T2N 1N4

Members Present:

Dr. Douglas P. De Master
National Fish and Wildlife Laboratory
c/o University of Minnesota EBB
108 Zoology Building
Minneapolis, Mn 55455
USA

Mr. Thor Larsen
Norwegian Polar Institute
Rolvstangveien 12
Box 158
1330 Oslo Lufthavn
Norway

Mr. Jack W. Lentfer
Alaska Dept of Fish and Game
210 Ferry Way
Juneau
Alaska 99801
USA

Dr. R.E. Schweinsburg
N.W.T. Wildlife Service
Government of N.W.T.
Yellowknife
Northwest Territories
Canada, X1A 2L9

Dr. Ian Stirling
Canadian Wildlife Service
5320 122nd Street
Edmonton
Alberta
Canada, T6H 355

Mr. Hans Støen
Ministry of Environment
Myntgt 2
Oslo - Dep
Oslo
Norway

Dr. Savva M. Uspenski
Central Laboratory on Nature Conservation
Ministry of Agriculture of USSR
Estate Znamenskoye - Sadki
142790 PO Vilar
Moscow Region
USSR

Dr. Chr. Vibe
Zoological Museum
Universitetsparken 15
2100 Copenhagen
Denmark

By Invitation:

Dr. Chas Jonkel
School of Forestry
University of Montana
Missoula, Montana 59801
USA

Dr. Nils A. Øritsland
Institute of Zoophysiology
University of Oslo
P.O. Box 1051
Blindern
Oslo
Norway

Miss L. de Bonneval
French MAB Committee
La Minière
78280 Guyancourt
France

Miss M.A.G. Warland
Environmental Data Services Ltd
14 Great Smith Street
London, S.W.1.
England

SUMMARY OF THE MEETING

1. Introductory remarks

Mr. N.O. Christensen, Director of the Arktisk Institut, welcomed Group members to the Institute and outlined the functions of this independent information centre. The Chairman of the Group, Dr. Christian Vibe, added his welcome and reminded the Group of their responsibilities. He then handed over to Dr. John Tenner, who, by previous agreement amongst Group members, had been requested to chair the meeting as usual. He read a telegram of greeting from the Director General of IUCN, Dr. David Munro.

2. Election of rapporteurs and resolutions committee

In the absence of secretarial assistance from IUCN, Moira Warland was elected rapporteuse with technical help from individual members where necessary. Thor Larsen, Ian Stirling and Savva Uspenski were appointed to a Resolutions Committee with the assistance of Laurence de Bonneval.

3. Matters arising from the Sixth Meeting

Recognising the financial and editorial problems attending the production of Proceedings for the above meeting, the Group nevertheless registered their concern that the finalized Minutes were not available for perusal at this meeting. IUCN had accepted responsibility to act as Secretariat for the Group; this responsibility was now even greater since the Oslo Convention had appointed the Polar Bear Group as scientific advisors to the 5 nations which had signed the Convention (see Annex D to the Summary Record of the Conference to Prepare an Agreement on the Conservation of the Polar Bear).

4. Conservation Progress Reports by Countries 1976-1978

CANADA:

A. Protected areas. Dr. Stirling referred to the one National Park in the Canadian High Arctic within polar bear range; this is situated on the southern tip of Baffin Island and native hunting is allowed. National Parks with maritime borders have been proposed at Wager Bay, northern Yukon, Ellesmere Island, Banks Island and Bathurst Inlet. All these existing and proposed parks are terrestrial only and stop at the edge of the sea. A three mile offshore extension has been proposed for the Yukon park. Four areas, with maritime portions, have been proposed for special consideration, either as parks or ecological reserves in Lancaster Sound. These sites are generally in the areas of SW Devon Island, SE Devon Island, Prince Leopold Island, and Bylot Island. The maritime boundaries proposed were based on the earlier suggestions for IBP sites in the area.

Ontario has a Provincial Park called Polar Bear Park. In 1978, Manitoba established a 6500 square mile Wildlife Management Area which includes the denning area and the staging sites used by polar bears along the coast in the fall. Neither area has a maritime component.

B. Protective measures. These remained substantially unchanged since the 1976 meeting and are summarized in Paper 1.

Dr. Schweinsburg, from the Northwest Territories Wildlife Service, described the substantial increase in quotas planned in some of the Management Zones into which the NWT is divided. These are also described in the paper and amount to a total of 64 extra bears (present quota is 530). These excess bears will be marked with a red tag, after the regular quota has been filled. This higher quota is conditional on a 100% return of

mandibles to enable a more accurate population estimate to be made and for assessing the effects of the higher quota on total mortality. Presently, natural mortality is estimated to be 2-3 times higher than the native kill and it is hoped that hunting mortality will replace natural mortality, rather than add to it. Dr. Nils Øritsland suggested that female reproductive organs should also be returned to assess the effects of hunting mortality on age of maturity.

During discussion, it emerged that population estimates for the management zones in question, based on capture/recapture data, were:

Zone	H	1200-1800
	F	1700
	E	1100 (minimum)

DENMARK:

A. Protected areas. Dr. Vibe outlined the protective measures applying in the NE Greenland National Park, established since 1973. People from neighbouring settlements are allowed to hunt only as far as a sledge can travel in one day. The Danish Sledge Patrol create a problem in wishing to hunt themselves. It is the intention to establish a zone around such stations, with specific rules.

Part of Melville Bay, in NW Greenland, is proposed as a reserve area where hunting and all movement would be totally prohibited. This had been requested by the inhabitants of the Thule area in view of the gradual northward extension of hunting activities by people in Upernavik. However, this had still not been approved by the Minister for Greenland and was now pending self-government.

B. Protective measures. All identified denning areas in Greenland now receive protection up to 12 miles out to sea and all cubs up to 1 year, together with their mothers, are wholly protected. All bears are totally protected in the two summer months (June and July). Any further protection, Dr. Vibe felt, would meet local resistance. In discussion, however, it was felt that hunting in Greenland should be made conditional upon the return of skull a.o. material.

NORWAY:

A. Protected areas. Mr. Støen mentioned that Svalbard still possessed three national parks (including 4 miles of territorial waters) and 2 small reserves to protect denning areas of polar bears, where no tourism was allowed. He outlined the provisions of the Svalbard Treaty[1] whereby full sovereignty had been vested in Norway since 1925. Other contracting parties have been given equal rights for hunting, fishing and mineral exploitation, but responsibility for wildlife protection was Norway's alone.

For this reason, other parties to the Svalbard Treaty, which were active in the area, were requested to cooperate with Norway in enforcing her national regulations relating to nature conservation, which have been passed to fulfil their obligations under the Svalbard Treaty.

Since the last meeting, 100 claims to mineral rights had expired, thereby enlarging the protected areas, and interest was fading in oil and gas exploitation, which had failed to realise much potential.

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1. Treaty regulating the Status of Spitzbergen (or Svalbard) and conferring Sovereignty on Norway, 9 February 1920. In force 14 August 1925.

B. Protective measures. New hunting regulations were issued in 1978 (these were circulated to participants). They replace the decree of 26 June 1970, concerning polar bear hunting, and 3 other decrees. Total protection for the bear continues for the time being. About 4-5 bears are killed per annum on Svalbard in self-defence.

USSR:

A. Protected areas. Dr. Uspenski indicated that Wrangel continued to be totally protected as Government or National Parks (zapovednik). Dr. Uspenski mentioned the particular interest of the Laptev Sea. This is dealt with in more detail under item 9.

B. Protective measures. Hunting polar bears is still prohibited, with permits for limited capture of live cubs for zoos and other special cases.

Dr. Uspenski proposed the Group should resolve that more attention be given to habitat protection for Arctic animals, not only in terrestrial areas but also in the Arctic Seas and open water areas. This was referred to the Resolutions Committee (see Resolution no. 2).

During discussion of this suggestion, it was felt that legal problems in extending territorial waters might be too great, even though in some countries, such as the USA, the 200 mile zone applied to conservation as well as economic measures (e.g. the Marine Mammal Act). Furthermore, since terrestrial and marine ecosystems differed so greatly it would be advantageous for such a resolution to concentrate on the marine environment, which was of great relevance to polar bear ecology.

USA:

A. Protected areas. Mr. Lentfer pointed out areas of concern in Alaska, where oil and gas development were occurring or might occur in the future. The Arctic Wildlife Range in the northeast corner of Alaska, where hunting is in fact allowed, is especially important because of the potential for development along much of Alaska's north coast. The Beaufort Sea outer continental shelf and the coastal plain from northwest Alaska to the Canadian border have high potential for oil and gas, and the coastal plain has extensive coal deposits. Extraction is or will be a major goal on State lands, Native lands, and on the National Petroleum Reserve - Alaska, and the Beaufort Sea outer continental shelf. There are also proposals to explore for oil and gas within the Arctic Range. Arctic Range jurisdiction extends seaward to a series of barrier islands which are about 3 miles offshore.

B. Protective measures. The polar bear is included in the Marine Mammal Protection Act of 1972 which transferred management authority from the State to the Federal government. Sport hunting was stopped but Native hunting, which was formerly restricted, is now permitted without restriction. Alaska's request for return of management is under review, but return is clouded by litigation which may result in a decision that Native take cannot be regulated by either the State or Federal government unless a marine mammal species is declared depleted.

If management is returned to the State, it would be directed toward maintenance of optimum sustainable population as required by the Marine Mammal Act. The basis would be a minimum population estimate from which a certain percent would be allowed for

harvest. The maximum annual quota would be 170 bears; no hunting would be allowed in the fall when bears were coming ashore to den; and cubs to 28 months of age and their mothers would be protected With these restrictions and Oslo Agreement restrictions against use of aircraft and large boats, it is quite likely that the annual kill will be well below 170.

5. Research Progress Reports by Countries 1976-1978

CANADA: Research on polar bears in Canada 1976-78 is described in Paper 2. Main topics can be summarized as follows:

i. population ecology of polar bears in the High Arctic and Foxe Basin (population size, discreteness of sub-populations, seasonal movements, denning areas, age and sex structures);

ii. monitoring of bear and seal numbers;

iii. behavioural studies at Cape Churchill, Manitoba, and SW Devon Island, NWT;

iv productivity studies in northern Ontario;

v. deterrent studies in the Northwest Territories (see also section 7);

vi. ecological inter-relationships between polar bears, seals and sea ice.

Future research will concentrate on:

i. satellite-tracking;

ii. a comparison of remote sensing and photographic techniques for estimating population sizes;

iii. the role of adult males in limiting populations;

iv. behaviour of harnessed compared with unharnessed bears in radio-tracking studies;

v. cooperative work with the USA.

During discussion, Dr. Schweinsburg estimated that a 5-10% interchange of animals occurred between discrete sub-populations in the Low Arctic Islands. This interchange appeared to involve mostly females under 3 years. He hoped that Danish University of Montana work would be continuing in Baffin Bay/Melville Bay, in view of the tagging programme on Baffin Island. Dr. Vibe assured him that, where possible, tags from shot bears in this area would be returned to him.

DENMARK: The results of the 1977 joint Norwegian/American/Danish polar bear survey of drift ice north of Svalbard and between Svalbard and NE Greenland are given in Paper 3. The survey was undertaken as the first stage in a study to ascertain the provenance of large numbers of bears in SE Greenland which do not appear to come from the land mass to the north, and to explore the possibility of polar bears living and breeding on the polar pack ice.

In Spring 1978, Dr. Vibe and Dr. Jonkel conducted a joint tagging programme in NW Greenland and Melville Bay, when 7 bears were tagged after 13 had been killed by Eskimos that season. A further 7 have since been shot but none with tags, which may indicate a higher bear population in this area than was hitherto suspected.

Considerable discussion followed Dr. Vibe's conclusions from his 1977 work. It was felt that his hypothesis that SE Greenland bears originated in the polar basin, following the drift ice with the East Greenland current, was premature. No intensive den surveys had been conducted in NE Greenland and some migration between discrete populations and sub-populations was known to occur. Drift ice played an important part in such

interchanges. However, Dr. Vibe believed there was a radical difference in behaviour in drift ice bears, which showed no fear of man, and onshore bears, which did. This, Dr. Vibe felt, was a further indication of a different origin.

Clearly, further work on this subject was required, including perhaps craniometric and bone tissue analysis of skulls from NW, NE and SE Greenland. Methods to investigate further population discreteness, particularly by international cooperation, were considered by the Group to have top priority in their work.

Future work. Dr. Vibe will participate in the Fram 1 expedition, another joint Danish/American/Norwegian venture, primarily to undertake geological, geophysical and hydrological studies on an ice-floe drifting down the E Greenland coast.

It is intended that the second stage of the project referred to above will be undertaken, whereby bears will be captured, marked and some fitted with transmitter harnesses. It was hoped that 50 bears would be caught in order to provide a sample size large enough for recoveries in SE Greenland to be significant and a conclusion to be made to Dr. Vibe's hypothesis. However, Dr. De Master held that, if bears were, in fact, moving in separate directions, this would only show up in a large sample size; in which case it would not be correct to conclude that a 5 in 50 recovery rate indicated all bears moved down to SE Greenland.

NORWAY: Severe limitations of funds and manpower have restricted Norwegian work mainly to biennial den surveys on Kong Karls Land and Nordauslandet. In 1977, an absolute increase in maternity dens was found.

A ship survey of the Barents Sea, between Svalbard and Franz Josef Land, was undertaken in 1977 to determine bear densities and populations. Fourteen bears were marked and no changes in distribution and abundance were apparent.

In 1978, a spring denning survey on Nordauslandet was undertaken as well as a behavioural study of females leaving dens on Kong Karls Land. A preliminary report is given in Paper 4. Future work will involve participation in the Fram 1 expedition and joint work with Sweden in 1980 in which an ice-breaker (the Ymer) will sail the Barents Sea as far as Franz Josef Land. Mr. Larsen sought the cooperation of the USSR in carrying out polar bear studies on land at the same time as the drift ice studies were being made. USSR drift ice stations have, in the past, recorded bear observations, which were published some years ago by Dr. Uspenski. Young and adult bears have been seen close to the North Pole, with greatest numbers being met in the Barents and Chukchi Seas, in areas with open water. USSR: Polar bear research in the USSR in 1977 and 1978 is described in Paper 5 and much of Dr. Uspenski's and other scientists' work on Wrangel Island has been fully written up (with English summaries) in a booklet handed out at the meeting: "The Polar Bear and its Conservation in the Soviet Arctic" published by the Central Laboratory on Nature Conservation, 1977. Dr. Stirling was having some chapters translated and could make these available to other Group members on request. The booklet also describes craniometric work on several hundred polar bear skulls found in middens from historic ritual killings on the Yamal Peninsula of W Siberia.

Population structure of polar bears within the USSR is still not yet clear; however, trace element analysis of cranial tissues from museum specimens has suggested the presence of three distinct taxonomic groups:

(1) E Siberian coast and sea;

(2) Taimyr Peninsula and Laptev Sea;

(3) Kara Sea and Novaya Zemlya (including Franz Josef Land)

Dr. Uspenski felt it would be interesting to use the same analytical method (fluorescent X-ray spectrophotometry on bone tissue from the zygomatic arch) for skulls from other parts of the Arctic, in particular Greenland and the Hudson Bay area. Considerable interest was shown in the method during discussion and Dr. Uspenski agreed to send a method-description to Drs. Schweinsburg, Vibe, Larsen and others who would wish to use it. In return, these scientists were to send him samples of skull tissue from museum specimens for analysis in the USSR for comparative purposes (see also Resolution no. 3).

Future work. Work on Wrangel Island is to begin again this season after a 2-year break during which the National Park was established. Bears will be captured and marked with plastic ear-tags and behavioural studies will be made of certain denning females. Because tagging is carried out in the den itself, the exact birth-location of tagged cubs is known. Dr. Uspenski felt he would now be in a position to know, after a 7-year tagging programme, whether female bears return to their birth location to give birth themselves. Some Group members felt, however, that plastic ear-tags were too easily lost over such a time-period and that lip-tattooing would give longer-term identity.

Some preliminary den counts will be made in 1980 in Franz Josef Land, in particular on Alexandra and George Islands, and mothers of cubs taken for zoos will be tagged.

USA: Main thrusts of polar bear research in Alaska in 1977-78 are summarized in Paper 6. These were:

(1) Denning studies on and off the Alaskan coastline (Lentfer and Hensel, in press)[1]. These indicated that dens were most abundant between the Colville River eastwards to the Canadian border.

(2) Analysis of capture/recapture data between 1967-76 (Lentfer et al., in press)[2]. Over 800 bears have now been marked with 200-250 recoveries. Data from these recoveries and the construction of life-tables have given estimates of fecundity and minimum survival rates required to maintain population size.

(3) Satellite-tracking of polar bears (Lentfer, Fallek and Kolz)[3]. Preliminary equipment testing on captive polar bears began in 1976 using the NASA Nimbus 6 satellite. Three free-roaming bears were fitted with satellite transmitters and tracked for 8, 20, and 390 days while travelling airline distances of 330, 500, and 1300+ kilometers from release sites. The short-term movements were in the Alaska sector and the long movement was to the west off the east Siberia coast.

Future work. Further satellite-tracking from Nimbus 6 has been accepted by NASA.

Dr. De Master described an integrated research project that will be initiated in February this year to investigate polar bear movements, distribution and abundance. The programme re-analyses existing mark-recapture data and employs radio telemetry

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1. Lentfer, Jack W. & Hensel, R.J. 1978. Alaskan polar bear denning. In press.
2. Lentfer, Jack W., Hensel, R.J., Gilbert, J.R. & Sorensen, F.E. 1978. Population characteristics of Alaskan polar bears. In press.
3. Lentfer, Jack W., Fallek, H.G. & Kolz, A.L. 1977. Satellite radiotracking of polar bears. Paper presented at Argos satellite meeting, Paris, 2 & 3 November 1977.

to investigate daily and seasonal movements. Physical and trophic relationships will be examined in order to build up a "total ecosystem" picture. The study will be concentrated in the Alaskan offshore areas near Oliktok and Barter Islands.

6. Satellite-tracking

In the discussion on this item, it was agreed that Dr. De Master would act as the Group's coordinator for approaches to NASA for use of satellite time on Nimbus 6 and Tyrus. He undertook to add the names of some members to the mailing list for the NASA "Satellite Data Users Bulletin". Although Mr. Lentfer had had talks in France over the use of their Argos satellite, which would enable much smaller collar-components to be used, it was felt that use of this system by the Group was premature.

Dr. Øritsland stressed that it was essential to include physiological parameters in satellite-tracking experiments in order to understand activity patterns (whether through human disturbance or other causal agencies). Dr. De Master pointed out that new risks and high costs would be involved in developing a new technology, but the Group felt that the proposal should be explored and Dr. Øritsland and Dr. De Master were asked to do so.

Dr. De Master also mentioned that Handar, the commercial supplier of the electronic transmitters, required firm commitments by October 1st from scientists wishing to use the equipment.

7. Other Research Programmes

A. Dr. Øritsland

a) Polar Bear Ecophysiology: A publication under this title was given to members of the Group. It brings together most of the work that has been carried out on this subject between 1972-77[1]

1. Øritsland, N.A. Ronald, K. & Jonkel, C. (1978) Polar Bear Ecophysiology 1972-77. College of Biological Science, University of Guelph, Ontario.

Since the 1976 meeting, physiological work, funded mainly by WWF Canada and the US National Science Foundation, has included:

- physiological monitoring of radio-marked polar bears in dens;
- laboratory studies of physiological parameters in polar bears;
- hibernation studies on polar bears in experimental dens;
- designs for similar studies on free-ranging bears;
- development of thermoregulatory models on harp seal pups[1] (for later application to polar bears);

b) System modelling: A total inter-species energy flow model for Arctic communities is being developed by Dr. Øritsland[2] and in the United States (Dr. De Master).

c) Remote sensing: Dr. Øritsland mentioned that IBM was developing a system (ERMAN) for visual and numerical evaluation of LANDSAT data. This was particularly valuable for the identification of den sites and for survey work on open ice.

d) Future priorities:

- in-den physiological studies;
- oxygen-consumption in exercising polar bears;
- development of long-range physiological monitoring by radio-telemetry;
- mathematical modelling;
- temperature and toxicity effects of crude oil on polar bears (see section 8b).

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1. Acta Phys. Scand. 103 (3): 263-269.
2. Norsk Polarinst. Aarbok 1976: 235-242.

B. Dr. Jonkel. Summarized work that was being carried out by his students in the High Arctic and the Churchill area of Hudson Bay. This was as follows:

- the effects of deterrents and attractants on polar bear behaviour and physiology (Papers 7 and 8);
- the status of the Kane Basin polar bears;
- the fidelity of pregnant females to certain denning areas on Hudson Bay;
- biochemical analyses of polar bear blood and expired gases during certain physiological states;
- modelling from black bear and polar bear hibernation studies.

Considerable discussion took place on a project[1] submitted by a student from the University of Montana to the World Wildlife Fund. The Group decided it could not support this project for funding from this source.

8. Polar Bear Public Relations

Two issues were raised under this subject:

(a) education and behaviour during polar bear encounters;

(b) public explanation of research activities which may harm the bear or its pelt.

(a) Polar bear encounters: Norway has produced a poster, in English and Norwegian, with the slogan "It attacks without warning. Keep your Distance". It explains how to recognize polar bear reactions and how to behave during encounters.

Alaska has problems with bear/man encounters involving DEW-line and seismic crews and US information campaigns are aimed particularly at these. In Greenland weather-station crews are allowed to shoot nuisance bears, but the skins must be sent to the Government.

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1. Environmental Factors affecting High Arctic Sea Ice Habitat of Polar Bears.

The Northwest Territories of Canada are conducting studies on detection and deterrent systems round camps, and tests are being carried out on various deterrent chemicals for personal safety out-of-doors (see Paper 2 and also Paper 7). A similar deterrent/detection system has been developed by Norway, using flares and electric wires, which appears to scare off 90% of bears.

Figures for accidents involving polar bears are:

3 persons killed) 3-4 mauled)	in NWT since 1970
4 killed) 1 mauled)	in USSR in last 3 years
1 killed) 2 mauled)	in Svalbard in last 2 years

Dr. Vibe made the point that rogue bears should be killed, since their loss will not much affect overall population levels, but will prevent adverse public opinion.

(b) Polar bears in research: Considerable discussion revolved around the controversial question of humanitarian problems in polar bear research activities. Polar bear scientists were increasingly beset by adverse publicity on this issue, which was certainly not confined to polar bear work. Because this was a recurring problem, which would and already did rebound on IUCN and WWF, and because it was felt that an informed public was a more understanding public, the Group decided that IUCN should be requested to produce a policy statement on the occasional need to cause discomfort or death in conservation-oriented research.

In this connection, Dr. Schweinsburg summarized the difficulties encountered by a project, to have been funded jointly by the oil industry and the Canadian Department of Indian and Northern Affairs and subcontracted to Dr. Nils Øritsland, on the temperature and toxicological effects of crude oil on polar bears. In view of

the total lack of knowledge on these subjects, the increased likelihood of oil spills and blowouts in arctic marine areas, and hence the need to prepare contingency plans, and in view of adverse effects on other Arctic mammals, the Group decided:

1. that a resolution should be drafted to examine the immediate and long-term effects of oil on polar bears (see Resolution no. 1);
2. that a letter should be directed to the Eastern Arctic Marine Environmental Survey (EAMES) management committee indicating the Group's unanimous support for the project (see Annex 1).

9. Polynias and other Marine Habitats in the Arctic

Dr. Vibe enumerated the known polynias in the Arctic areas of Greenland, Svalbard and Siberia, and stressed that considerable research was still required to elucidate their importance to sea mammals. It was now known that these openings in the sea-ice are not necessarily permanent.

The most important polynias appear to be located:

- in the Laptev Sea;
- off the coast of Siberia (the Great Siberian polynia);
- off Central East Greenland (that off NE Greenland is now closed);
- off NW Greenland (North Water);
- along the edge of the High Arctic islands of Canada;
- in the Hudson Bay and many smaller areas within the Arctic Islands;
- NE from Point Barrow, Alaska;
- at the NE edge of Alaska.

Dr. Stirling pointed out that colonies of nesting sea-birds were an indicator of permanent polynias and that the productivity studies in such polynias might prove interesting. He will circulate copies of a general review article he is compiling on aspects of the biological significance of polynias in the Canadian Arctic.

Dr. Tener referred to an archaeological study by Dr. Sledermann of the Arctic Institute, Calgary, which showed that evidence from 5000-year old middens can give an indication of the permanence of local polynias.

Considerable interest was shown in the Laptev Sea polynia, which is isolated from the Arctic Ocean by large ice-fields, thereby creating discrete populations of narwhal, walrus and sea-birds. It is also, together with the East Siberian Sea, a winter gathering area for polar bears. Dr. Uspenski agreed to send Dr. Vibe records of sea-birds in this area, whilst Dr. Vibe was to send him old records of sea-ice movement off NE Greenland.

Mr. Larsen, in commenting on the movements of polar bears with the sea-ice north of the Siberian Islands, asserted that this was an area low in productivity and it was therefore not possible for animals to move across it.

Dr. Uspenski again raised the question of greater protection for Arctic marine habitats. This would serve to reinforce Article II of the Oslo Agreement, which was considered necessary in view of increasing concern over contamination of Arctic drift ice, pollution by oil spills and by the outflow of large rivers into the Arctic Ocean. The Group noted that the IUCN/WWF "The Seas Must Live" programme gave little attention to the Arctic, despite accelerating development in this area. It was agreed that a resolution should be drafted on the importance of certain areas in the polar basin (see Resolution no. 2).

Mr. Larsen emphasised the importance of studies in the eastern Arctic into polar bear populations and movement. This was likely to be an area of population interchange between Svalbard and Franz Josef Land and, as such, studies here were vital to the Group's work. A proposal for a resolution on this subject was referred to the Resolutions Committee but was subsequently rejected by them.

10. Publications

(a) Polar Bear Group History: Moira Warland outlined the contents of the first draft which was nearing completion. This would be circulated to Group Members with individual requests for information to fill in the details of their annual research programmes, where this was needed.

(b) Popular book on field research: Mr. Larsen had earlier distributed copies of his book "The World of the Polar Bear" recently published by Hamlyns in a number of countries. This was one of a number of books that were due to be published on the polar bear. Nonetheless, the Group decided that a book on their own experiences during polar bear field research could be valuable and Dr. Vibe was asked to continue his negotiations with a Danish publisher. However, Mr. Larsen stressed that a contract should be signed before the co-editors, Mlle . de Bonneval and Miss Warland, began work. Failing this, Miss Warland agreed to approach potential publishers in England.

11. Polar Bear Agreement, Oslo 1973

Mr. Støen, on behalf of the Norwegian Government, asked the Group whether it would be useful to hold a meeting in 1980 to review this Agreement. This was shortly before Governments, under the terms of the Agreement, were able to withdraw if they wished to do so. The Group felt such a meeting could be useful and that it might include other matters relating to the Arctic environment, in particular the management and protection of Arctic marine ecosystems. Accordingly, a letter was drafted to IUCN requesting it to convey these considerations to the Government of Norway (see Annex 2).

12. Future Activities

These have been dealt with in some detail under the country and specialist reports. The Government of USSR had requested the inclusion of Dr. S.E. Belikov in the Group, as their second representative. This was unanimously agreed.

Dr. Jonkel drew attention to the existence of the Bear Biology Association (BBA) in the USA which operated through a network of working groups. It was felt by the Group that the BBA newsletter could be used for polar bear communications, in default of an SSC-produced newsletter.

The next meeting of the Group was fixed provisionally for December 1980, either in Morges or in Oslo, if a meeting was to be convened on the Agreement at that time. The February 1980 meeting of the Bear Biology Association was probably too early. A final decision rested with the new Chairman.

13. Election of Chairman

Dr. Savva Uspenski was unanimously elected as Chairman of the IUCN Polar Bear Specialist Group 1979-81.

14. Other Business

Mr. Larsen mentioned that a world bear bibliography was being prepared by Dr. Fred Dean of the Cooperative Wildlife Research Unit, University of Alaska, and IUCN/WWF funding would be sought.

Dr. De Master drew attention to a movie being prepared by David De Vries of the Public Broadcasting Service of the USA, which might involve Group members.

Dr. Vibe was warmly thanked for organizing a very successful meeting; Laurence de Bonneval and Moira Warland were also thanked for their assistance during the meeting (see Resolution no. 4). Dr. Uspenski proposed a vote of especial thanks to Dr. Tener for his fine work in conducting the meeting, which closed at 4.50 pm on the third day.

RESOLUTIONS

Resolution 1: Research on the effects of oil on polar bears

The IUCN Polar Bear Specialist Group,

recognizing that it is widely perceived by the general public that oil spills or blowouts will occur in Arctic marine areas as a result of offshore petroleum development and that these may have detrimental effects on wildlife in Arctic marine ecosystems;

recognizing that while no data exist for polar bears but that the results of studies on other species suggest the concern is valid;

recognizing that it is now important to assess what the impact of oil on polar bears will be, in order to develop contingency plans to cope with the problems that blowouts or spills may cause to wild populations,

therefore recommends that research be undertaken to examine the immediate and long-range effects of oil on polar bears.

Resolution 2: Protection of areas significant to polar bear survival

The IUCN Polar Bear Specialist Group,

noting that Article II of the Agreement on the Conservation of Polar Bears states in part that, "Each Contracting Party shall take appropriate action to protect the ecosystems of which polar bears are a part, with special attention to habitat components such as denning and feeding sites and migration patterns";

noting that there are several areas in the polar basin, such as polynias in particular, which are of great importance to the continuing survival of viable populations of polar bears and of their prey species;

noting that, to date, no national or international initiatives have been made in the polar basin to conserve or protect these areas,

requests that IUCN urge the polar nations to consider appropriate measures to ensure adequate protection of these biologically important areas.

Resolution 3: Development of new research techniques

The IUCN Polar Bear Specialist Group,

noting that sound management of polar bears requires identification of discrete sub-populations;

noting that the results of studies conducted to date on variations in skeletal morphology, heavy metals, and the movements of tagged bears have indicated the existence of several different discrete sub-populations;

calls attention to the fact that recent studies in the USSR on analyses of trace elements on bone tissue have given promising results in terms of the identification of sub-populations, and

therefore recommends that new techniques continue to be developed as required and with international cooperation.

Resolution 4: Votes of thanks

The IUCN Polar Bear Specialist Group,

noting the fine organization, warm hospitality, and excellent facilities that were so carefully prepared for their Seventh meeting in Copenhagen, and which resulted in the success of the meeting,

therefore, wish to thank Dr. Vibe most sincerely for his excellent efforts in organizing this meeting; Dr. Tener for chairing it so skilfully and sympathetically and Mlle. de Bonneval and Miss Warland for their work on the Group's behalf; and

furthermore, wish to thank Mr. N.O. Christensen, Director of the Artisk Institut Denmark, in Copenhagen, for his warm welcome and for making his facilities available for hosting their meeting.

POLAR BEAR MANAGEMENT CHANGES IN CANADA 1976-78

Ian Stirling and Pauline Smith
Canadian Wildlife Service

Since the December 1976 meeting of the IUCN Polar Bear Specialists Group, there have been several changes in the management of polar bears in Canada. The regulations covering polar bear management in Canada as of 31 December 1978 are summarized in Table 1. Changes made prior to 30 November 1976 are outlined in management reports prepared for previous IUCN meetings.

The Federal-Provincial Technical and Administrative Committees for Polar Bear Research and Management, representing the four provinces (Manitoba, Newfoundland, Ontario and Quebec) and the two territories (Northwest Territories and the Yukon Territory) and the Federal Government continued to meet annually to discuss research results and to make management recommendations. Research programs arising from these meetings are outlined by Stirling *et al.* in these proceedings.

The polar bear quotas by jurisdiction are based on recommendations by the Federal-Provincial Committees. The numbers of polar bears killed or captured from 1975-76 to 1977-78 are summarized and recommended quotas for 1978-79 are also given (Table 2). Figure 1 shows the boundaries of the present management zones in Canada.

Northwest Territories

Several increases in quotas were made in the NWT during the past two years. In November 1976, the 1976-77 quotas for three Baffin Island settlements were increased by a total of 15 bears:

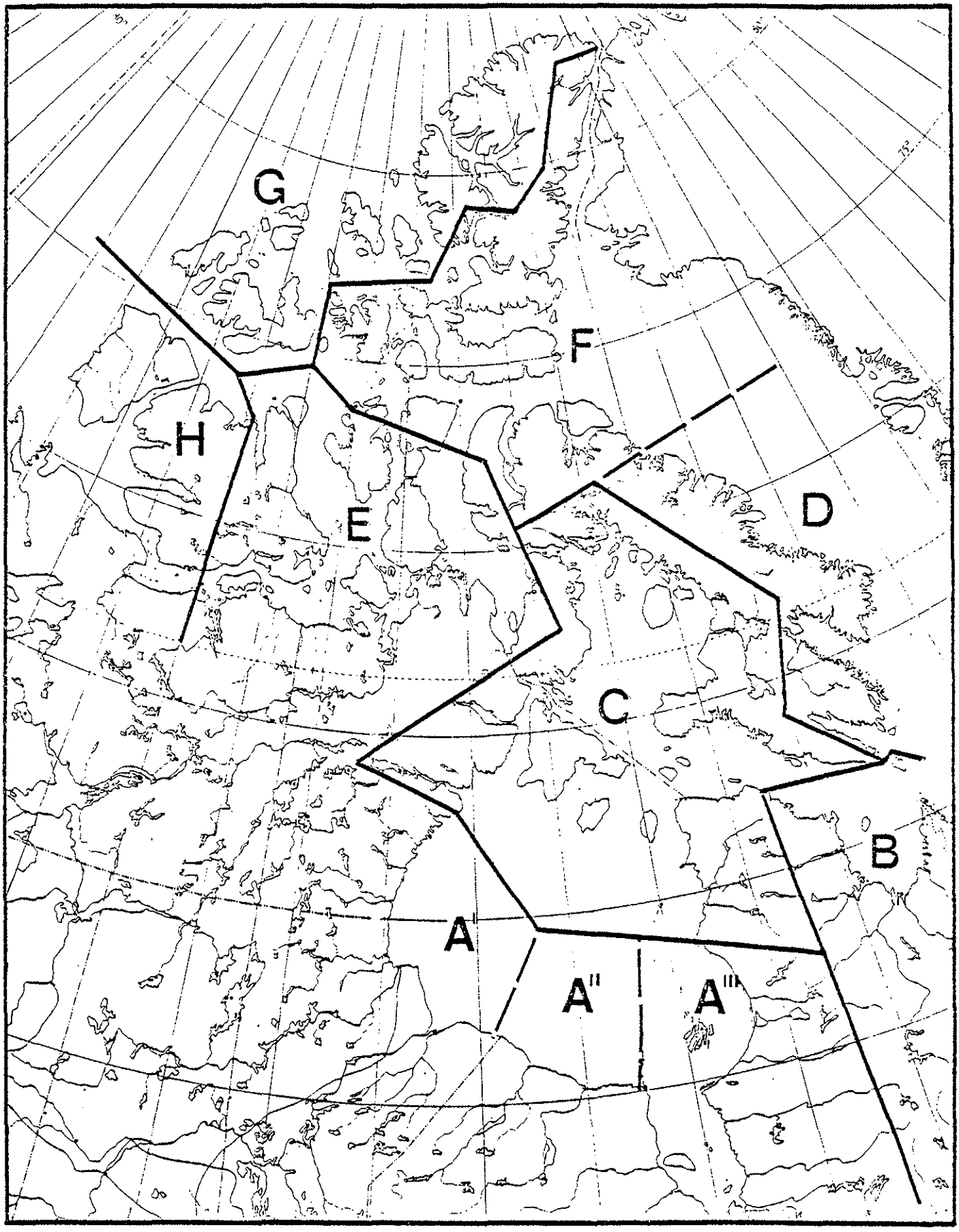

Fig. 1. Current polar bear management zones established by the Federal-Provincial Polar Bear Technical Committee.

Table 1. Summary of regulations covering polar bear management in Canada as of 31 December 1978.

Category	Jurisdiction					
	MANITOBA	NFLD.	N.W.T.	ONTARIO	QUEBEC	YUKON
Hunting season	-closed	-none at present -reopening under consideration for 1979 or later	-1 Oct. to 31 May except 1 Dec. to 31 May in Game Management Zones 24 and that portion of Zone 25 lying west of 127°W	-none	-1 Oct. to 31 May	-1 Oct. to 31 May
Who can hunt	-natives of coastal region for own use, but sale of hide prohibited	-residents only	-native Inuit -resident with licence or non-residents with special licence	-protection only -permissible kill by native Indians -need a licence	-Inuit and Indians	-Inuit only by special permit
Quota	-maximum of 35 annually (not exercised at present)	-4 possible but not yet allocated	-quota by settlement -1978-79 limit equals 530	-permissible kill of 30 (by restricting sales over 30)	-quota by zone -total quota equals 46	-total quota equals 6
Females and cubs protected	-no	-yes	-cubs and females with cubs under 1.37 m in length, prior to being stretched and dried or 1.68 m after being stretched and dried	-no	-yes	-yes

Table 1. Continued.

Category	Jurisdiction					
	MANITOBA	NFLD.	N.W.T.	ONTARIO	QUEBEC	YUKON
Bears in dens	-no	-yes	-yes	-no, but dens are	-yes	-no
Proof of origin of untanned bear	-seal proposed	-verbal proof (no seal implemented to date)	-seal on hide and export permit if origin outside or if leaving NWT	-seal on hide -proof of origin required on imported hides	-seal on hide	-seal on hide -kill monitored by export permit
Export permit required and cost(out of province or territory of origin)	-nil	-required -$5.00	-required -$1.00	-required -no cost	-required -no cost	-required -$5.00
Export permit out of Canada	-required for all polar bears or parts thereof exported out of Canada -obtained from Province or Territory in which port of export					
Scientific Licences	-discretion of Minister	-discretion of minister	-discretion of Superintendent of Fish and Wildlife Service	-discretion of deputy	-discretion of Minister	-discretion of Director

Table 1. Continued.

Category	Jurisdiction					
	MANITOBA	NFLD.	N.W.T.	ONTARIO	QUEBEC	YUKON
Selling of hide by hunter	-prohibited -skins of nuisance bears sold by Manitoba Gov't. through sealed tender	-allowed if legally obtained	-yes -must be sealed	-must be sealed by Dept. staff	-$5.00 Royalty fee -must be sealed	-permit required from Director of Wildlife
Basis Regulation	-Wildlife Act 1970	-Wildlife Act 1971 -classified as big game	-Game Ordinance amendments 1970, 72,75. 1960 Order-in-Council (Endangered Species)	-Fish and Game Act 1970	-Wildlife Conservation Act 1969 -Order-in-Council 2401-75	-Game ordinance 1958 as amended
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 & Trafficking Licence $10.00	-Fish and Game Act -Licence $10.00	-$50.00 licence (one location) -$100.00 licence (ambulent)	-Game ordinance Resident - $25.00 Non-resident -$30.00
Taxidermy	-Wildlife Act licence $5.00	-legislation in preparation legal if obtained legally elsewhere	-nil	-Fish and Game Act		-Game Ordinance

Table 1. Continued.

Category	Jurisdiction					
	MANITOBA	NFLD.	N.W.T.	ONTARIO	QUEBEC	YUKON
Tanner's authority	-licence $10.00	-no legislation at present	-nil	-Fish and Game Act (fee currently under review)	-$50.00 tanner's licence	-nil
Live Animals Capture	-Ministerial permit	-illegal unless authorized by permit from Minister for scientific purposes	-scientific licence and/ or permit to export live big game	-Ministerial authority	-Ministerial permit	-Scientific licence
Export	-Ministerial	-illegal	-special permit	-Ministerial authority	-Ministerial permit	-Special permit

Table 2. Quotas and known numbers of polar bears killed or captured in Canada, 1975-78

	Jurisdiction							
	NWT	Ontario	Manitoba	Newfoundland	Quebec	Yukon	Norway	Total
1975-76[1]								
Suggested quota	501[a]	30[+]	35	0	42[b]	6	5[*]	619
No. bears killed	519[a]	15	9	0	37[b]	2	0	582
No. bears captured	0	2	2	0	3	0	0	7
1976-77[1]								
Suggested quota	516[c]	30[+]	35	0	42[b]	6	5[*]	634
No. bears killed	479[c]	33	29	0	45[b]	0		586
No. bears captured	0	0	0	0	0	0	0	0
1977-78[1]								
Suggested quota	530[d]	30[+]	35	0	42	6	5[*]	648
No. bears killed	503[d]	14	15	0	25	0		557
No. bears captured	0	0	0	0	0	0	0	0
1978-79[1]								
Suggested quota	522[e]	30[+]	35	4	46	6	5[*]	648

[1] Management year extends from 1 July to 30 June the following year
[+] Permissible kill
[*] Allowed to Norway for protection of life under the Agreement on the Conservation of Polar Bears (1973)
[a] Includes 31 problem bears, killed in self-defence, or from drug-overdoses
[b] Includes 1 bear killed from drug-overdose
[c] Includes 6 bears killed from drug-overdoses
[d] Includes 14 problem bears, killed in self-defence, or from drug overdoses
[e] Quota as of 31 December 1978; not included in this total but to become effective later in 1978-79 hunting season: Regular quota increases of 7 bears
Special quota increases of 64 bears.

Zone C: Cape Dorset, increase of 3, from 7 to 10

Lake Harbour, increase of 6, from 7 to 13

Zone D: Pangnirtung, increase of 6, from 8 to 14

Quota increases of a total of 14 bears for three other Baffin Island settlements came into effect on 22 December 1977 and were as follows:

Zone D: Broughton Island, increase of six, from 16 to 22. It had been intended that the additional six bears be taken south to Cape Dyer. However, the stipulation was inadvertently left out of the regulations.

Frobisher Bay, increase of six, from 12 to 18. Eight of those bears must be taken in the area north of 62°50'N and west of 65°10'W.

Zone F: Pond Inlet, increase of two, from 13 to 15.

In return for quota increases, the above settlements agreed to delay the opening of the hunting season to 1 January from 1 October in order to protect pregnant females.

Increases in the regular quotas for Repulse Bay and Clyde River have also been proposed for the 1978-79 season based upon those settlements agreeing to delay their hunting season to 1 January.

Zone C: Clyde River, increase of 3, from 42 to 45.

Zone D: Repulse Bay, increase of 4, from 16 to 20.

These increases have not yet been approved. Conservative increases in exchange for delayed seasons were approved in principle by the Polar Bear Technical Committee.

In addition to the above increases, special quotas have been proposed for Zones A'(10 bears), E (20 bears), F (14 bears) and H (20 bears), based upon studies by the Canadian Wildlife Service and the NWT Wildlife Service. In each zone, it was determined that the number of bears killed by hunters accounted for only about 1/3 to 1/2 of the total annual losses from the population. Therefore, cautious increases were proposed to the Polar Bear Technical Committee, which were designed to attempt to replace some of the natural mortality by hunting mortality without increasing the total. Since it is not empirically known how the proposed increases will affect productivity and mortality rates, safeguards accompany the proposals as follows:

1) the increase will be experimental and separate from the regular quotas;
2) these special quotas will be identified by red tags;
3) the special quota season will not start until 1 January (to protect pregnant females) and tags will not be given out until after the regular quota is filled;
4) special quotas will be accompanied by a mandatory return of the lower jaws from all bears in both the regular and special quotas to facilitate age determination for monitoring the kill;
5) any settlement that fails to hand in all the jaws will be penalized by reduction or retraction of the special quota;
6) emphasis for the special quotas will be placed on the taking of adult males. This will be encouraged through public relations programs and, if needed, through restrictions on the minimum length a hide must be to be legally sold; and,

7) no females accompanied by cubs of the year (i.e. < 137 cm long) will be legally killed on any quota.

The Zone A' special quota is likely to be incorporated in the NWT Game Regulations early in 1979. The ten bears are to be divided between the settlements in the following way:

Chesterfield Inlet	- 3 bears
Eskimo Point	- 3
Rankin Inlet	- 2
Whale Cove	- 2
Total special quota Zone A'	10

The increased quota is not expected to function to reduce any of the fall polar bear problems at Churchill, Manitoba. The proposed special quotas for the other three zones may come into effect later in the present (1978-79) hunting season.

In July 1979, it is proposed to change the NWT Game Ordinance so that the opening of the hunting season will be delayed until 1 December and that the legal hunting length of a bear will be raised from 137 cm (54 inches) to 150 cm (60 inches). Through discussions with the Hunters and Trappers Associations in each settlement, the NWT-WS is working toward the hunters' understanding and acceptance of the delayed opening of the hunting season, directing some of the hunting into areas not now being hunted, and eliminating the taking of members of family groups with cubs of any age.

Inuit-guided sport-hunt

The sport-hunt in the NWT continued in 1977 and 1978 with a limited number of hunts (Table 3). Under the 1968 NWT Game Ordinance, these Inuit-guided sport-hunts, using traditional hunting methods, have been allowed since January 1970. Tags used for the sport-hunt must be

alloted from the settlement quotas. Tags allocated to unsuccessful sport hunters cannot be used later by Inuit hunters. In 1977 and 1978, the cost per hunt from each settlement was $4,000 which did not include the hunter's travel expenses to the settlement or the cost of a licence.

Table 3. The number of polar bear sport-hunters by settlement in the NWT, 1976-78. Numbers in brackets are successful hunters.

Settlement	1976-77	1977-78
Cambridge Bay (Parry Island)	--	1 (1)
Holman Island	4 (2)	4 (3)
Paulatuk	5 (4)	5 (0)
Tuktoyaktuk (North Star Harbour)	2 (1)	1 (1)
Total	11 (7)	11 (5)

In recent years, the number of applicants for the sport-hunt has been greater than the number of tags made available by the settlements. This situation has arisen for a number of reasons. Because of the ubiquitous use of snowmobiles, there are few trained and conditioned sled dogs. According to the Canadian Declaration attached to the Agreement on the Conservation of Polar Bears (1973), dog teams are an integral part of the sport-hunt. Consequently, sport-hunts are not licenced unless suitable dogs are available in the settlements requesting the permission. The time period during which sport-hunting can be carried out is relatively short (i.e. March-April).

Cultural differences between Inuit guides and sport-hunters sometimes cause misunderstanding. Complaints about the poor quality of

accommodation and of guiding have been received from sport-hunters. A program to correct some of these problems is being planned. Many Inuit hunters are unwilling to give up their polar bear tags in exchange for the sport-hunting fee. In addition, the relatively high prices paid for polar bear hides may discourage Inuit hunters from offering a sport-hunt. During 1977-78, the known average prices obtained for Canadian polar bear hides at the auction houses increased to $907, about 48 percent above the 1976-77 average, $612 (Smith, unpublished data). For additional information on prices obtained for polar bear hides during 1975 to 1977, see Smith (1977 and 1978).

In the last two years, sport-hunters have originated from North America, western Europe, and Japan. Under a June 1977 interpretation of the Marine Mammal Protection Act of 1972, a U.S. citizen can now participate in a sport-hunt in Canada without requiring a permit from the Marine Mammal Commission. However, the attraction of the sport-hunt to U.S. citizens is probably limited since the hides still cannot be imported back into the U.S.

Ontario

Some consideration is being given to opening a season and establishing a quota for the Cree Indians so that the law would be more in line with what is actually happening. At present, the Indians can only legally kill polar bears in defence of property, life, etc. All hides taken are presently sold through the Ontario Trappers Association, in North Bay. However, there is no legal base for this,and in future, Ontario wants to leave the marketing methods open. No requirements for jaws or other specimens are being considered at the moment. Hunters are

being encouraged to take male polar bears rather than pregnant females and females with cubs, but males tend to spend less time on land in northern Ontario and are therefore not as accessible to the hunters.

Quebec

In the past, the Direction-Générale du Nouveau Québec (DGNQ) issued polar bear tags and gathered information on the kills for the Québec Wildlife Service. However, for a variety of reasons, a complete record on polar bears killed by Québec hunters has not been maintained. In future, a more direct method for issuing tags for polar bear hides is to be implemented. The number of tags will correspond to the recommended quota and will be issued directly to the local government in each community. Discussions with the James Bay Coordinating Committee are in progress, and attempts to reach an agreement between the government and the native peoples should help the hide-tagging program and information return. The problem of a suspected illicit trade in polar bear hides remains.

The quotas established for each management zone in January 1975 remain the same except for the Zone B quota which has been increased by 4 bears, from 12 to 16, for the 1978-79 hunting season. With the closing of the NWT settlement of Port Burwell, on Killinek Island, off the northern tip of the Labrador Peninsula, its quota of eight bears for 1978-79 has been divided between Quebec and Newfoundland, if those jurisdictions wish to use them.

Yukon

In the past, the six Yukon tags were issued through the NWT settlements of Aklavik and Tuktoyaktuk. In order to maintain more direct

control in the future, the tags will be issued directly from Whitehorse by the Chief Conservation Officer.

Manitoba

The Cape Churchill Wildlife Management Area, encompassing 6,500 square miles and including the polar bear denning and staging areas, was designated in 1978. This designation will offer greater protection to Manitoba's polar bear population and habitat.

The polar bear depredation control programs continued as usual in the falls of 1977 and 1978, and greater emphasis has been placed on public educational aspects.

A holding cage concept has been put forward as an alternative plan to Brian Davies' airlifting bears to Kaska and the Seal River. Although construction had commenced as a part of a winter works project, progress was halted when funds were frozen. To date, there has been no evidence to suggest that holding of polar bears for varying periods of time has had any adverse effects on the health or subsequent behavior of the individuals concerned.

One-week package tours for tourists from the northeastern U.S. to Churchill area in the autumns of 1977 and 1978 to look at polar bears were successful. More tours are planned for the future.

Newfoundland

The killing of polar bears in Newfoundland and Labrador, except in self-defence, has been illegal since the beginning of 1971. However, the Port Burwell quota of eight bears for 1978-79 has been divided in half and reallocated to Québec and Newfoundland. Thus, it is now possible

that the hunting season for polar bears may be reopened in 1979 to allow northern Labrador residents to take their four bears. However, because the number of polar bears to be taken is small, and there is some difficulty in deciding how to allocate the harvest, no decision has yet been made on whether or not to utilize the quota this year.

Federal

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973) has now been in effect since July 1975. Polar bears are included in Appendix II to the Convention ('all species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival'). Since July 1975, the Federal Government, through the issue of permits, has maintained a permanent record of all polar bears, hides or any other product legally exported, or imported (Table 4). Most of the exported hides (89 percent) were destined for Japan.

Table 4. Number of live polar bears and polar bear hides legally exported from Canada, 4 July 1975 to 31 December 1977 (from Heppes 1978a and b, Heppes and Robillard 1978).

	1975*	1976	1977	Total
Live polar bears+	2	4	4	10
Polar bear hides**	-	73	170	243
Total	2	77	174	253

*4 July - 31 December

+mainly bred in captivity

**some hides with skulls

References

Heppes, J.B. 1978a. 1975 annual report for Canada. Canadian Wildlife Service CITES Report No. 1. 9 p.

Heppes, J.B. 1978b. 1976 annual report for Canada. Canadian Wildlife Service CITES Report No. 2. 9 p.

Heppes, J.B. and J.R. Robillard. 1978. 1977 annual report for Canada. Canadian Wildlife Service CITES Report No. 3. 19 p.

Smith, Pauline A. 1977. Resumé of the trade in polar bear hides in Canada, 1975-76. Canadian Wildlife Service Progress Note No. 82. 8 p.

Smith, Pauline A. 1978. Resumé of the trade in polar bear hides in Canada, 1976-77. Canadian Wildlife Service Progress Note No. 89. 5 p.

Polar Bear Specialists
Seventh Meeting
Paper No. 2

RESEARCH ON POLAR BEARS IN CANADA 1976-78

Ian Stirling[1], R.E. Schweinsburg[2], G.B. Kolenosky[3],
Ian Juniper[4], R.J. Robertson[5], and S. Luttich[6]

INTRODUCTION

Most polar bear research in Canada continues to be carried out by federal, provincial, and territorial governments. This situation has arisen largely because of the cost involved, but also because of the management responsibilities of those governments. Some research, such as the physiological studies at Churchill, is carried out by universities with private funding. Such projects are coordinated with government research through bilateral discussions and the Federal-Provincial Polar Bear Technical Committee but are not included in this report.

A wide variety of both coordinated and independent research projects, several of which are continuing, were conducted during 1976-78. This report summarizes the cooperative studies, studies conducted by individual jurisdictions, and lists reports completed between 1976 and 1978.

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[1]Canadian Wildlife Service, 5320 - 122 Street, Edmonton, Alberta T6H 3S5
[2]NWT Fish and Wildlife Service, Government of NWT, Yellowknife, NWT X1A 2L9
[3]Wildlife Research Section, Ontario Ministry of Natural Resources, Box 50, Maple, Ontario L0J 1E0
[4]Department of Tourism, Fish and Game, Box 7200, Charlesbourg, Quebec G1G 5H9
[5]Manitoba Department of Renewable Resources and Transportation Services, Box 2250 The Pas, Manitoba R9A 1M4
[6]Newfoundland Wildlife Service, Box 376, Goose Bay, Labrador

COOPERATIVE PROJECTS

Arctic Islands Pipeline Project (AIPP)

The discovery of natural gas in the Canadian High Arctic resulted in a proposal to build a pipeline to transport this resource from the Sverdrup Basin through the Arctic Islands to southern Canada and the U.S.A. Construction and operation of such a pipeline is an enormous undertaking which could result in potential disruption to the environment. Field work on polar bears was funded from 1975 through 1977 and provided a continuation of existing CWS and NWT-WS programs, which had begun in 1970, so that a broad base of assessment and management data was obtained. The final report was completed in March 1978 (Stirling *et al.* 1978). The following summary of the project is abbreviated from the abstract.

The study provided baseline information on polar bears as part of the overall ecological background required by the Federal Government to assess the environmental consequences of the proposed gas pipeline. Two aspects were of particular importance: 1) baseline information on the population ecology, distribution, abundance, seasonal movements, number of discrete subpopulations affected, and the location of important denning, feeding, and summer retreat areas; and, 2) to identify important areas or times in the annual cycle of the polar bear that might warrant protection from, or modification of, construction or operational activities.

From 1970 through 1977, 914 polar bears were captured, 140 recaptures were made on 124 individual bears, and 48 were shot by Inuit hunters in the study area which was restricted to an area adjacent to the proposed Arctic pipeline route north of Spence Bay. Air and ground surveys of maternity denning areas were conducted and unpublished observations were included whenever possible.

The polar bears of Barrow Strait, NE Victoria Island, and the southern portion of the study area appeared to be discrete from each other. The summer feeding and retreat areas were found to be of particular ecological importance because bears can continue to hunt there for significantly longer than elsewhere.

Maternity denning appeared to occur over a wide area, apparently at low densities. The relative importance of maternity denning areas was evaluated within the limitations of the data available.

Polar bear hunting still represents a significant part of the economic and cultural base in Inuit settlements throughout the Central and High Arctic.

In our judgement, it appeared that the major potential impacts on polar bears of the proposed gas pipeline will occur during the construction phase and that once in operation, impacts will be of a lesser and probably more local nature. The data suggested that the average distance over which pipeline-related activities may have an effect on polar bears is probably in the order of 150 to 200 km from the area under the influence of that activity. A widespread high level of disturbance to maternity denning areas would probably occur on the Sabine Peninsula, Byam Martin Island, Bathurst Island north of Graham Moore Bay and around Bellot Strait.

All the proposed channel crossings go under important winter and spring feeding areas. The laying of pipe will involve extensive activity of men and machinery on the sea ice and in the air as well as year-round, or almost year-round, use of large icebreakers to supply the operation. Any significant changes in distribution or numbers of polar bears in the Barrow Strait area in particular could cause a moderate impact on the

hunting success of Inuit from the Resolute area. Because of their importance as summer feeding areas, we recommended that Brentford Bay on Boothia Peninsula, Graham Moore Bay, and Radstock Bay on Devon Island,receive the maximum amount of protection possible.

We forecasted that a substantial number of conflicts between men and bears will occur and that an increasing but unpredictable number of polar bears, and possibly some men, may be killed.

Reviews of the polar bear population studies completed to date in Zones E and F for the purpose of management have now been completed (Schweinsburg *et al.* 1978; Stirling 1978).

Offshore Drilling in Lancaster Sound and Baffin Bay

In February 1974, approval in principle was granted to Norland Petroleums Limited to drill for petrochemicals in Lancaster Sound, in the eastern High Arctic. After considerable debate, some funds were made available by Norlands to partially finance one year of polar bear research in 1976 to augment the data collected prior to that. It was made clear to Norlands that this amount of additional work would be insufficient to fill the data gap and the results could still comprise only an interim report, which was completed in December 1977 (Schweinsburg *et al.* 1977). Field work and report writing were done jointly by NWT-FWS and CWS. A summary of that research, based on the abstract follows:

This study sought to determine the following baseline information on polar bears in Lancaster Sound: 1) the seasonal distribution and movements, 2) the size and discreteness of the subpopulation(s), 3) the location of important habitats and time of their use, and 4) basic population characteristics such as age structure and reproductive rates. The information

obtained was used to assess the possible impact of drilling a deep-water well for hydrocarbons in Lancaster Sound.

In spring, polar bears are distributed throughout Lancaster Sound and contiguous waters but appear to concentrate along the northern coast of Bylot Island, in the mouths of Navy Board, Admiralty, and Prince Regent inlets, in Barrow Strait between southwestern Devon Island and Prince Leopold Island, and along the southern coast of Devon Island. Little is known about the distribution of polar bears along southeastern Devon Island and in Baffin Bay. Limited data suggest that there may be more bears along the northern than the southern coast of Lancaster Sound.

As the ice melts, polar bears tend to move onto land or into deep bays that retain ice longer than does Lancaster Sound. Summer retreats were confirmed on Bylot Island, northern Borden and Brodeur peninsulas, in Maxwell and Radstock bays, and probably in Croker Bay and on Philpots Island. Analyses of sex and age characteristics of bears caught in summer retreats suggest that these areas are important for adult females, females with cubs, and sub-adult bears of both sexes. In comparison, fewer adult males were found at summer retreats. Some males may spend part or all of the summer on drifting ice or move to more stable ice but this aspect is not well understood.

Little is known of the autumn and winter distribution of polar bears in Lancaster Sound. Pregnant females must move onto land during October or November to dig maternity dens. They emerge from the dens, with their cubs, during late March and early April. Known maternity denning areas are on Bylot Island, Borden and Brodeur peninsulas, and southern Devon Island. No high density maternity denning areas have been found in the Lancaster

Sound area. This may be a survey artifact, but is more likely a reflection of abundant, widespread, readily accessible denning habitat.

There is insufficient capture-recapture information about the bears of Lancaster Sound to determine fidelity to particular areas or the magnitude of their movements. Most bears probably spend their life within a relatively restricted area (as do most polar bears elsewhere), although movements of some Lancaster Sound polar bears may be longer than elsewhere within the Arctic Islands because of drifting ice. Polar bears of Lancaster Sound appear to belong to the same subpopulation as the bears of Barrow Strait. The northern and eastern boundaries of the subpopulation remain undefined. (Stirling *et al*, 1978; Kiliaan *et al*, 1978).

There were not enough data to estimate the size of the polar bear population in the Lancaster Sound area. Preliminary calculations were made of age distributions, productivity, and mortality rates based on the limited data available but the results were too tentative to facilitate reliable analyses or comparisons with other areas.

Inuit from three communities (Arctic Bay, Pond Inlet, Resolute) hunt polar bears within the Lancaster Sound area. Hunters from two other communities (Grise Fiord, Clyde River) may take bears which spend part of the year in Lancaster Sound. The polar bear is an important renewable resource to these communities.

In 1978, Petro Canada assumed leadership for offshore exploration in eastern Lancaster Sound and Baffin Bay and became responsible for the required environmental studies. In 1978, more mark and recapture studies were undertaken by the NWT-WS and CWS. Hopefully, these studies will continue until an adequate data base is obtained but funding arrangements are uncertain at present.

Southern Baffin Island, Northern Quebec, and Northern Labrador

Because of requests by native hunters to have the polar bear quotas reviewed, population ecology studies have been initiated in this area, concentrating largely on the southeastern Baffin Island - Davis Strait area. The research is oriented toward: a) discreteness of the subpopulations being harvested by native hunters; b) estimating the size of these subpopulations c) determining the seasonal movements, key feeding areas, and areas of summer retreat; d) locating and determining the extent of maternity denning areas; and e) determining the age structure and reproductive capability of the subpopulations. Since 1974, mark and recapture studies have been conducted by CWS with assistance from NWT-WS, Newfoundland Wildlife Service, and the Hunters and Trappers Associations in the settlements. Denning surveys were conducted by the NWT-WS and CWS prior to 1976 (Jonkel *et al*, 1978). In 1978, federal government funding for studies of polar bears was greatly reduced which resulted in the discontinuation of research in the southwestern Baffin Island area. However, supplemental funds for the southeastern Baffin Island-Davis Strait area were made available in 1978 by Imperial Oil Ltd., through the EAMES (Eastern Arctic Marine Environmental Study) Management Committee. Funding and plans for field work in 1979 are still uncertain. An interim report is presently being prepared.

Computerization of Polar Bear Data

The data base on polar bears is now so large that it has been necessary to computerize it to facilitate access. This has been a much larger project than was originally anticipated and some time was lost by changing the methodology early in 1978. The major obstacles have now been

overcome and we are now able to retrieve most kinds of data. The emphasis now is being placed on removing errors in existing files and continuing to code old data for entry into the computer.

SINGLE AGENCY PROJECTS

Canadian Wildlife Service

Polar Bear Ecology in the Eastern Beaufort Sea

The population ecology study on the polar bears in the Western Arctic, with aspects that related to the Beaufort Sea Project, was completed and reported on (Stirling *et al.* 1975).

However, it was apparent from the studies of both polar bears and seals that their populations had undergone marked declines in numbers, productivity, and survival of young in 1974 and 1975. The decline apparently occurred because of natural causes that are not completely understood.

Up until the present, the numbers of seals and bears in relation to the marine ecosystem have been regarded as being fairly static. This is the first time that major changes in numbers and reproductive parameters caused by natural influences have been documented in populations of arctic seals and polar bears. If possible, it was decided to monitor these populations for two reasons: 1) hopefully, monitoring will provide some baseline information on the speed with which they can recover from lower numbers, in the absence of any additional environmental damage which might aggravate the situation. This could provide some guidelines as to what might be expected in the event of a major environmental disaster such as an oil blowout that went unchecked for a protracted period. Milne and Smiley (1975) theorized that it might take ten years for the marine system to recover but this was only a guess based on the limited information they had in hand. Also, because offshore drilling is taking place before the populations have recovered, and

are therefore more vulnerable to detrimental effects, it is essential that we monitor the status of those populations; 2) local management of polar bear and seal quotas has to be dynamic and may have to be altered in response to the present biological realities.

Budgets were limited from 1976-78 but mark and recapture studies were carried out each spring. Preliminary analyses indicate that the polar bear populations are into the recovery phase now.

A comprehensive review of population ecology studies from 1970-78, for management purposes, has been completed (Stirling 1978a).

In June 1977 and 1978, aerial surveys of ringed and bearded seals were conducted in the eastern Beaufort Sea so as to obtain results that were directly comparable to those conducted between 1974 and 1976. Analyses are not complete but there appears to be a marked increase in numbers in 1978. Independent unpublished data from other sources indicate that reproductive rates have also increased markedly from the low levels recorded in 1974 and 1975. Because seals reproduce more rapidly than polar bears, and are lower on the food chain, recovery of the marine ecosystem should be noticeable sooner in the seal population than in that of the bears. It is hoped that this monitoring can continue for at least two more years.

The Behavior of Free-Ranging Polar Bears

Behavioral research on polar bears at Radstock Bay on Devon Island in the High Arctic continued in 1977 and 1978. Significant progress was made in the study of the comparative hunting abilities of cubs of different ages (Stirling and Latour 1978). Cubs of all age-classes did almost no hunting during the spring. The proportions of time spent hunting by yearling and 2 year-old cubs and the duration of their lying "still hunts" were not

significantly different from each other. However, the frequency of lying "still hunts" of 2 year-old cubs was double that of yearling cubs and the kill rate of 2 year-old cubs was comparable with that of adults, even though they hunted for a significantly lesser proportion of their time. These results suggest that cubs which remain with their mothers until they are weaned have a higher probability of survival than those that do not and this interpretation lends support to the management concept of total protection of family groups and the harvesting of independent bears only.

In 1978, in a joint project with the U.S. Fish and Wildlife Service, radio collars and harnesses simulating the package used for satellite tracking were put on polar bears in Radstock Bay. These bears were then observed to see if the harnesses caused any detrimental changes to their behavior or hunting abilities. A preliminary examination of the data indicates that bears with harnesses killed seals at the same rate as unharnessed bears. No detrimental effects were noted.

Analyses of data continue on the time budget, hunting ability of bears of different age and sex classes, seasonal utilization of habitat, diurnal rhythm, proportion of time spent in various activities, and effects of aircraft and tagging. It is hoped to produce a major work on this research in the next two years. Research on ecological relationships between polar bears, seals, and ice conditions continues in conjunction with the behavioral studies.

Field work on the behavior of undisturbed polar bears at Cape Churchill was completed in the fall of 1978 by Paul Latour, who will be writing the final report as a MSc thesis (University of Alberta) during 1979. The research concentrated on the activity budgets and ritualized interactions between polar bears forced to spend the summer and fall on land, after the ice in Hudson Bay had melted. Approximately 80 bears were individually marked during the three-year study.

Northwest Territories Wildlife Service

Central Arctic (Hadley Bay, M'Clintock Channel, Victoria Strait and the Gulf of Boothia)

Following completion of the AIPP report (Stirling *et al.* 1978) additional field work and data analysis were undertaken in this area. The boundary between the subpopulation of bears in Zone E(Central Arctic) and the one in Zone F(Eastern High Arctic) in Prince Regent Inlet and Peel Sound appears to be at about the latitude of Creswell Bay, Somerset Island. The relationship of the bears of Hadley Bay (northeastern Victoria Island) and M'Clintock Channel remains unknown as there has been no recorded exchange with other areas. The relationship between the bears of the Gulf of Boothia and Foxe Basin remains unknown, but to date no Zone E bears have been returned by hunters from Foxe Basin (Zone C).

The polar bears in the Central Arctic displayed a high fidelity to certain areas. Four areas have been identified: 1)Franklin Strait and Brentford Bay, 2) southwestern Gulf of Boothia around Harrison Islands, 3) Victoria Strait and south M'Clintock Channel, and 4) Hadley Bay. With the exception of Hadley Bay, there was a 5 to 10 per cent interchange of marked bears between these areas.

Known and suspected denning areas include Simpson Peninsula, Harrison Islands, the southeastern coast of Boothia Peninsula, northern Boothia Peninsula, southern Somerset Island, southern Prince of Wales Island, some islands in the James Ross Strait - Victoria Strait - Southern M'Clintock Channel area, and Hadley Bay. With the exception of Gateshead Island no high density denning areas were found.

Approximately 53 bears are killed by hunters in Zone E each year. An

average of 2-3 bears each year have been killed at Hadley Bay since hunting began there during the 1973-74 hunting season. All settlements with good records on kill information appeared to harvest more males than females. In recent years, Gjoa Haven, Pelly Bay and Spence Bay have reported a large part of their kill in autumn before pregnant females have had a chance to den. However, only in Pelly Bay were more females killed in autumn than in spring. We estimated that the area contained 1100 polar bears; possibly an underestimate because M'Clintock Channel and Committee Bay were not adequately sampled.

Man/Bear Conflicts and Deterrent Studies

During 1977 and 1978 tests were made by Don Wooldridge at Churchill, Manitoba on one and two strand trip-wire detection fences, a proximity alarm system and acoustic repellent systems. The trip-wires have to be broken by the intruding polar bear to trigger the alarm. The proximity alarm system depends on alteration in the charge on a wire by nearness of the intruder. Two sounds were tested: recorded natural aggressive vocalizations of a polar bear and a synthesized aggressive sound which was based on an electronic analysis of the natural sounds.

Single and double wire fences were set up around bait stations and were capable of "detecting" intrusions by free-ranging polar bears. Approach time in experimental areas, as compared to non-fenced control bait stations, was increased by an average of 3 seconds($p = 0.95$) for the double wire fences, while there was no significant difference for the single wire fence. The increase in approach time reflected the time spent investigating the upper wire by approaching polar bears although in no instance did the upper wire prevent an entry into the fenced area. Bears that attempted to go under the

top wire succeeded in tripping the lower wire.

If this fence were connected to an alarm circuit, it would be possible to segregate the fence perimeter into sections, each one of which would be electronically independent. Such replication would increase the reliability of the warning system in the event of failure or disruption of one of the fences. The possibility of failure to detect a bear would be further lessened if each wire of a double strand fence was on an independent circuit. The results of these tests suggest that the undetected intrusion of a bear past a double strand fence is highly unlikely.

A proximity detection circuit and antenna were capable of indicating the intrusion of a free-ranging polar bear. Bears may present the antenna with considerably more electrical disturbance potential than a human intruder which may enhance the effectiveness of the system in actual field applications. It remains to be seen whether an expanded system would prove as effective, and only further tests at a large site can prove this conclusively. The system offers the advantage of low maintenance, immunity to Arctic weather conditions, and continued security after an intrusion. Solutions to sensitivity problems are under consideration.

Biologically significant sounds appear to be effective in eliciting an apparent fear response in some free-ranging polar bears. The polar bears near Churchill may be under some nutritional stress during the late summer and fall, and should therefore be interested in the bait stations used in these tests. The effective repulsion of these animals indicates the potential application of agressive sounds in areas which experience problems with intruding polar bears. The advantages of this technique include low maintenance, ease of installation, the ability easily to interface the system with an

electronic alarm device or detection system, and the apparent long distance effectiveness of the sounds. The possibility exists that some bears may react in an aggressive manner. However, this has only been seen in one instance in all the tests utilizing the aggressive sounds (Wooldridge and Belton 1977). This particular bear was subsequently repelled on a second exposure to the sounds. Although the lack of complete predictability of a bear's behavior will always preclude any one system from offering the complete non-destructive solution to all intruding nuisance bears, techniques such as acoustic repellents may significantly reduce the probability of dramatic encounters between men and bears at localized sites.

These conclusions are preliminary and further work continues at Churchill under the direction of Dr. Barrie Gilbert of Utah State University (chief contractor) and Don Wooldridge.

Future Research

Several areas are intended for investigation and development, depending on resources and priorities. These include: drawing up a five-year plan for management, conducting system oriented research with experimental harvests, technically oriented studies on subjects such as remote sensing, photographic census techniques, satellite telemetry, monitoring of pollutant levels, ground surveys for denning areas, and improved information dissemination.

Ontario

The annual aerial surveys along the Hudson Bay and northern James Bay coast of Ontario and eastern Manitoba were conducted 7-8 September in both 1977 and 1978. The totals of 143 and 147 sighted in 1977 and 1978 respectively, were the second and third highest values recorded since inception of the surveys in 1963. Distribution during both years was similar to previous

years, with major concentrations in the Pen Islands and Cape Henrietta Maria areas. A small island west of Cape Henrietta Maria that has repeatedly served as a preferred summer retreat, contained a record 36 bears in 1977, an estimated density of 3 bears per hectare. All of the bears appeared large and most exhibited little concern at the presence of the aircraft.

In 1978, cubs and yearlings constituted almost 21 per cent of the total sightings. That represented the first year in which numbers of young sighted during the fall survey correlated well with estimated spring cub production.

A sample of 38 teeth removed from skulls collected from Indian hunters between 1970 and 1976 were aged by the Canadian Wildlife Service.

A continuation of the annual fall aerial surveys and a collection of skulls from Indian hunters is planned. More detailed studies are not anticipated in the immediate future because of budget constraints.

Maternity denning and productivity studies

Aerial surveys with fixed-wing aircraft to determine the distribution and extent of maternity denning in northern Ontario were again conducted in 1977 and 1978. To ensure that as many emerging groups as possible would be spotted, the surveys were carried out in three phases that extended from mid-February to late March. Previously, only one survey that coincided with the expected peak of emergence was conducted. The surveys confirmed that peak emergence occurred from approximately 1-15 March.

Although time of maximum emergence for both years was similar, estimated production for each of the two years was quite different. In 1977, actual sightings and track observations indicated total cub production was only about 40. That value was the lowest recorded during the five years of

the survey and was only about 50 per cent of the annual production recorded during the two previous years. In contrast, the 1978 survey revealed an estimate of about 115 which represented the highest value recorded to date. Undoubtedly, productivity was markedly different between the two years, but part of the wide variation was attributed to differences in weather and snow conditions, both during and prior to each year's surveys. In 1978, weather and snow conditions were classified as excellent, whereas poor snow conditions and blowing snow prevailed throughout much of the early spring period in 1977. Average litter size was 1.9 during both years.

On the basis of all evidence collected to date, the population along the northern Ontario coast appears quite stable, and thus future spring survey flights will be conducted at less frequent intervals. It is anticipated that spring surveys conducted for two consecutive years every fifth year may be adequate to provide an index of productivity for the polar bears along the northern Ontario coast. However, fall survey flights and collections of specimens from Indian hunters will continue as before.

Manitoba

Polar bears were tagged in the falls of 1977 and 1978 in conjunction with the polar bear control program at Churchill. A greater emphasis was placed on public information aspects. No new research was undertaken but personnel at Churchill assisted other research being carried out in the area by several other groups.

Quebec

In August 1977, aerial censuses of polar bears were conducted on Mansel and Akpatok islands. Thirty-two bears were counted on Mansel Island (six family groups) and one bear on Akpatok Island. A small group of islands

south of Mansel Island was also surveyed in September and four bears were seen. About 1100 km of the Hudson Strait coastline from Port Burwell to Sugluk were surveyed in September but no bears were observed.

Mansel and Akpatok islands were censused again in August 1978. Thirty-three bears were observed on Mansel Island (seven family groups)and 24 (five family groups) on Akpatok Island. In August, the eastern coast of Hudson Bay from Ivugivik to Great Whale, a distance of about 900 km, was surveyed but no bears were observed.

The Quebec Wildlife Service is maintaining efforts to obtain greater participation by Inuit hunters in discussion of polar bear management and research in Quebec.

Newfoundland

Field personnel cooperated with CWS in conducting mark and recapture studies in northern Labrador in 1978. No additional studies were conducted or are planned.

LITERATURE CITED

Jonkel, C., E. Land and R. Redhead.1978. The productivity of polar bears (Ursus maritimus) in the southeastern Baffin Island area, Northwest Territories. CWS Progress Note No. 91, 7pp.

Kiliaan, H.P.L., I. Stirling, and C. Jonkel. 1978. Polar bears in the area of Jones Sound and Norwegian Bay. CWS Progress Note 88, 21pp.

Milne, A., and B. Smiley. 1975. Offshore drilling for oil in the Beaufort Sea: A preliminary environmental assessment. Beaufort Sea Technical Report 39. 43pp.

Schweinsburg, R.E., I. Stirling, B. Oosenbrug, and H.P.L. Kiliaan. 1978. A status report on polar bear studies in Lancaster Sound. Report to Norland Petroleum Limited, 2 parts, 56pp. and 26pp.

Stirling, I. 1978. A review of population ecology studies of polar bears conducted in the Western Canadian Arctic from 1971 through 1977, for the purpose of evaluating management practises. A Report submitted by the Canadian Wildlife Service to the Northwest Territories Fish and Wildlife Service. 68pp.

Stirling, I., D. Andriashek, P. Latour, and W. Calvert. 1975. The distribution and abundance of polar bears in the eastern Beaufort Sea. A Final Report to the Beaufort Sea Project. Fisheries and Marine Service, Dept. of Environment Victoria, B.C. 59pp.

Stirling, I., and P.B. Latour. 1978. Comparative hunting abilities of polar bear cubs of different ages. Canadian Journal of Zoology 56: 1768-1772.

Stirling, I., R.E. Schweinsburg, W. Calvert, and H.P.L. Kiliaan. 1978. Population ecology of the polar bear along the proposed Arctic Islands Pipeline Route. Final Report to the Environmental Management Service, Dept. of Environment. Edmonton. 90pp.

Wooldridge, D.R. and P. Belton. 1977. Natural and synthesized aggressive sounds as polar bear repellents. Fourth International Conference on Bear Research and Management, Kalispell, Montana, February 28,1977; in press

PAPERS AND REPORTS

Best, R. 1976. Ecological energetics of the polar bear. M.Sc. thesis, University of Guelph, Guelph, Ontario. 136pp.

Best, R.C. 1977. Ecological aspects of polar bear nutrition, pp.203-211. In: R.L. Phillips and C. Jonkel (eds.), Proceedings of the 1975 Predator Symposium, 16-19 June 1975, University of Montana, Missoula.

Cinq, Mars J. 1977. Inventaire des aires estivales de l'ours polaire (Ursus maritimus) sur la Côte-Nord de Labrador, l'île Akpatok et dans le secteur du détroit d'Hudson. Service de la Recherche Biologique, Ministère du Tourisme, de la Chasse et de la Pêche, Québec.

Cross, D. 1976. Polar bear denning survey 1976. Manitoba Department of Mines, Resources and Environmental Management. 2pp. and 5 apendices (typed).

Geraci, J.R. and T. G. Smith. 1976. Direct and indirect effects of oil on ringed seals (Phoca hispida) of the Beaufort Sea. Journal of Fisheries Research Board of Canada 33: 1976-1984.

Jonkel, C.J., I.Stirling, and R. Robertson. 1976. The polar bears of Cape Churchill. Proceedings of the Third International Bear Conference, Binghamton, New York, June 1974.

Jonkel, C., E. Land, and R. Redhead. 1978. The productivity of polar bears (Ursus maritimus) in the southeastern Baffin Island area, Northwest Territories. CWS Progress Note No. 91, 7pp.

Jonkel, Charles, Pauline Smith, Ian Stirling and George B. Kolenosky. 1976. The present status of the polar bear in the James Bay-Belcher Islands area. Canadian Wildlife Service Occasional Paper No. 26, 42pp.

Kiliaan, H.P.L., I. Stirling, and C.J. Jonkel. 1978. Notes on polar bears in the area of Jones Sound and Norwegian Bay. Can. Wildlife Service Progress Note 88, 21pp.

Kiliaan, H.P.L. 1976. Polar bear tagging, northern Labrador, 23-30 March 1976. 32pp. (typed).

Kiliaan H.P.L. 1977. Polar bear tagging northern Labrador and southern Baffin Island 1977. Canadian Wildlife Service (typed).

Kiliaan, H.P.L. and I. Stirling. 1978. Observations of overwintering walruses in the eastern Canadian High Arctic. Journal of Mammalogy 59: 197-200.

Kiliaan, H., I. Stirling, and C. Jonkel. 1978. Polar bears in the area of Jones Sound and Norwegian Bay. CWS Progress Note 88, 21 pp.

Kolenosky, G.B. Productivity and maternity denning of polar bears in Ontario. Ontario Ministry of Natural Resources. 31pp. (typed).

Kolenosky, G.B. 1977. Polar bear survey flight along Hudson Bay coast of Ontario and Manitoba, September 7-8,1977. Ontario Ministry of Natural Resources, Fish and Wildlife Research Branch. 10pp. (typed).

Ransom, S. 1976. Polar bear survey 1976. NWT Fish and Wildlife Service. 9pp. and 1 appendix (typed).

Redhead, R. 1976. Hoare Bay polar bear (Ursus maritimus Phipps) survey report. NWT Fish and Wildlife Service. 5pp. and 2 appendices (typed).

Schweinsburg, R. E. 1976. Work report of polar bear research in and around Admiralty Inlet, July-August 1975. NWT Polar Bear Special Report No.2 (typed).

Schweinsburg, R.E. and I. Stirling. 1976. More research needed to minimize conflicts between men and polar bears. Oilweek 27(5): 54-55

Schweinsburg, R.E., I. Stirling, S. Oosenbrug, and H.P.L. Kiliaan. 1977. A status report on polar bear studies in Lancaster Sound. Report to Norlands Petroleum Limited. 2 parts, 56pp. and 26pp.

Siniff, D.B., I. Stirling, and L.L. Eberhardt. 1978. Problems in the conservation of polar marine mammals. pp.161-174. In: M.A. McWhinnie (Ed). Polar Research: To the present and the future. AAAS Selected Symposium 7. Westview Press, Washington, D.C.

Smith, P.A. 1977. Résumé of the trade in polar bear hides in Canada, 1975-76. Canadian Wildlife Service Progress Note No. 82. 8pp.

Smith, P. 1977. Résumé of the trade in polar bear hides in Canada, 1976-77. CWS Progress Note 89, 5pp.

Smith, T.G. 1976. Predation of ringed seal pups (Phoca hispida)by the arctic fox (Alopex lagopus). Canadian Journal of Zoology 54: 1610-1616.

Smith, T.G. 1976. The icy birthplace of the ringed seal. Canadian Geographical Journal 93: 58-63.

Smith, T. G. and I. Stirling. 1978. Variation in the density of ringed seal (Phoca hispida) birth lairs in the Amundsen Gulf, Northwest Territories. Canadian Journal of Zoology 56 (in press).

Stirling, I. 1977. Adaptations of Weddell and ringed seals to exploit the polar fast ice habitat in the absence or presence of surface predators, pp. 741-748. In: G. A. Llano (ed.) Adaptations within Antarctic Ecosystems. Gulf Publishing Company, Houston.

Stirling, I. 1977. Polar bear conservation in Canada, pp. 41-45. In: T. Mosquin and C. Suchal (eds.), Canada's Threatened Species and Habitats. Proceedings of a Symposium sponsored by the Canadian Nature Federation, held in Ottawa, 20-24 May 1976.

Stirling, I. 1978. A review of population ecology studies of polar bears conducted in the Western Canadian Arctic from 1971 through 1977, for the purpose of evaluating management practises. A Report submitted by the Canadian Wildlife Service to the Northwest Territories Fish and Wildlife Service. 68pp.

Stirling, I. 1978. A review of population ecology studies of polar bears conducted in the High Arctic in polar bear management Zone F for the purpose of evaluating management practises. A report submitted by the Canadian Wildlife Service to the Northwest Territories Fish and Wildlife Service. 25pp.

Stirling, I. and D. Andriashek. 1978. Polar bears and seals in the Beaufort Sea. In: B. Pelletier (ed.), Beaufort Sea Atlas (in press).

Stirling, I. and W.R. Archibald. 1977. Aspects of predation of seals by polar bears. Journal of Fisheries Research Board of Canada 34:1126-1129.

Stirling, I., W.R. Archibald and D. DeMaster. 1977. Distribution and abundance of seals in the eastern Beaufort Sea. Journal of Fisheries Research Board of Canada 34:978-988.

Stirling, I., D. DeMaster and D. Andriashek. 1977. Report to DINA on the 1977 survey of the distribution and abundance of seals in the eastern Beaufort Sea. Canadian Wildlife Service, 11pp. (typed).

Stirling, I., C. Jonkel, P. Smith, R. Robertson and D. Cross. 1977. The ecology of the polar bear (Ursus maritimus) along the western coast of Hudson Bay. Canadian Wildlife Service Occasional Paper No. 33. 62pp.

Stirling, I. and H.P.L. Kiliaan. 1977. Polar bear research on southern and southeastern Baffin Island, northern Quebec, and northern Labrador. Canadian Wildlife Service. 14pp. (typed).

Stirling, I. and P.B. Latour. 1978. Comparative hunting abilities of polar bear cubs of different ages. Canadian Journal of Zoology 56:1768-1772.

Stirling, I., A.M. Pearson, and F.L. Bunnell. 1976. Population ecology studies of polar and grizzly bears in northern Canada. Transactions of 41st North American Wildlife Conference 41: 421-430.

Stirling, I., R.E. Schweinsburg, and H.P.L. Kiliaan. 1976. Polar bear research along the proposed arctic islands gas pipeline route. Progress report to the Environmental Management Service, Department of the Environment, Edmonton, Alberta. 32pp. (typed).

Stirling, I., R.E. Schweinsburg, W. Calvert and H.P.L. Kiliaan. 1977. Population ecology of the polar bear along the proposed Arctic Islands pipeline route. Progress report to the Environmental Management Service, Department of the Environment, Edmonton, Alberta.

Stirling, I., R.E. Schweinsburg, W. Calvert, and H.P.L. Kiliaan. 1978. Population ecology of the polar bear along the proposed Arctic Islands Pipeline Route. Final Report to the Environmental Management Service, Dept. of Environment. Edmonton. 90 pp.

Stirling, I. and T. G. Smith. 1977. Interrelationships of arctic ocean mammals in the sea ice habitat. Proceedings of Circumpolar Conference on Northern Ecology, Ottawa, 15-18 September 1975: II-129-136.

Wooldridge, D.R., and P. Belton. 1977. Natural and synthesized aggressive sounds as polar bear repellents.Fourth International Conference on Bear Research and Management, Kalispell, Montana, February 28, 1977; in press.

POLAR BEAR SURVEY
Norwegian/American/Danish study, April 1977

Bart W. O'Gara[1], Thor Larsen[2], Christian Vibe[3], Per Wegge[4]

INTRODUCTION

About 100 polar bears (Ursus maritimus) are shot in southeast Greenland each year without apparent detrimental effects upon the population. To sustain such a kill, the population supplying the bears must consist of nearly 2,000 individuals. However, according to Dr. Christian Vibe from the University of Copenhagen, Denmark, few polar bears live and breed in the coastal region of Greenland, south of Scoresbysund. He counted, captured and marked, and made den surveys in northeast Greenland. The counts, and a large recovery rate in the same area of the relatively few bears marked, indicate that the polar bear population north of Scoresbysund is also small. None of his marked bears from there have been recovered in southeast Greenland.

Vibe believes that bears which are shot in southeast Greenland come from the polar basin, particularly the Eurasian Basin. They travel with the drift ice north of Spitsbergen and enter the Greenland Sea with the East Greenland Current. If not shot in the southern parts of Greenland, these bears apparently die from other reasons; this route can be regarded as a "blind alley" from which they cannot return.

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[1]Montana Cooperative Wildlife Research Unit (U.S. Fish and Wildlife Service, Montana Fish and Game Department, University of Montana, and the Wildlife Management Institute cooperating).
[2]Norwegian Polar Institute.
[3]University of Copenhagen.
[4]Norwegian Wildlife Research Institute.

Vibe's theory was discussed extensively at the sixth Meeting of the IUCN Polar Bear Specialist Group, Morges, Switzerland, 7-10 December 1976. If it is correct, Norway, the USSR and North America may supply southeast Greenland with polar bears from their respective populations.

Canadian and American scientists have suggested that there may even be polar bears which live and breed on the polar pack ice. Those scientists have initiated studies to gain information concerning the possibility of such bear populations. If they do exist, bears from throughout the Polar Basin may drift with the ice and contribute to the catch of polar bears in southeast Greenland.

To test the validity of Vibe's theory, Thor Larsen and Charles Jonkel proposed a two stage study of the area involving first a general survey of the area, and secondly, an extensive tagging program. We recently (middle of April 1977) surveyed the drift ice north of Svalbard to 83°N, and between Svalbard and northeast Greenland from Station Nord to Shannon Island, to determine the dispersion and densities of bears as Stage I of the proposal.

Funds for this survey were provided by the Norwegian Polar Institute; the National Science Foundation; and the World Wildlife Fund, Denmark.

MATERIALS AND METHODS

A twin-engine Piper Navajo, leased from "Paralift" and piloted by Norwegian Chief Pilot Petter Ringvold, was used while locating polar bear tracks on the sea ice north and west of Svalbard to the Greenland Coast. The surveyed area was between 34° east and 20° west, and 75° and 83° north. Einer Pedersen of Longyearbyen, Svalbard, served as navigator on the flights north of Svalbard. A navigator was not used on

flights between Svalbard and Greenland because the distances dictated keeping weight to a minimum and because fixes could be established on both coasts. Four observers (the authors of this report) alternated on the flights, with three of the four usually aboard at one time. A preliminary flight on 15 April 1977 north of Nordaustlandet allowed the observers and pilot to test the techniques of Jonkel et al. (1977) in an area with many tracks. Data gathered during that flight indicated that two observers, one at the rear window on each side of the aircraft, recorded approximately the same number of tracks as three observers did when one was in the copilot seat, the only other good seat for observations. Thereafter, to reduce fatigue and increase efficiency, two observers watched while one rested, allowing one-half hour of rest between one hour periods of observation.

The plane was flown at as near to 160 km per hour ground speed and 100 meters elevation as possible. The pilot and observers synchronized their watches at the beginning of each flight. The pilot or navigator notified the observers of the time and point of departure from and arrival at land, times of turns, and times that lines of latitude and longitude were crossed.

Even researchers experienced in arctic flying required half a day to become efficient in locating and recording tracks. Thus on subsequent surveys, an effort should be made to keep the same observers throughout the survey.

Positively identified polar bear tracks were recorded on tape recorders or paper to the nearest minute, minute + (1 - 30 seconds after) or minute ++ (30 - 50 seconds after the minute). Recording the exact second required too much time in looking at a watch and some

tracks would be missed. Old tracks sometimes showed as raised, packed snow; only tracks forming depressions in the snow were recorded. Every track crossed by the plane was recorded by either or both observers if they saw it. Tracks running roughly parallel to the line of flight were recorded at first observation and watched to avoid recording the same track twice. After each flight, the observers prepared a composite list and eliminated obvious duplicate sightings. Some bias was undoubtedly introduced by this method, but it was probably consistent from flight to flight.

Ice conditions were recorded during flights. Vibe's experience in this field was an asset and he has compiled most of the ice data. Satellite photos of the area were also used to correlate ice conditions with concentrations of tracks.

Distribution of bear tracks were mapped using all the positions noted by the pilot and navigator, then determining ground speed and bear locations by time. For convenience, the eastern flight line was designated number one and the remainder were numbered consecutively counter clockwise.

RESULTS

Polar bears were scattered throughout the polar ice with a zone of concentration approximately 150 km wide north and northwest of Svalbard, and a sharp decrease in abundance at about 82° N latitude. This zone continued to the southwest towards central East Greenland (Fig. 1).

The pattern of track distribution indicated that the bears ranged farther north on the eastern (First) leg of our survey (Fig. 2), north of Kvitøya, than they did north and west of Svalbard. Along that leg,

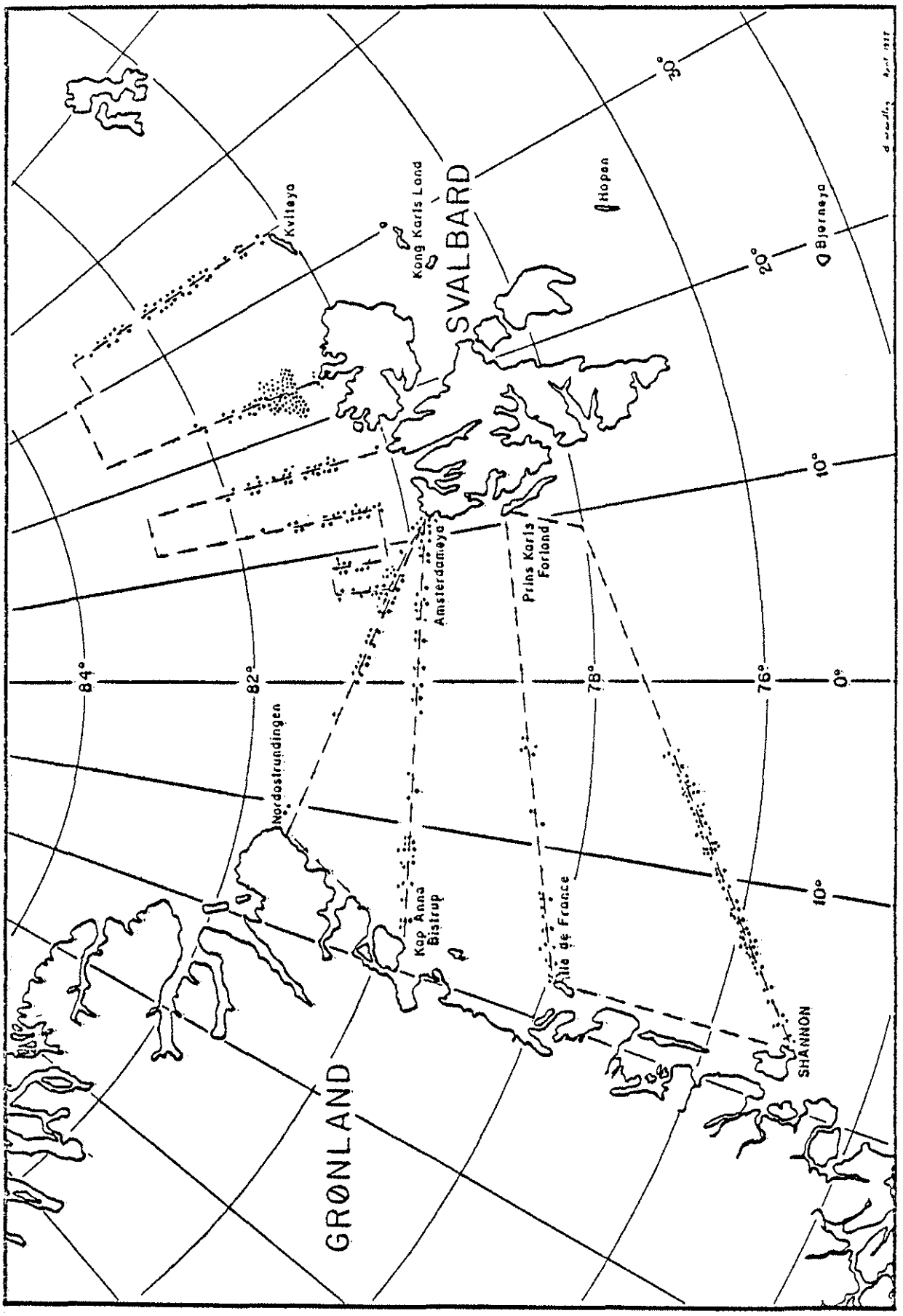


Fig. 1. Map of the study area showing distribution of polar bear tracks along survey lines.

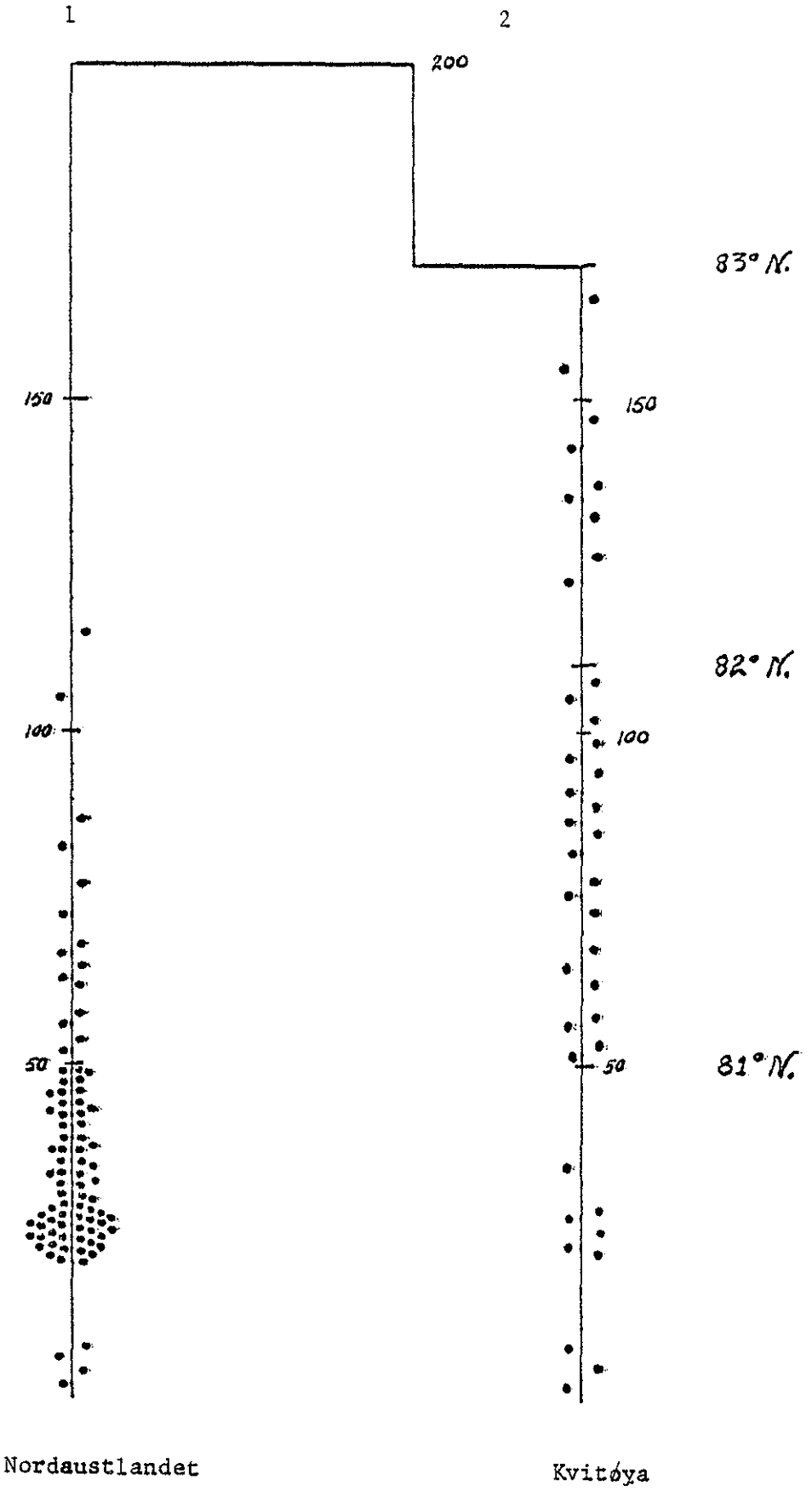


Fig. 2. The first and second survey lines.

tracks were common from land for about 240 km to 83° N. The greatest concentration of tracks occurred along the second leg between 30 and 100 km north of Nordaustlandet, but tracks were scarce at 82° N (Fig. 2). Flight lines 3 and 4 showed a somewhat similar distribution as that of 2, but tracks were not as numerous (Fig. 3). Legs 5 and 6 were not continued farther north because the light was failing and open water and fog made both the possibility of tracks being there and us sighting them slight (Fig. 3). Legs 7 and 8 revealed more tracks near Svalbard than Greenland (Fig. 4). On leg 9, most of the tracks were within 50 km of Isle de France, and none were closer than 120 km to Prins Karls Forland (Fig. 5). However, much of that 120 km was new, gray ice, probably still too thin for bears. One of the tracks about midway of the leg indicated that a bear had fallen through the ice and had to swim under it for a considerable distance, occasionally breaking an air hole, to reach solid ice. On the southernmost leg (10), tracks were common between 50 and 180 km from Shannon, but none were seen closer than 170 km from Svalbard. That 170 km portion was mostly open water (Fig. 5).

Tracks were most numerous on old ice along leads, with new ice and open water in the leads (Figs. 2 - 5). Few seals were seen, probably because of the cold weather, but two kill sites were noted. Cub tracks were seen a number of times, but most of them were within 50 km of land.

DISCUSSION

The distribution of tracks and the known ice movements indicate that Svalbard and the Siberian Islands may supply the major part of the bears found in southeast Greenland. The belt of tracks north and west of Svalbard seemed continuous for flight lines 1 through 8 (Figs. 2 - 5).

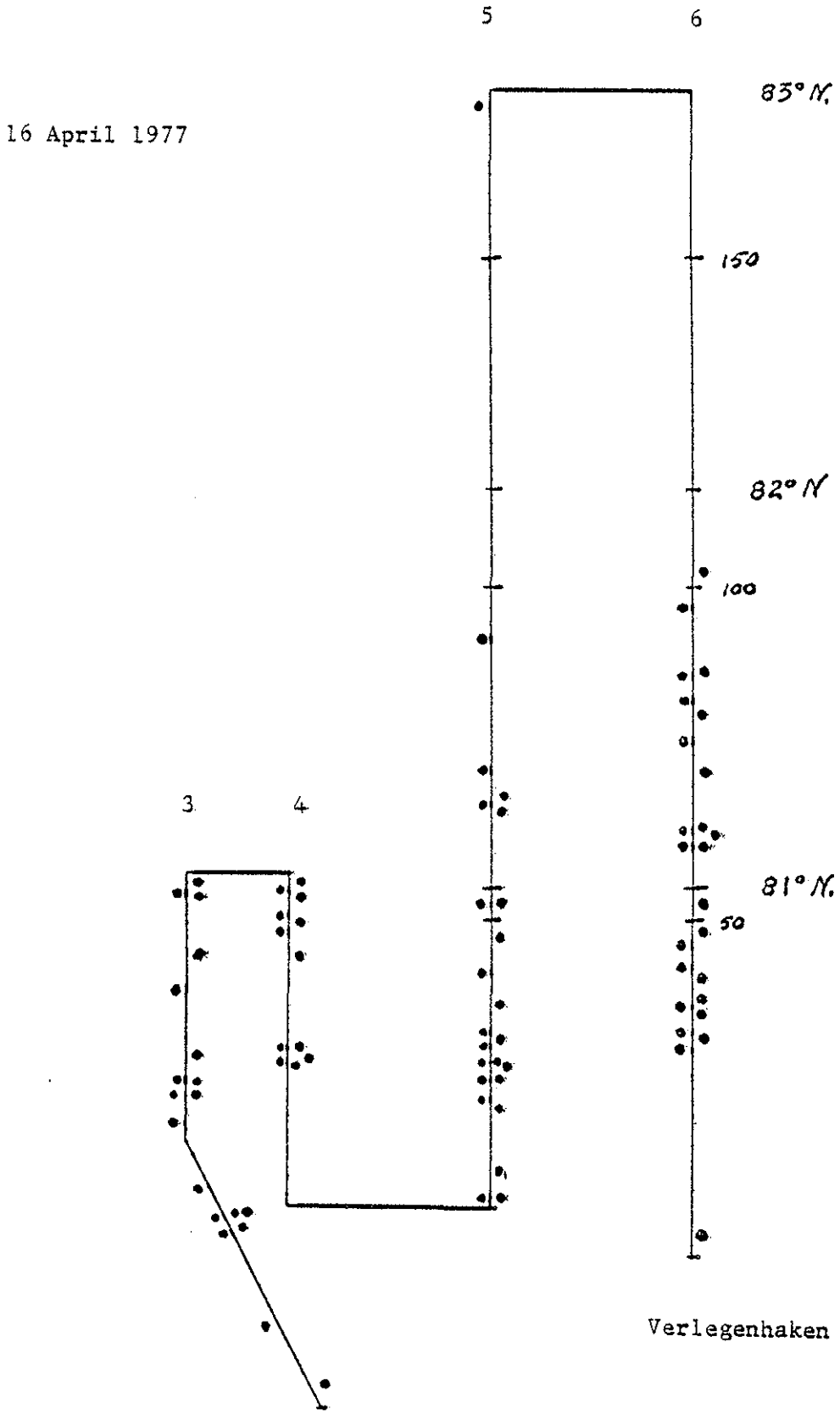
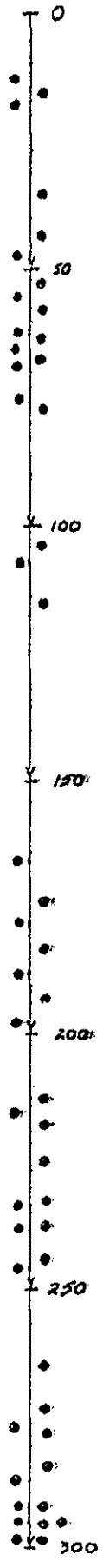


Fig. 3. Flight lines 3 - 6.

7

Kapp Anna Bistrup



Amsterdamøya

17 April 1977

8

Nordostrundingen
Grønland

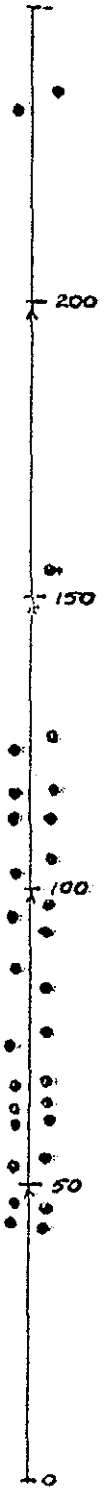


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Fig. 4. Flight lines 7 and 8.

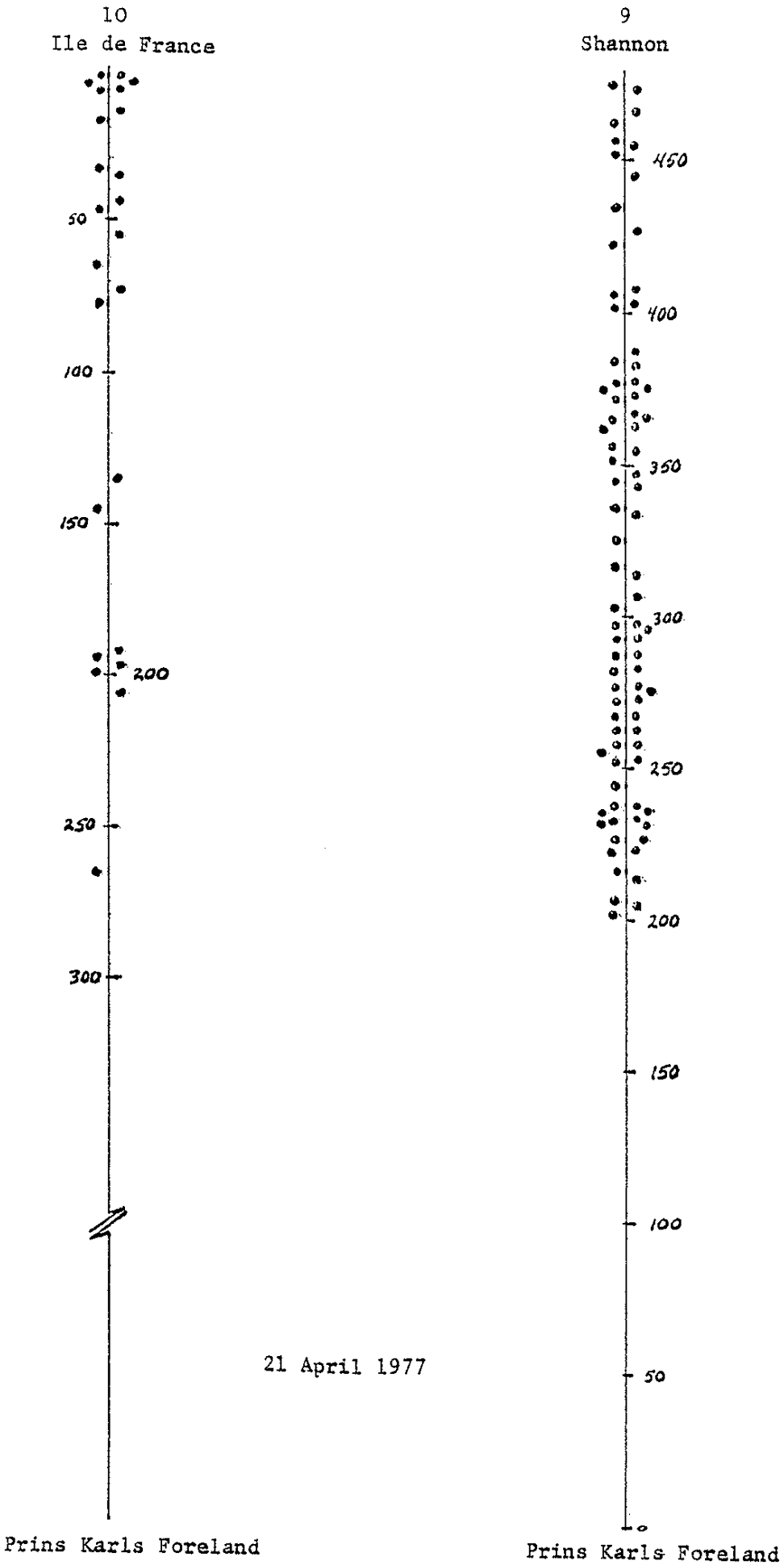


Fig. 5. Flight lines 9 and 10.

The lack of tracks near Svalbard on leg 9 apparently corresponds with the recently open water and thin ice (Fig. 5). However, the light was poor and the observers were tired on that leg, so some tracks were probably missed. The concentration of tracks noted closer to Greenland than Svalbard on flight line 10 (Fig. 5) could be a continuation of the pattern of tracks seen on legs 1 through 8. Further studies, involving the marking of fairly large numbers of bears and possible satellite tracking of a few, are now required if the origin of Greenland bears is to be determined.

One bear tagged near Kong Karls Land was later killed in southeast Greenland, Larsen (1972), and the wreckage of a Norwegian ship which had become frozen in the ice north of Alaska was found on the south Greenland Coast. Those two incidents, plus evidence presented by Vinjya (1973) that the polar ice rotates clockwise around the North Pole and moves south between Svalbard and Greenland at a rate of approximately 15 to 30 km a day, strengthens Vibe's theory. Bears hunting on the ice as much as 240 km from land would have to travel great distances to keep from being carried south.

If bears are to be marked, the marking should be accomplished as early in the year as temperatures will allow. At the time of this survey (16-21 April), ice conditions may already have separated bears destined to reach Greenland from the Svalbard population. The first marking should be done to the west and northwest of Svalbard, with later efforts directed to the north and northeast. Such a scheme would allow marking of bears from a broad section of the population.

REFERENCES

Jonkel, C. J., I. Stirling, R. Robertson, and P. Smith. 1977. The polar bears of Cape Churchill. C.W.S. Mongr., Ottawa.

Larsen, T. 1972. Polar bear research in Norway. IUCN New Series Publ. Suppl. Paper No. 35, Paper No. 6:60-65.

Vinjya, T. 1973. Sea ice and drift speed observations in 1971. Norsk Polarinstitutt Arbok 1971:81-85.

Polar Bear Specialists
Seventh Meeting
Paper No. 4

ETHOLOGICAL STUDIES OF THE POLAR BEAR
Preliminary Report 1978

Jørn Thomassen and Rasmus Hansson
Institute of Zoology, University of Trondheim

In cooperation with research scientist Thor Larsen of the Norwegian Polar Institute and Professor Yngve Espmark of the Zoological Institute, University of Trondheim, a research project on the behavior of polar bears was initiated in 1976.

Earlier surveys by Thor Larsen showed that Kong Karls Land on Svalbard was a suitable study area for behavioral investigation. The islands have an extremely high and stable population of denning females. Kongsøya was chosen for the study area because it possesses both a good base-hut and suitable observation possibilities (Bogen denning area). The highest concentration of dens is on the N and NE slopes of Bogen. The bears emerge from their dens from about mid-March; we therefore planned to start the fieldwork before that time.

The primary objective of this investigation was to collect as much information as possible on an undisturbed polar bear population. All activity outside the observation hut was therefore minimized and, as far as we know, the bears were not disturbed during the observations. We also tried to avoid food with a strong smell and coal for heating.

The first female left her den 18 March. All observations were made from the observation hut with a monocular (40x) and binoculars (8x and 25x). The single parameters were collected on record sheets and tape recorded. The observation period was decided by the length of the day. Within the first fortnight the light permitted us to

start continuous observations 24 hours a day. We seldom observed more than one family outside the den at a time. The last family left their den on 17 April and the observations from the denning area were concluded within a few days.

The total number of observation hours during the first field season was about 700, of which approximately 210 were so-called effective, i.e. that bears were followed through a spotting scope. Bad weather conditions in the form of fog or snow-storms caused the only breaks in the observations. 5 dens were followed from between 4 and 31 days; 4 of them contained 2 cubs, while the last one had 3.

In addition to tape recording and record sheets we also used:

- sketches of characteristic features of behavior;
- sketches of the area with the plotting of the groups' movements every 5th minute for use in delimiting the animals' home range;
- photographing and filming of special and characteristic features of behavior;
- continuous tape recording of bear behavior for use in later detail study;
- mapping of the dens with measurements and position in the denning area;
- collecting of meteorological data four times a day (06, 12, 18 and 24 hrs).

The information on the record sheets will primarily be used for quantification and analysis of activity patterns, while the combination of record sheets, tape recordings, photos and film plus sketches will provide the basis for the more descriptive part of the work.

The fieldwork ended 16 May.

Polar Bear Specialists
Seventh Meeting
Paper No. 5

POLAR BEAR RESEARCH AND CONSERVATION IN THE USSR 1977-1978

S. M. Uspenski and S. E. Belikov
Central Laboratory on Nature Conservation, USSR
Ministry of Agriculture

As in previous years, the leading organization carrying out and coordinating polar bear research in the USSR was the Central Laboratory on Nature Conservation, USSR Ministry of Agriculture. Other organizations and agencies to take part in the research and elaboration of practical measures aiming at the improvement of the conservation of the species included: workers at the Institute of Evolutionary Morphology and Ecology, USSR Academy of Sciences, Arctic and Antarctic Research Institute and polar stations and observatories, Main Administration of Game Management under the RSFSR Council of Ministers.

Emphasis in this research was given to the analysis of polar bear numbers, the structure of the population, ecology, behaviour and morphology. Most of the results of this research were published in the collection of articles "Polar bear and its conservation in the Soviet Arctic" M., 1977. For this reason, only some additions to the data contained in this publication are given.

Research 1977-78

In Spring 1977, in Wrangel Island and Herald Island, selective counts of dens of pregnant females were made. The results obtained (45 dens in Wrangel Island and 18 in Herald Island) cannot be used for an evaluation of the total number of dens in this area. They do provide new evidence, however, for the dependence of den distribution on ice conditions and the accumulation of snow on land. In fall 1977, a cycle of observations was conducted of females preparing to den.

In 1977-1978, the Central Laboratory on Nature Conservation, USSR Ministry of Agriculture, gathered questionnaire data on the state of polar bear populations in the Soviet Arctic (the correspondents were from polar stations or professional hunters). These data showed that, in winter 1976-1977, polar bears occurred more frequently than usual on the mainland (sometimes very far from the coast). This may have been caused by the unusual ice conditions at this period in the Chukchi and Bering Seas; the movement of big masses of ice (and with it the polar bears) into the Bering Sea through the Bering Strait. Bears moving northwards on land sometimes approached inhabited areas. In the Chukchi Sea, almost the whole surface was covered with ice and this caused the appearance on the coast of a great number of polar bears. These attacked people several times without being provoked.

The Central Laboratory on Nature Conservation, together with the Institute of Marine Geochemistry of the Latvian SSR Academy of Sciences, carried out the first stage of research into the structure of polar bear populations in the Soviet Arctic using geochemical methods. The research was stimulated by the lack of results from the analysis of craniological features and by the need to work out a management strategy for the species.

For this purpose, X-ray fluorescent analysis of bone tissue from 88 polar bear skulls in the Zoological Museum of Moscow University was made on an RA-2 spectrometer. It was noted that the tissues analysed varied very much one from another in their contents of strontium, potassium and iron. Mathematical evaluation of the data (by the direct cumulates or Henry method) showed, for potassium content, that the samples fell into three different groups. Two of these were characteristic of the areas of the Barents and Kara Seas and the

Chukchi and Bering Seas. Samples of tissues from the Laptev and East-Siberian Seas differed from the previous two by the higher contents of potassium. It was possible to note that the difference between the polar bears from the three areas held good for representatives of both sexes and different age groups (2 - 15 years). These preliminary data enable us to conclude that there are in the Soviet Arctic at least three more or less isolated groupings of polar bears located in definite geographical regions.

Plans for future research

During the two years to come and in the remote future it is planned:

(1) To continue work in the Central Laboratory on Nature Conservation where the craniological samples, results of the questionnaire research, etc. are collected. The goals of this research are:

(i) analysis of population structure of the species (together with the craniometric, geochemical and questionnaire data);

(ii) changes in distribution and numbers of the polar bear;

(iii) its importance for the people's economy and its relations with man.

It is desirable that specialists in polar bear research from other countries take part in the work, and that materials from other Arctic regions be used in the analysis of samples (geochemical analysis of bone tissue from Svalbard skulls, from western and eastern coasts of Greenland, from Hudson Bay and from the western Canadian Arctic).

(2) To continue field research both in the eastern and western region of the Soviet Arctic. In particular, it is planned:

(i) to conduct an expedition in Wrangel Island in spring 1979 to count the dens (aerial counts over large areas and scrupulous terrestrial counts in key areas), and to resume tagging of animals;

(ii) to participate in the elaboration of a polar bear research plan for the Zapovednik "Wrangel Island";

(iii) to carry out polar bear field research in summer 1979 in the North of Western Siberia (Yamal peninsula and Beli island).

The goal is to clarify the current status of the local polar bear population.

(3) In spring 1980 it is planned to carry out similar field research and also to count dens and to tag polar bears on the islands of Franz Joseph Land. For the future, it is planned to carry out similar research in the other areas of the Soviet Arctic.

It is reasonable that the IUCN Polar Bear Specialist Group prepare a collective monograph on this species, with data on the current status of separate populations, their ecology, behaviour, etc. and with details of deterrent methods for preventing attacks by polar bears. This problem is becoming more and more important.

Polar bear conservation and management in the USSR

In conformity with national legislation and international agreements, polar bear hunting in the USSR in the period under review was totally prohibited. The exceptions were as follows:

(1) Limited, licensed catch of cubs for zoos, the females being alive and tagged. In 1977, the catch of cubs did not take place in the USSR. In 1978, in Franz Joseph Land, a special team caught 6 cubs. Three females were immobilized and tagged with plastic ear tags. Their numbers are as follows: 05254; 05274; 04647.

(2) Limited polar bear catch, with special permits, for scientific purposes (in the period under review this was not carried out in the USSR).

(3) Self-defence when under attack (in the period under review not more than 10 polar bears were killed).

In effectuating protection of the polar bears, much attention in the USSR was given to public education through periodicals, radio, TV and the cinema.

For the next two years, it is planned to continue the total prohibition of the polar bear hunt in the USSR (except for the cases mentioned above). Improvements in the conservation of the species will be carried out (in addition to mass information) and much attention will be given to planned scientific research and scientific and technical measures in the zapovednik "Wrangel Island", and to the enlargement of the system of protected territories in the Soviet Arctic.

Polar Bear Specialists
Seventh Meeting
Paper No. 6

POLAR BEAR RESEARCH AND MANAGEMENT IN ALASKA, 1977-1978

Douglas P. De Master
National Fish and Wildlife Laboratory
University of Minnesota
U.S. Fish and Wildlife Service

Recent management of polar bears in Alaska

An estimated total of 140 polar bears were harvested in 1977 and 1978 (Table 1) by native Alaskans. This estimate is a minimum estimate as native Alaskans are not legally required to furnish information on bears harvested for subsistence needs. Data from sealed specimens are being accumulated by the Alaska Department of Fish and Game.

Table 1. Estimated polar bear harvest by native Alaskans since the Marine Mammal Protection Act of 1972.

Year	Harvest	Year	Harvest
1973	7	1976	167
1974	50	1977	81
1975	60	1978	59

Future management of polar bears in Alaska

On January 11, 1979, the U.S. Fish and Wildlife Service (USFWS) published in the Federal Register the regulations and conditions which, if acceptable to the State of Alaska, will allow a waiver of the moratorium on the "taking" of polar bears in Alaska. (The proposed waiver would also cover 8 other species of marine mammals in Alaska.) At this time, it is impossible to determine if the published regulations will be acceptable to the State of Alaska, and if so, when management will be returned to the State. A workshop involving the U.S. Fish and Wildlife Service, Marine Mammal Commission, National Marine Fisheries Service, University of Alaska, and the Alaska Department of

Fish and Game was convened in Fairbanks, Alaska (11, 12 and 13 of January 1979) to discuss the proposed research and management program of the state. A report on this workshop is being prepared.

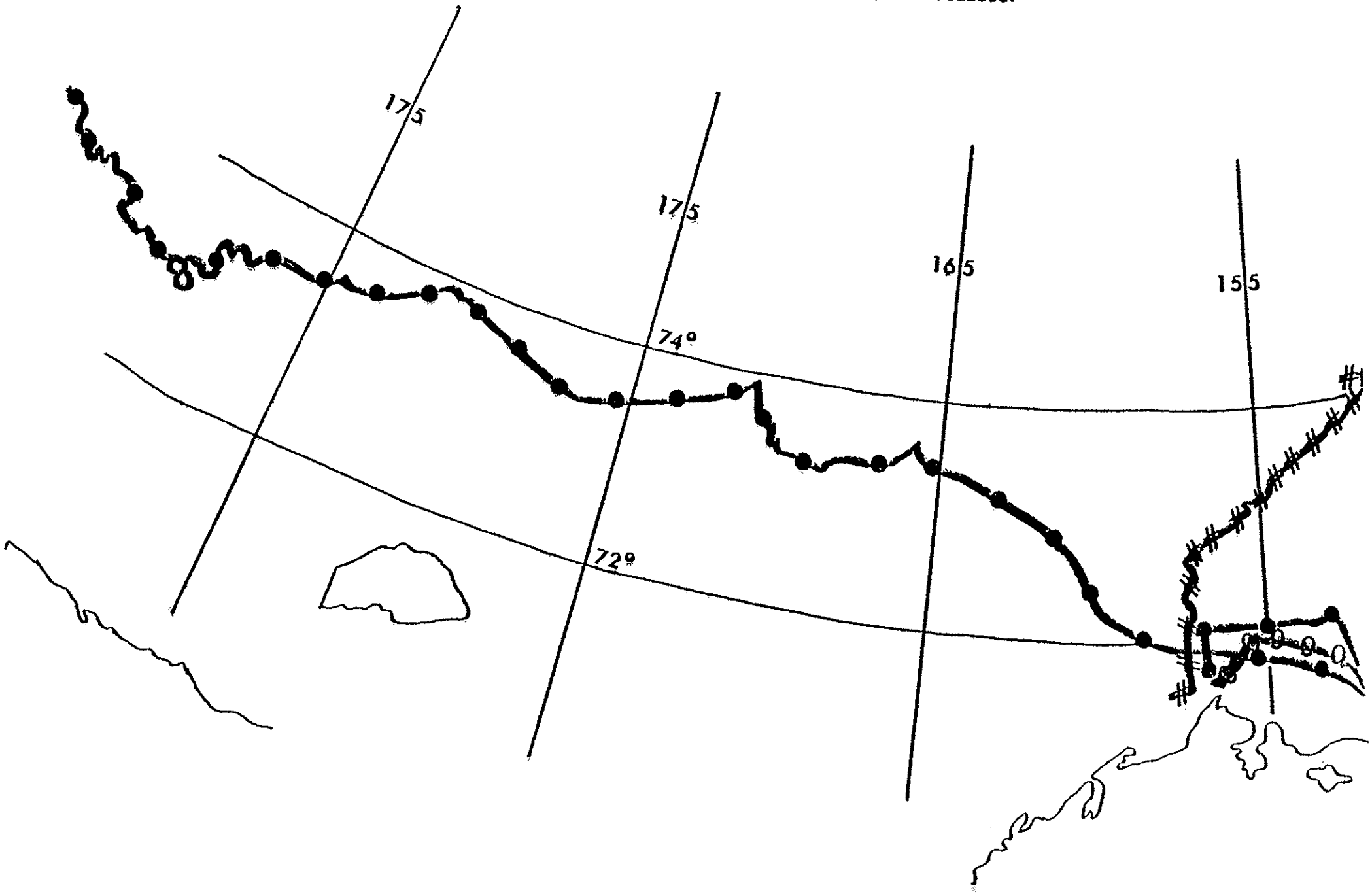
Current research on polar bears in Alaska in 1977 and 1978

In 1977, research by the USFWS on Alaskan polar bears concentrated on developing and initiating a satellite tracking program (Kolz et al., 1978). Three mature female polar bears believed to be in estrous, or possibly pregnant, were fitted with transmitter collars in March and June, 1977. They were subsequently tracked via the Nimbus 6 meteorological satellite for 8, 20, and 390 days, while traveling airline distances of 330, 500, and 1300+ km, respectively, from their release sites (Fig. 1). An overlay of ice maps and positions (4 day interval) from bear 1795 (tracked 390 days) suggests that this bear moved westward along the ice edge (73.5^{o} latitude). In mid-November, the rate of movement for this bear decreased markedly, in an area of relatively stable ice. By mid-April, the pattern of positions suggests that the bear was slowly moving northward. However, at this time the ice in this part of the Chuckchi Sea also moves in a northerly direction, at a rate similar to what was observed for bear 1795. Therefore, we cannot discriminate among the following alternatives:

1) the satellite collar fell off the bear, and is being moved by ice currents;
2) the polar bear has died, and is being moved by ice currents; and
3) the collar is working properly. If the third alternative is true, the changes in rates of movement suggest that this female denned in mid-November (reduced rate of movement) and emerged from her den in mid-April with cubs (increased rate of movement, but less than July-November rate of movement).

Further information regarding direction and rates of ice movement are being analyzed (Sorenson and Lentfer, 1979).

Fig. 1 Map showing movement pattern of three polar bears tracked via satellite.



In 1978, the field program of the USFWS was reduced, and an emphasis on data analysis was initiated. 27 polar bears were marked in the vicinity of Pt. Barrow, Alaska (Table 2). A technique was developed, whereby free ranging polar bears could be marked without having to be immobilized. This involved shooting bears from a helicopter with a dart (Palmer Chemical Co.) that was designed to spray 13 cc of dye over 600 cm^2 of fur. Both black and red dyes (Jamar Chemical Co.) were found suitable to mark bears so as individuals could be recognized. One such marked bear was resighted 3 days later with the mark still clearly visible. These "marker darts" were intended to enable us to mark up to 20 animals a day, and, over a 3 week period, allow a single season mark/recapture estimate of a local population. However, densities in the Point Barrow area were such that even with this technique for rapidly marking individuals, large enough sample sizes could not be obtained.

Table 2. Summary of polar bears that were captured and released by the U.S. Fish and Wildlife Service in 1977 and 1978 in Alaska (Pt. Barrow).

	Total captured	Number recaptured	Adult females	Adult males	Cubs Coy	Cubs Yrl.	Cubs Two
1977	4	0	4	0	0	0	0
1978	27	9	12	10	4	1	0

The analysis of existing data involved an initial appraisal of existing techniques and the development of new techniques, when necessary. A standard format was developed to estimate the age of first reproduction and the conditional probability that a female, of age i, produces cubs, given that she does not have yearlings or two year olds (Table 3). In addition, a system of equations was developed that relates the reproductive success of females, annual cub survivorship, and breeding interval to one another (that is data on any two variables, allows

Table 3. Estimating average age of 1st reproduction for Alaskan polar bears

(Age i)	Total Females i	Females w yrl i	Females w two i	Avail. i	Females w yrl i+1	P(litter prod /avail.)i	P (1st litter)i	i(P 1st litter) i
3	51	0	0	51	0	0.0	0.0	0.0
4	51	0	0	51	0	0.0	0.0	0.0
5	51	0	0	51	7	.156	.156	.78
6	34	7	2	25	11	.500	.344	2.064
7	36	11	4	21	17	.920	.298	2.086
8	53	17	15	21	12	.649	.161	1.288
9	32	12	12	8	10	1.430	.033	.297
10	24	10	3	11	4	.413	.007	.070
11	18	4	8	6	3	.568	.001	.011
	162	70		84	59	.798		
12	12	3	4	5	2	.455	--	--
13	13	2	6	5	2	.455	--	--
14	5	2	0	3	5	1.894	--	--
15	10	5	3	2	1	.568	--	--
16	2	1	0	1	2	2.273	--	--
17	3	2	-	1	1	1.136	--	--
18	2	1	0	1	--	--	--	--
	349	77						$\bar{x}$ = 6.596

$$P(\text{litter production/avail}) = \frac{\text{number of females with yearlings } i+1}{(\text{number of females available})_i \cdot \phi}$$

ϕ = .88

$$P(\text{avail}) = \frac{\text{number available females } i}{\text{total females } i}$$

Table 4. Summary of average breeding interval (in years) for 6 different models

	Annual Survival of Cubs				
	.80	.85	.90	.95	1.0
Model 1	2.960	2.978	2.990	2.998	3.000
Model 2	2.830	2.901	2.954	2.989	3.000
Model 3	2.895	2.939	2.972	2.993	3.000
Model 4	3.260	3.277	3.290	3.297	3.300
Model 5	3.130	3.200	3.254	3.287	3.300
Model 6	3.196	3.239	3.271	3.292	3.300

the value of the third variable to be estimated - Table 4). Further evaluation of analysis techniques is necessary to provide an understanding of how robust different estimates are, and under which circumstances a particular estimator is best.

In addition to studies by the USFWS, the Alaska Department of Fish and Game continued research programs concerning predation by polar bears on ringed seals, and denning habits of polar bears in 1977 and 1978.

Future research on polar bears in Alaska

The USFWS's polar bear study in 1979 will undertake a program which contains mark-recapture work to evaluate population parameters such as age of 1st reproduction, reproductive success, survival and mean litter size. The program also employs radio telemetry (4 satellite packages and 20 radio frequency collars) to investigate daily and seasonal movement patterns, and it begins to delineate relationships at the community level in the Alaskan Arctic. Generally the community-oriented work is intended as supplemental to the primary objectives i.e., to delineate population parameters and movement patterns of Alaskan polar bears.

References

Kolz, A. L., J.W. Lentfer, and H. G. Fallek. 1978. Polar bear tracking via satellite. Presented at the 15th Annual Rock Mountain Bioengineering Symposium. Ames, Iowa. April, 1978.

Sorenson, F. and J. W. Lentfer. 1979. Interpretation of the movements of a polar bear tracked via satellite (in preparation).

Polar Bear Specialists
Seventh Meeting
Paper No. 7

THE EFFECTS OF HUMAN MENSTRUATION AND OTHER SUBSTANCES ON POLAR BEARS - INTERIM REPORT

Bruce S. Cushing
University of Montana, Missoula 59812

Abstract: Preliminary results indicate that menstrual odors of the human female may act as an attractant to polar bears (Ursus maritimus). In laboratory and field tests, used tampons elicited a stronger bear response than any other test stimuli except for seal oil and seal blubber. Tests also indicate that seal scents are valid to use as a baseline criterion for an indication of relative attractiveness.

Introduction

With the increasing contact between people and bears it is becoming ever more important to understand what types of products might lead to conflicts. By learning more about the animals and what attracts them, it may be possible to reduce these conflicts and thereby benefit both man and animal.

There are several aspects of humans that have been postulated as possible attractants to bears. One of these is that of a menstruating female (Glacier National Park 1967). This question, "Does a menstruating female attract bears?", is of great interest. For years, both the National Park Service and the U.S. Forest Service, have advised in brochures that women should not go into the back-country during their period in order to prevent conflicts with bears. This theory has never been tested, and with the increasing number of men and women backpacking and camping this question becomes one of particular worth to investigate. The question has another aspect also. That of the possibility of an interaction between different species of mammals caused by scents or even pheromones. Menstrual odors and their

effects on bears is not the only possible attractant that will be investigated, but it is the major initial thrust of this research.

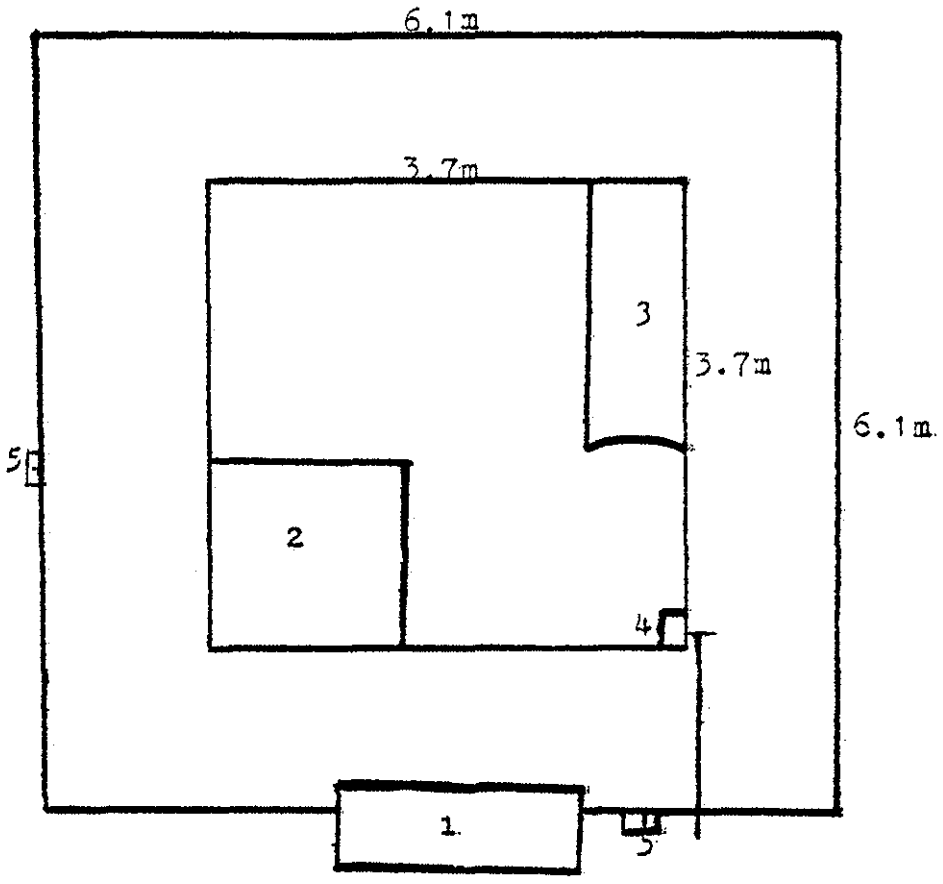
Attractants to animals above the level of the Insecta are very difficult to work with because of the problem involved in attempting to define what an attractant is for an individual species. This difficulty makes the polar bear an excellent species to use for an attractant study, because during the year the bears' major source of food is the seal. The polar bear uses sight, scent, and possibly hearing to locate lairs or the seals (Stirling 1974, Smith and Stirling 1975, Stirling 1973). Seals can therefore, in a sense, be considered as a natural attractant for the polar bear. The bears' various responses to the sounds and odors of the seal can be used as a baseline criterion to determine what other stimuli may also be acting as attractants.

Materials and Methods

The study consisted of a laboratory and a field phase. The laboratory portion was conducted at the Churchill Bear Laboratory located in Churchill, Manitoba. The animals were captured in the wild and then placed in a cage room (see diagram) in the laboratory. The bears were allowed at least one week to adjust to such things as walking on bars. Heart rate and temperature transmitters were then implanted into the bears. After allowing for a recovery period, basal observations were begun. Basal observations consisted of observing but not disturbing the bears over 5 days for a total time of 40 hours. The observations were broken up into blocks ranging from 4 to 10 hours, covering all hours of the night and day. Behavioral and physiological observations were recorded for a one minute period every 10 minutes.

Upon completion of the basal measurements, testing was begun. Test stimuli were presented to the bears once or twice daily for a period of

Cage Room



1) Observation booth
2) Plate
3) Culvert or artificial den
4) Water trough
5) Fan box

25 days. Observations of the bears' behavior began one hour prior to testing and continued for an hour after completion of the test run. The test stimuli were presented to the animals for a period of 20 minutes. During the test run, behavior of the bears was recorded at every minute mark for a duration of 10 seconds, as was any change in behavior between times. Heart rate was monitored throughout the test run with skin and deep body temperature taken every two minutes.

Scents or odors were presented to the bears by placing the scent material in a fan box located outside the room. At test time, the fan was started, controlled from the observation booth, and run for 20 minutes, slowly spreading the odor into the cage area. Not all of the tests were run this way, since the menstruation tests using female volunteers were conducted with the subject in the cage room. The volunteers came in during and before their periods and sat passively for the duration of the test run.

The field phase was of short duration, lasting 5 days. Work was conducted at the Gordon Point tower which is located 15 km east of the Laboratory. Work was done with the cooperation of Don Wooldridge, who is conducting a study of bear deterrents and detection systems for the Fish and Wildlife Service of the Northwest Territories. Two bait stations were set up. Within each bait station were at least two samples. These consisted of one known attractant (seal oil or sardine mash used by Wooldridge as bait) and a test stimuli. The seal oil was placed in a quantity of no more than one tablespoon, but the sardine mash was used liberally. Numbers of bears, numbers of visits, duration of responses, and behavioral response to the test stimuli were compared to that of the known attractant.

Results

The results are divided into laboratory (see Table I) and field (see Tables II and III). In the laboratory, testing was completed on two animals. Bear No. 1, a 4.5 to 5.5-year-old female weighing 204.5 kg, and Bear No. 2, a 12.5-year-old female weighing 272.7 kg. The behavioral responses ranged from none to actively tracking the scent to its source. The duration of the response never exceeded 64 seconds or 5.3 percent of the test run. After the response, the bears returned to activities that were known to occur when there was no test being run. Only three stimuli produced a strong or maximal effect on both bears. These were seal blubber, seal oil, and a used tampon.

The field results consisted of 37 approaches to the two sites by 10 different individuals. Since there was often more than one stimulus present, the 37 approaches added up to 47 samples. The bears approached the test sites from downwind or by turning when crossing the scent in the wind 70 percent of the time, and 30 percent from accidentally crossing the site or using visual clues. Sardine mash was present at both sites for all approaches. The sardine mash was approached first 53 percent of the time. When available, the seal oil was approached first 78 percent of the time, followed next by used tampons 67 percent.

Table II shows the number and type of responses by the bears. Like seal oil, the sardine mash was consumed 100 percent of the time unless it was undetected, with used tampons being consumed 67 percent, which was by four different bears. The only other consumption was of one of the control tampons. This occurred immediately after the consumption of a used tampon by the same individual.

Table I

Test Stimuli	Bear No. 1	Bear No. 2
Animal scents		
castoreum	mod	min
chicken (liquid)	none	none
decaying meat (beef)	min	mod
horse manure (liquid)	none	min
musk	min	min
sardine mash	-	none
seafood (liquid)	none	none
seal blubber	str	str
seal oil	str	str
Controls		
blood (bear)	none	none
fan boxes	none	none
non-menstruating 1	min	mod
non-menstruating 2	none	-
non-menstruating	min	-
sanitary napkin	-	none
tampon	none	none
Menstruation		
female 1	mod	*mod+
female 2	mod	min
female 3	mod	-
sanitary napkin	-	**min
tampon	str	min+
tampon	als	str
Miscellaneous		
bear trail	min	-
seal model	mod	mod
seal model/oil	none	none
treated fabric	-	none

Key

min = Sniffs air 1 to 3 times. Total time less than 8 seconds.

min+ = No movement towards scent but sniffs air many times. 20 seconds or more.

mod = Approaches area from which the odor is being emitted. Sniffs air many times but only in area in front of fan.

mod+ = Similar to mod, but approaches area and sniffs more than one time during test run.

str = Sniffs air several times and then appears to track scent directly to source. Places muzzle through bars and sniffs deeply. Duration 20 to 60 seconds.

* After response, turned and pounced in air at subject.

** Mentrual flow was dry.

Table II + III

Test Stimuli	Response 1	2	3	4	5	6	Total
Castoreum	2	1	1	-	-	-	4
Musk	-	-	-	-	1	2	3
Seal oil	-	-	-	9	2	-	11
Blood	6	-	-	-	-	3	9
Tampon	2	1	1	8	1	-	13
Control tampon	3	-	-	1	-	3	7
							47

Average Duration in Sec.

Test Stimuli	Response 1	2	3	4	5	6
Castoreum	9	16	12	-	-	-
Musk	-	-	-	-	0	0
Seal oil	-	-	-	129*	0	-
Blood	11.5	-	-	-	-	0
Tampon	15.5	16	29	88.5	0	-
Control tampon	19.3	-	-	22	-	0

* Excludes average of 41 for times when there was consumption after site had been visited without further rebaiting.

Response

1. Sniffs
2. Sniffs and licks
3. Chews (does not consume)
4. Consumes
5. No detection (not downwind)
6. Ignores (passes downwind)

Table III has the average duration of response time, excluding the sardine mash. This is because the sardine mash was placed in large quantities and varied from one re-baiting to the next. In general, duration of response was for only a short period, less than 20 seconds. The bears then went to other stimuli, or left the area, depending upon whether the short-term stimulus was approached first or after the other stimuli.

Discussion

In order to undertake a proper study of attractants it is essential to have a substance which can be defined as an attractant. This study was begun with the assumption that the seal or seal products fulfilled this requirement. The laboratory and field results confirm this premise. Also, both animals in captivity were fed a variety of meats. When presented with a mixture of meats, both Bears No. 1 and 2 sorted out the seal meat and consumed it before eating the other kinds of meat.

Although both physiological and behavioral responses were recorded in the laboratory, only the behavioral results are contained in this report. There were difficulties with the heart rate transmitters in that after a short period of time in the animals they malfunctioned. Heart rates were obtained only from Bear No. 1, and these for less than half the test trials.

The heart rate does appear to be useful in analysing the bears' responses. If for no other reason, the change in pattern of the beat can be used to indicate when the animal is asleep (see Table I, Bear No. 1 tampon als) at which time no response would be expected. The changes in skin and body temperature appear to be related to physical

activity, and it also appears that there is no correlation between change in temperature and a response to an attractant.

There is a strong correlation between the bears in the laboratory and those in the wild. The seal oil elicited a strong response in the laboratory and consumption in the field. Used tampons also followed a similar pattern, however, in this case there was a variance in responses, which indicates that while all bears are attracted by seal, a response to menstrual odors may be dependent upon variances in individual odors or bears.

The design of the field experiment does not permit the conclusion that menstrual odors alone will attract bears. This is because there were a variety of scents in the wind. However, once the animals were within 10 m, it was evident that some of the bears were going selectively to the used tampons. This is backed up by at least five occurrences of the bears turning and going directly to the tampon after crossing its scent in the wind. The bears could be seen to stop, raise their heads to the wind, sniff several times, and then track the scent to its source. These results are consistent with the strong response noted in the laboratory. The high percentage of the time that tampons were approached first should also be noted.

Preliminary results of this study strongly suggest that further experimentation should be undertaken. The results indicate that if a bear were in an area of a menstruating female that conflict could arise. Further experimentation should have an emphasis on a design to determine whether or not menstrual odors by themselves will attract bears. There does seem to be an indication that this may be true based upon the laboratory results.

References Cited

Glacier National Park. 1967. Grizzly bear attacks at Granite Park and Trout Lake in Glacier National Park, August 13, 1967. pp. 22; in Herrero, S. 1976. Grizzly bears and people in the National Parks. Alberta Wilderness Association Newsletter. pp.17.

Smith, T. G. and I. Stirling. 1975. In breeding habitat of the ringed seal (Phoca hispida) the birth lair and associated structures. Can. J. Zool. 53(9): 1297-1305.

Stirling, I. 1973. Vocalization in the ringed seal. J. Fish. Res. Board of Can. 30(10): 1592-1594.

1974. Midsummer observations on the behavior of wild polar bears. Can. J. Zool. 52(9): 1191-1198.

ARKTISK INSTITUT

L. E. Bruuns Vej 10 · 2920 Charlottenlund · Denmark

TELEFON: ORDRUP 543 · GIRO 81560

IUCN Polar Bear Specialist Group
Meeting January 1979

February 1st, 1979

Dr. Olaf Loken
Chairman,
E.A.M.E.S. Management Committee,
Northern Environmental Protection Branch,
Department of Indian and Northern Affairs,
Ottawa,
Canada

Dear Dr. Loken,

As a result of the recent controversy in Canada over research on the effects of oil on Polar Bears, the I.U.C.N. Polar Bear Specialist Group undertook a complete and in-depth discussion of both the subject area and the specific proposal at hand. We concluded unanimously that there is a need for research on this subject to develop contingency plans or otherwise act in the event of an oil spill. We further concluded that the proposal by Dr. Øritsland to investigate the subject is scientifically valid.

The imperative for these studies is enhanced by the rapid development of hydrocarbon resources in arctic waters as well as our almost total ignorance of the consequences of oil on polar bears. At our present level of knowledge, we cannot make informed decisions to save polar bears, in the event of an oil spill, and as such it is difficult to conform with the intent of the International agreement on the conservation of Polar Bears.

Sincerely,

Chr. Vibe.

Chr. Vibe
Chairman/Dr. philos.

ANNEX 2

ZOOLOGISK MUSEUM

UNIVERSITETSPARKEN 15
DK 2100 KØBENHAVN · DANMARK
TELF. (01) 35 41 11

IUCN Polar Bear
Specialists Group

The Director-General
International Union for the Conservation
of Nature
1110 Morges - CH

2nd February 1979

Dear Sir,

As you are aware, the final conference for the preparation of the Agreement on the Conservation of Polar Bears was held in Oslo, Norway, in 1973, at which time the five contracting parties became signatories. The instruments of ratification were deposited with the Government of Norway and the Agreement came into effect, for an initial period of five years, in May 1976.

According to Article X, Section 5, any of the contracting parties may request termination of the Agreement, so the Government of Norway is considering taking the initiative and inviting the contracting parties to meet in Oslo in 1980, one year before the expiring of the initial five year period of the Agreement, in order to discuss its future. Thus the Government of Norway asked the IUCN Polar Bear Specialists Group to evaluate unofficially and informally the idea of a meeting of the contracting parties in 1980 to discuss the Agreement. We have discussed the Norwegian proposal at our meeting in Copenhagen on 30th January - 1st February and concluded that such a conference could be beneficial in achieving the objectives of the Agreement. Furthermore we suggest that the other matters relating to conservation problems in the polar basin be discussed at the same time.

Because we are a technical and not a legal or political group, we would request that the IUCN convey the results of our unofficial and informal discussion to the Minister of the Environment in the Government of Norway in Oslo.

Yours sincerely,

Chr. Vibe.

Christian Vibe
Chairman.

SIXTH WORKING MEETING OF POLAR BEAR SPECIALISTS

CONTENTS

LIST OF PARTICIPANTS

Chairman

Dr. John S. Tener
Assistant Deputy Minister
Environmental Management Service
Ottawa, Ontario K1A 0H3
Canada

Members Present:

Dr. G.B. Kolenosky
Research Scientist
Fish and Wildlife Research Branch
Ministry of Natural Resources
P.O. Box 50
Maple, Ontario L0J 1E0
Canada

Mr. Thor Larsen
Norsk Polarinstitutt
Rolvstangveien 12
Box 158
1330 Oslo Lufthavn
Norway

Mr. Jack W. Lentfer
U.S. Department of the Interior
Fish and Wildlife Service
National Fish and Wildlife Laboratory
Anchorage Field Station
4454 Business Park Boulevard
Anchorage, Alaska 99503
USA

Dr Ian Stirling
Research Scientist
Environment Canada
Room 1110
10025 Jasper Avenue
Edmonton, Alberta T5J 1S6
Canada

Mr. Hans A. Støen
Ministry of Environment
P.O. Box 8013
Oslo Dep.
Oslo 1
Norway

Dr. S.M. Uspenski
Chief, Arctic Ecosystem Division
Central Laboratory on Nature Conservation
Ministry of Agriculture of USSR
Estate Znamenskoye - Sadki
142790 PO Vilar
Moscow Region
USSR

Dr. Chr. Vibe
Zoological Museum
Universitetsparken 15
2100 Copenhagen
Denmark

By Invitation:

Dr. Fred Bunnell
University of British Columbia
6270 University Boulevard
Vancouver, B.C. V6T 1W5
Canada

Dr. Charles Jonkel
School of Forestry
University of Montana
Missoula, Montana 59801
USA

Dr. Nils A. Øritsland
Institute of Zoophysiology
University of Oslo
P.O. Box 1051
Blindern
Oslo
Norway

SUMMARY OF THE MEETING

Welcome and Introductory Business

The sixth meeting of the IUCN Polar Bear Specialist Group was convened by Dr. John Tener on 7 December 1976 at IUCN headquarters in Morges. Dr. Colin Holloway of IUCN welcomed participants on behalf of Dr. Duncan Poore, Acting Director General, who was out of the country and expressed regrets at being unable to attend the Polar Bear Meeting. Dr. Holloway stated that the Polar Bear Group was an active group and one which IUCN followed with particular interest. He referred to the Group's original charter and stated that many original objectives had been or were being met. He also referred to the increased emphasis on research now that the Agreement on Conservation of Polar Bears has become effective.

A wire signed by Dr. Peter Scott was received stating that the chairman and members of the Survival Service Commission who were meeting in Mexico sent their warmest wishes for a successful meeting.

Dr. Holloway and Dr. Pierre Hunkeler offered the full services of IUCN during the session. Dr. Hunkeler met with the Group during all their sessions.

Mr. Jack Lentfer was selected as rapporteur and Dr. Charles Jonkel volunteered to assist. Resolutions were to be prepared as topics arose. Mr. Lentfer, Dr. Jonkel, and Dr. Tener were to prepare a news release at the conclusion of the meeting.

Unfinished Business of the Fifth Meeting, Morges - 1974

Mr. Thor Larsen reminded the Group that it had asked IUCN to contact the IUCN Seal Group to encourage increased research on ringed seals. The Group agreed to again request IUCN to do this.

The Group at the last meeting recommended after the Polar Bear Agreement became effective that IUCN request non-member governments whose nationals might have an interest and capability to harvest polar bears and deal in trade of skins to take necessary steps to insure that their nationals abide by provisions of the Agreement relating to harvest and trade and traffic in skins. Now that the Agreement is in effect, the Group agreed that IUCN should formally contact non-member countries in this regard.

Publication of polar bear books was discussed. Since the last meeting Dr. Jonkel has discussed with Miss Moira Warland the possibility of her preparing a summary of the status of polar bears in the various countries with information to be supplied by Group members. Information for such a book was provided to IUCN by some members after the 1970 meeting. However, copies of the information were not made in some cases, and with changes in personnel, some of the information has been lost. Thus Group members would again have to provide information for the book. Dr. Vibe had also talked to Miss Warland and said she would need some financial support if she were to write a book.

Mr. Lentfer reported that he had contacted Dr. Richard Cooley regarding Dr. Cooley's writing a book on the history of the Polar Bear Group. Dr. Cooley would very much like to do this but has so many other involvements that he will not be able to in the near future and was not certain if he could even do it at some distant time in the future. There was considerable discussion on what form such a history might take and what value it would have. The Group agreed that a summary of events leading to the formation of the Group and the Polar Bear Agreement would have value, especially in relation to formation of similar groups for other arctic species. The Group also agreed that the new chairman should contact Dr. Cooley to get his most recent thoughts on writing a book and if he could not do so by himself, the possibility of collaborating with another author or making his notes available. It was further agreed that the book should be reviewed by members of the Group before publication.

Dr. Savva Uspenski suggested two possibilities for books to be published in English and Russian. One would be a series of articles by different authors published together to provide a history. The other would be a scientific monograph with different sections by different authors.

Mr. Larsen mentioned a possible source of funds for a book from the sale of another polar bear book which he and Wolfgang Naegeli have collaborated on. This book is ready for publication but a publisher has not yet been selected. If delays continue, Mr. Larsen suggested that the Polar Bear Group consider recommending

a publisher. It was also suggested that IUCN which has experience in publishing be kept advised of the status of the book.

Morphometric studies by Mr. Tom Manning of Canada were discussed. Dr. Jonkel said Mr. Manning would probably not be doing any more morphometric studies. Dr. Stirling agreed but also said Mr. Manning might possibly continue if funds were available.

The Group was concerned in 1974 about the Cominco mining operation north of Disco Island which was reportedly dumping mine wastes and effluent into the sea. Dr. Vibe now reported that this is an open-water area and not important for polar bears. Mining is occurring and possible ecological damage is being investigated. Dr. Jonkel reminded Dr. Vibe that the currents flowed northward and then to the Canadian Arctic Islands from the mine site, and that contaminants could thereby harm the food chain.

Dr. Nils Øritsland, an invited participant, stated that funding for his research is better than it was two years ago, perhaps due in part to a resolution which the Group passed pointing out the significance of his work and need for continued funding.

Mr. Larsen reminded the group that scat collections were available from different areas and their analyses would be a suitable study for a graduate student. These collections have been made by Mr. Larsen in Spitsbergen, Drs. Jonkel and Stirling in Canada, and Northwest Territories workers in Canada. Dr. Jonkel offered to do the scat analyses if the various jurisdictions concurred.

Mr. Larsen pointed out that nothing new had been done on the polar bear range and habitat map during the past two years. The form such a map should take may become better defined as plans progress for a polar bear book.

Research Progress Reports by Countries, 1974-76

Canada

Dr. Stirling and Mr. George Kolenosky distributed a research report by Stirling, Kolenosky, Schweinsburg, Juniper, Robertson and Luttich. Cooperative projects where more than one agency is involved include the Arctic Island Pipeline Project; studies in

south Baffin Island, northern Quebec and northern Labrador; and computerization of data. There are also a number of single agency projects. The Canadian Wildlife Service is studying polar bear ecology in the western Canadian Arctic, behaviour of free-ranging bears, and ecological relationships of bears and their environment. The Northwest Territories is conducting studies in the Central Arctic (Hadley Bay, M'c Clintock Channel, and Victoria Strait) and Northwest Baffin Island. They are also monitoring pollutants in polar bears and conducting ground productivity and denning surveys in certain areas. Ontario is making aerial surveys along the Hudson Bay coast and conducting denning and productivity studies. Manitoba is making aerial surveys and tagging at Churchill. Quebec is making denning surveys and some counts of bears. Newfoundland is recording bears seen on aerial and boat surveys. The Federal-Provincial Technical Polar Bear Committee coordinates work among the various investigators and defines research needs. One particular need is a standardized method for recording hide seal numbers.

Denmark

Dr. Christian Vibe distributed reports and described the third Danish expedition to study polar bears in July and August 1975. Based on the recapture of females and mortality of accompanying young, Dr. Vibe thought conditions for polar bear survival were poor in 1974-75. He put forth the hypothesis of two separate groups of East Greenland bears, one associated with land and one associated with drift ice. He based this on the fact that previously marked animals are captured close to land but not in drift ice, and that bears in fjords are afraid of men and ships but bears in drift ice are not. Few younger bears are captured in southern Greenland and Dr. Vibe believes that southern Greenland does not support denning. Chinook winds and rain may be one reason. White fox are not common in southern Greenland but they do occur, possibly because they follow polar bears. Dr. Vibe also hypothesized that bears that reach southern Greenland may come from the Soviet sector, possibly the New Siberian Islands. They may not go ashore on Spitsbergen and northeast Greenland because bears already there exhibit territoriality, and the drift ice bears tend to stay with

the drift ice which is their biotype. Dr. Vibe suggested that one way to check this hypothesis would be a tagging programme in the central Soviet Arctic. He also said that in recent years it has been cold in Canada and there may have been an associated movement of Canadian bears to northwest Greenland. Three Canadian tagged bears have been killed in northwest Greenland.

Dr. Uspenski inquired about snow conditions. There was heavy snow in east Greenland in March, April, and May 1973 and 1974. Snowfall was light in the spring of 1975 based on muskox calf survival. Dr. Vibe also mentioned that Spitsbergen ice-thickness data are published by the Norwegian Polar Institute. In response to a question by Dr. Uspenski about age composition of bears that might travel from the New Siberian Islands to east Greenland, Dr. Vibe stated that there were no cubs among the bears which reach southeast Greenland. Eskimos say that cubs are lost when the female polar bear swims under thin ice. Mr. Larsen pointed out that denning areas in a region may go undetected for long periods and suggested there that the possibility of denning in southern Greenland should not yet be ruled out completely.

Norway

Mr. Larsen distributed a research progress report. Research has been greatly reduced since hunting stopped in 1973. Counts of polar bears and dens from the ground with snowmachines along the north coast of Nordaustlandet in 1976 resulted in observation of 45 polar bears and indication of at least 10 maternity dens. Nordaustlandet is probably an important denning area but not as important as Kong Karls Land. Skulls from 29 bears which probably died from natural causes were collected on Kong Karls Land and Nordaustlandet and have provided some indication of sex and age composition. Dr. Terry Dobson is examining 20 enzyme components in blood serum by electrophoresis. Mr. Larsen will send reports to Group members. Future plans include study of polar bear behaviour in Spitsbergen and possibly cooperative work with the Soviets which has been under consideration for some time.

United States of America

Mr. Lentfer distributed a research progress report. With passage of the Marine Mammal Protection Act, the State of Alaska

stopped research and the U.S. Fish and Wildlife Service increased its research effort on polar bears. Research is directed primarily at obtaining information which can be used to evaluate and make recommendations on effects of development and hunting. Animals are being marked and recaptured to obtain data on population size, composition, distribution, reproductive rate, and movements. Denning and reproductive biology are being studied. Technology is being developed to provide for tracking of animals from a satellite. A report has been prepared on environmental contaminants and parasites in bears.

The U.S. Fish and Wildlife Service also funded a study of polar bear predation on seals by the Alaska Department of Fish and Game.

In response to questions about radio-tracking, Mr. Lentfer said that a prototype transmitter provided accurate location fixes via satellite and functioned for at least eight days on a free-ranging bear. A redesigned smaller and lighter unit will be tested in the spring of 1977. Work is being done at government expense and technology will be available to the scientific community. Mr. Lentfer will keep the Group informed of the progress of this programme.

U.S.S.R.

Dr. Uspenski distributed a report by Uspenski, Belikov, and Kupriyanov. Most studies have been conducted by the Central Laboratory on Nature Conservation but other groups have also done some work. Chukchi Sea field studies are complete and data are now to be analyzed and reports prepared. Polar bear work will be continued in a new reserve which includes Wrangel and Herald Islands and part of the Chukotsk Peninsula. Polar bear tagging was continued on Wrangel Island in 1975 and 1976. Only one previously-tagged animal has been recaptured, perhaps because relatively few animals have been captured. This was a female with a broken ear tag which did not provide for positive identification other than having been originally tagged in Alaska or Canada. Model plots have been established so that aerial and ground counts can be made in the same areas, and counts can be

repeated in successive years. The weights of females and cubs have diminished during the last four years. Dr. Uspenski had no explanation but stated that it was something that should be watched closely. Wrangel Island had unfavourable ice conditions and little snow in the fall of 1975 and significantly fewer bears that denned there than in previous years. Herald Island had deep snow and an increased number of denning bears during the same period. Future research plans include field studies in the central and western Soviet Arctic and analysis of a new collection of 150 skulls from the North Yamal Peninsula.

In response to questions about den counting, Dr. Uspenski stated that surveys are made on about 25 March and 5 April after the massive break-out period from dens. Maternity and temporary dens cannot be distinguished from the air. In model plots where dens were counted both from the air and ground, about 25 percent of all dens were counted from aircraft. Based on the aerial survey and the plot sample on the ground 250-300 dens were estimated for the area. Obscuring of dens by blowing snow is a major problem.

Dr. Stirling had questions about deaths of cubs in dens. Dr. Uspenski believes that females kill cubs when shallow snow depth causes bears to become stressed. Dr. Stirling stated that weights of females and cubs are probably correlated and may also be correlated with snow depth. Dr. Øritsland said that in relation to energetics, distance of the den above ground, which is a heat source, should be measured as well as snow depth above the den.

Conservation Reports by Countries, 1974-76

Canada

Legislative changes, most resulting from ratification of the Agreement on Conservation of Polar Bears and the Convention on International Trade in Endangered Species of Wild Fauna and Flora, are summarized by Stirling and Smith in these Proceedings. The Federal-Provincial Technical and Administrative Committees continued to meet in 1975 and 1976 to discuss research results and management recommendations. Kill figures for the last two years and quotas for 1976-77 are also presented by Stirling and Smith in these Proceedings (see Paper No. 1).

Denmark

Although Denmark intends to ratify the Polar Bear Agreement it has not done so yet because of technicalities involved with putting regulations into effect which conform to the Agreement. Dr. Vibe described the Conservation Act for Greenland which established a national park in northeast Greenland providing total protection to polar bears. There was some discussion on access to parks and it was generally agreed that there must be access, probably by aircraft to established locations. In Greenland the use of aircraft will be necessary if the military protects the parks as is being considered now.

Norway

Approximately 40 percent of the land area on Spitsbergen is protected by Royal Decree establishing national parks, nature reserves, and bird sanctuaries. This provides protection for most of the polar bear habitat. Recent drilling indicates low potential for oil and gas in areas originally not protected because it was believed they had oil and gas potential. These areas may now also receive protection. Norway has ratified the Agreement on Conservation of Polar Bears and the Convention on International Trade in Endangered Species of Wild Fauna and Flora. A proposal for new hunting regulations will protect all species on Spitsbergen except certain species listed with a specified hunting season. Polar bears will continue to receive complete protection and there is uncertainty as to what will happen when the present five-year moratorium on hunting expires. There is much feeling in Norway against opening Spitsbergen to hunting of polar bears again but there is also some feeling for the resumption of hunting. Research needed as a basis for recommendations is not being done at present. Since hunting has stopped there have been some serious bear-people encounters. Eight bears have been killed and hides which are the property of the state have been offered to museums and study groups. There is some pressure for compensation for damages from bears. Dr. Uspenski asked the best way to protect people and Mr. Hans Stöen mentioned standard procedures of proper care of garbage, educating people, and using dogs for warning. He also said that bears posing serious problems should be shot; it is a mistake to protect bears to the extent that serious accidents occur to people as public feeling could then go against bears.

United States of America

Polar bear management is still the responsibility of the U.S. Interior Department as provided for by the Marine Mammal Protection Act, but a request by the State of Alaska to have management responsibility returned to the State is under review. It is quite possible that management could be returned to the State within a year. The proposed State programme would provide for both recreational and subsistence hunting with an open season from 1 January through 31 May. The Marine Mammal Act allows only Natives to harvest bears. The kill was substantially higher in 1975 and 1976 partly because heavy ice made more bears available to Chukchi and northern Bering Sea villages. Also cessation of aircraft hunting and resulting reductions in harvest may have caused the population to increase and eliminated disturbing factors which formerly tended to keep bears away from the coast. The Agreement on Conservation of Polar Bears has been ratified and ratification deposited with Norway. A major management problem exists because there is potential for oil and gas development along much of Alaska's north coast. Recommendations are being developed which if followed would tend to minimize impact.

U.S.S.R.

The U.S.S.R. has ratified the Agreement on Conservation of Polar Bears and the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Wrangel and Herald Islands were designated as State refuges in 1976. In response to a question by Mr. Stöen, Dr. Uspenski stated that managers in Soviet reserves may stop or restrict all human activity including research. In response to a question by Dr. Jonkel, Dr. Uspenski stated that reserves have many similarities to international parks but also some differences. For example, parks allow visitors but reserves do not.

Activities of Invited Participants

Churchill Studies

Drs. Øritsland and Jonkel reported on work at Churchill, Manitoba which has been underway since 1972. A manuscript on hematology of 36 bears has been submitted for publication and a review paper on remote sensing has been prepared. Effects of oil on seal and polar bear fur has been studied. Oil amplifies heating effect of solar

radiation on seal fur and does not significantly reduce insulating value of polar bear summer fur. Norman Wells crude oil was used for these tests, and perhaps oil from the Beaufort Sea would have a different viscosity and a different effect on fur. A student, Paul Watts, is studying bear denning at Churchill. Objectives are to make metabolic measurements of a polar bear in an artificial denning chamber and thereby gain insight to the characteristics of the denning area. Subsequent studies will be done in the denning area, utilizing bears denned in natural dens. A re-transmittal system will be essential for these studies.

Dr. Uspenski referred to the interesting work in Churchill and stated that Soviet workers are interested and might like to participate. Dr. Øritsland stated that Soviet scientists would be welcome to participate and suggested that a letter from the Soviets indicating their interest and desire be sent, as the first step.

Modelling and Population Projection

Drs. Fred Bunnell and Nils Øritsland led the discussion. Two reasons for modelling are to determine numbers of animals which can be removed from a population either by hunting or because of habitat changes and to guide research. Dr. Bunnell has had considerable experience in working with bear populations and has three bear models, the simplest of which Dr. Øritsland demonstrated for the Group by use of an IBM computer and a television screen. The other two models are more suitable for data obtained from a mark-recapture programme since information from individual animals can be used rather than averages. The breeding interval is especially sensitive, i.e. small changes in the breeding interval can significantly change the future population size. A number of simulations were run demonstrating how changing variables can affect populations in the future.

A general discussion included the following points. Modelling shows that polar bear investigators are not now getting representative population composition data which are the basis for any population projection. Modelling should be used to aid in defining research needs and in defining results for governments. Modelling techniques should perhaps be used to examine and re-define goals

of the Polar Bear Specialist Group. Each nation must be concerned with specific management problems and the Polar Bear Specialist Group should be process-oriented. There was agreement that intensive study was needed on a few populations and findings tested to see if they would apply elsewhere. The Group should consider how to foster process-oriented work with different countries supporting one another.

Planning and Coordination of Management and Research Programmes in 1977-79

Mark and Recapture Studies

Marking procedures were discussed. Mr. Lentfer described the polyurethene ear tag which is being used in Alaska and Dr. Stirling described a similar tag of aluminium and teflon being used in Canada. Mr. Lentfer will send an Alaskan tag to Group members who requested it. Marking numbers assigned to date and proposed are as follows:

	Number	Jurisdiction	Date Assigned
A	1-249	Alaska	1968
N	250-499	Norway	1968
X	500-749	Canada	1968
C	750-999	U.S.S.R.	1968
A	1000-1999	Alaska	1969
X	2000-2999	Canada	1971
X	3000-3999	Canada	1973
X	4000-4999	Canada	1975
X	5000-5999	Canada	1976
A	6000-6999	Alaska	1976
D	7000-7499	Denmark	1976
N	7500-7999	Norway	1976
C	8000-8499	U.S.S.R.	1976

Dr. Uspenski remarked that marking programmes are no longer as effective as they once were because hunting has been reduced, and other methods of marking are therefore of greater importance. He suggested development of markers which could be attached to the back, be visible from a distance, and have a number which could be

read from a plane. Another alternative would be inexpensive transmitters. The increasing number of planes in the Arctic make these techniques more feasible. Attachment methods for markers and transmitters need to be studied and he mentioned the Moscow Zoological Gardens for possible experimentation.

A proposal by the U.S. Marine Mammal Commission to establish a Marine Mammal Tagging and Marking Centre was discussed. The objective would be to assign tag numbers and store and make available tagging data. The consensus was that coordination provided for polar bear marking through the Polar Bear Specialist Group was adequate and there was not a need to become involved with another system.

Frydtjof Nansen Drift Station

The proposed repeat of the "Nansen Drift" was discussed. An ice breaker would drift, probably in 1978, from the vicinity of Wrangel Island toward Franz Josef Land to obtain oceanographic and basic productivity data. The Group agreed that the Nansen Drift would provide an excellent opportunity for study of vertebrates including polar bears. Proposals by Dr. Jonkel and Norwegian workers for polar bear work were submitted but not included in the latest drift proposal. It was agreed that a resolution should go from the Group to the organizers of the expedition asking that they revise the research plan to include vertebrate research in general and polar bear research which had been proposed. Mr. Larsen and Dr. Jonkel will re-write polar bear proposals for attachment to the resolution.

National Science Foundation Grant

Dr. Jonkel asked for advice in setting priorities on research to be conducted with a $300,000 National Science Foundation grant extending from 1 October 1976 to 31 March 1979. He distributed a list and briefly reviewed research topics which might be possible with the grant. The following comments are part of the general discussion which followed.

Mr. Kolenosky suggested intensive study in one area similar to Isle Royale wolf studies with application whenever possible to other areas. Dr. Stirling said that studies must concentrate

on reaching a quantified result and suggested Churchill laboratory studies and modelling as priority items. Dr. Bunnell suggested a workshop with advisors including some from other disciplines to develop a positive programme. Mr. Larsen thought modelling could identify research needs and favoured studies on Greenland and in conjunction with the Nansen Drift. Dr. Øritsland thought it important to obtain information on all vertebrates from the Nansen Drift since vertebrates apparently were not included in the original proposal. He also favoured continuation of physiological work and more emphasis on modelling. Dr. Vibe stated that it was hard to obtain additional funds for research in Greenland because it is believed the new national park in northeast Greenland will solve many problems. He believes the Thule area should receive more study, partly because bears in that area may be shared with Canada. Dr. Vibe also favoured the Nansen Drift or work from Spitsbergen as an alternative. This should include studies on basic productivity. Mr. Lentfer suggested summer studies from a ship with ice-breaking capability and more definitive studies of "disturbance" effects in addition to modelling, Churchill studies, and Nansen Drift studies. Mr. Larsen noted the need for productivity studies which extend across continental shelf edges.

Other discussion centred around management responsibilities of individual nations. Outside funds such as an NSF grant might supplement national research programmes but should not be used in place of national programmes. The outside funds, such as NSF, could help the Group to look at the real world problems rather than national programmes, e.g. to tie together both research and management programmes. Research needs fall into three categories: meeting national management needs; resolving international problems and understanding populations which occur in more than one jurisdiction; and making in-depth process studies, some of which may have application elsewhere. More specifically, priority needs are physiological studies at Churchill, modelling and population projections, Nansen Drift studies, and studies of U.S.S.R.-Greenland ice drift and polar bear relationships.

Dr. Vibe also stated a need for more information on ringed seals and food chains. Dr. Stirling suggested perhaps a low budget project by which a student would relate primary productivity in various sections of the Arctic to seals and bears. Mr. Larsen suggested a study in the area between northeast Greenland and Spitsbergen. Dr. Vibe said that national governments should look at food chains and Dr. Jonkel said that food chain components are being studied individually. Dr. Stirling said a complete ecosystem study may occur off the coast of Labrador.

There was some discussion of a summer study north of Alaska. This would require a helicopter based on a ship with ice-breaking capability. Coast Guard vessels and Norwegian sealing vessels are two possibilities. Such a study would be expensive and could best be done as a coordinated effort by several investigators.

Dr. Uspenski noted his plans to visit the New Siberian Islands area in the coming year. Further discussion evolved into a general discussion of research needs and the Group summarized its thoughts in a resolution indicating areas where more studies are needed.

Deterrent and Attractant Studies of North American Bears

Dr. Jonkel described this work which is being started at Churchill. Deterrents for polar bears are becoming more necessary as man increases his activities in the Arctic. Dr. Øritsland pointed out that this is a difficult project because bears may habituate to stimuli, and suggested having a behaviourist involved in measuring heart activity and stress hormones in the blood. Dr. Uspenski favours development of deterrents and reported that polar bears had killed two people in the Soviet Union in November 1975. Mr. Kolenosky suggested checking with the U.S. Fish and Wildlife Service Research Centre at Denver, Colorado where much work on development of deterrents for carnivores has taken place. Funding for this project is from a number of different sources. Mr. Lentfer suggested the Alaska Oil and Gas Association (AOGA) as another possible source of support.

Physiological Studies at Barrow

Mr. Lentfer reported that the Naval Arctic Research Laboratory at Barrow, Alaska now has the capability to hold polar bears. They

have a veterinarian and will soon have an animal physiologist on their staff and thus have the capability to do physiological research. They would like to develop a method for field determination of stage of the reproductive cycle of females captured for marking, but do not wish to duplicate work that is planned for Churchill. Dr. Øritsland suggested that NARL proceed with a study of reproductive hormones in the blood.

Hide Marking System

Mr. Lentfer referred to the Polar Bear Agreement (Annex D, Statement 5, Page 44) in which the U.S. Delegation to the Conference for the Agreement suggested that contracting parties undertake consultation within six months after the Agreement becomes effective to attempt to establish a system of identification for parts of polar bears and to coordinate enforcement regarding parts of polar bears not taken in accordance with the Agreement. Mr. Lentfer further pointed out that implementation would require an international hide marking system with appropriate documentation. His reason for bringing it before the Group was that the Group would probably be asked if they now thought an international hide marking system was necessary, and, if so, the mechanics of implementing it. Members agreed to find out from their respective governments if governments thought an international hide marking system was necessary.

Climatic Changes

Dr. Vibe distributed a draft report on "Climatic and Ecological Changes in the Arctic Explained by Fluctuations in the Occurrence of Spring Tide in Relation to the Latitude of the Sun" and asked for review and comment. He also pointed out that managers are concerned with the impact of man on animals but in the case of polar bears, climate may have more influence than man. This can be especially serious for polar bears because of their low reproductive rate. The Group directed a resolution to managers addressing this point, and calling upon nations to be especially watchful of situations where detrimental activities of man and serious climatic fluctuations coincide.

Age Determination

Dr. Vibe inquired if there were data on weights of young animals for age determination of bears that are killed. Dr. Stirling will provide measurements of hides as used by the Northwest Territories to distinguish between yearlings which are illegal and two-year-olds which are legal.

Future Activities

Theriological Congress

Dr. Uspenski announced a Theriological Congress in Czechoslovakia in 1978. He said this was perhaps a good opportunity for a symposium on bears including one section on polar bears. Items that might be covered could include international cooperation in analysis of morphological data and methodology such as standardization on taking of skull measurements. It was decided that the next chairman should provide members with details of the Congress and ask their thoughts on a bear symposium. The Group might then want to communicate with the organizers of the Congress.

Formation of New Bear Group

Dr. Jonkel informed the Group about the suggestion for formation of an IUCN Survival Service Commission bear group for species other than polar bears. Dr. Uspenski felt that such a group was not necessary because only polar bears require international coordination. Others felt that the Bear Biology Association, in existence since 1970, was functioning adequately as an international bear group and that a third group would be duplicative and could dilute effort. Dr. Jonkel was requested by the Group to convey these thoughts to Sir Peter Scott.

Publication of Proceedings

Dr. Pierre Hunkeler opened discussion on publication of the Proceedings of the IUCN Polar Bear Specialist Meetings. IUCN is having to curtail expenses, and a policy effective in 1977 states that IUCN must be assured that it will not lose money on anything it publishes. Members will have to pay for publications which were formerly free, although IUCN will be able to issue reports of meetings at no cost if there is no need to edit or retype. If there is new information of much interest IUCN may publish it in a book form. The Polar Bear Specialist Group must now decide

how to fit their wants into the new policy. The cost of publishing the Polar Bear Meeting Proceedings is approximately 2000 Swiss francs or $800 for 800 copies. There was some discussion on the value of the Proceedings of the Polar Bear Specialist Group Meetings and the distribution they should receive. It was generally agreed that the proceedings were not the place to publish scientific papers but that they did have value as periodic summaries of research and management activities. Distribution to libraries is especially appropriate. All members favoured scientific editing by IUCN, retyping for uniformity, and publication in the same form as before. The desirability of authors seeing proofs was mentioned. The new chairman of the Group will coordinate publication of the present proceedings with IUCN. The number of copies to be printed is still to be decided.

New Chairman and Next Meeting

Dr. Vibe was unanimously elected chairman of the Group until the next meeting. In scheduling the next meeting, comments were made that there is some advantage in being flexible since new information and new business may not accumulate rapidly enough to warrant a meeting every two years. It was also pointed out that participation at these meetings must be planned well in advance. The first part of February 1979 was chosen as a tentative date for the next meeting with a final decision to be made six months prior to this date. The meeting could perhaps be delayed a year if there was not enough business to warrant a meeting in February 1979. Future meetings might include more non-structured time to discuss topics of interest as they arose during the meeting.

Meeting Close

The new chairman, Dr. Vibe, expressed thanks to Mr. Lentfer for serving as chairman during the past two years and for his work in organizing this meeting. He also thanked Dr. Tener for his participation since 1965 and expressed the wish that Dr. Tener can chair the next meeting.

Dr. Tener in closing the meeting spoke for the Group and expressed thanks to the following: Frank Nicholls for advice during the formulation of the Agreement and for other advice and

guidance; IUCN, and especially Pierre Hunkeler, for all that was done to make this meeting a success; IBM for free use of computer; and Dr. Øritsland and Dr. Bunnell for their participation.

RESOLUTIONS

Resolution 1: Fridtjof Nansen Drift Station

The IUCN Polar Bear Specialist Group,

considering that the Norsk Polarinstitutt has submitted a polar bear research proposal for the planned "Fridtjof Nansen Drift Station", and that

the University of Montana has requested and received funds from the National Science Foundation for polar bear research on the planned Nansen expedition, and that

all five nations of the IUCN Polar Bear Group have recognised the need for polar bear research,

hereby recommends that the organizers of the proposed expedition should consider revising their research plan for the Drift Station to include vertebrate research in general, and polar bear research referred to herein as attached, in particular.

Resolution 2: Climatic and Human Impact

The IUCN Polar Bear Specialist Group,

recognising that the impacts of man are ever-increasing, and are particularly serious in northern regions; and

recognising that some climatologists and glaciologists are predicting significant fluctuations in the climate during the coming decades which could alter present distribution and numbers of northern species;

hereby request the IUCN to draw to the attention of appropriate management agencies the possibility of adverse effects on various species, especially in the Arctic, whenever detrimental climatic changes coincide with harmful impacts of man and,

therefore requests the IUCN to draw to the attention of appropriate management agencies the need to take into full account the accumulated impact of those changes when considering northern conservation programmes.

Resolution 3: Research Priorities

The IUCN Polar Bear Specialist Group,

recognising the importance of fulfilling the provisions and intent of Article VII of the Agreement on the Conservation of Polar Bears, and recognising that critical gaps in information presently existing must be filled by the nations signatory to the Convention in order that international and national programmes for polar bear management can be soundly based and implemented, and

recognising the urgent need for continuing assessment of present management practices, including the effects of moratoriums, on populations of polar bears,

urges signatory countries to intensify their research programmes as a high priority and more particularly

a) population estimates, distribution and population dynamics of polar bears in the Svalbard area;
b) intensified studies of the discreteness and movements of polar bears in the Barents Sea;
c) studies of the origin, numbers, movements and ultimate destination of polar bears which possibly cross the Eurasian Basin towards Southeast Greenland;
d) distribution and ecology of polar bears in the summer in the area north of Alaska;
e) pay special attention to the improvement of existing and developing new methods of marking polar bears;
f) put emphasis on increasing cooperative laboratory studies, with emphasis on research techniques.

Resolution 4: The Sasquatch

The IUCN Polar Bear Specialist Group,

recognising that the development and implementation of effective conservation measures for rare species, distributed at low densities over extensive areas, is more effectively undertaken by coordinated international efforts than by those of single nations, and,

recognising that the IUCN was constituted to serve such conservation needs, and

recognising that such an internationally coordinated programme was most successful in the case of the polar bear, and
recognising that there is an equally important species the biology of which is almost totally unknown, but which is distributed over an apparently equally large range at unknown densities and which is variously known as "Sasquatch", "Bigfoot", "Yeti" or "Tchoo-Tchoona",
hereby resolves that a Sasquatch Specialist Group be constituted under the auspices of the Survival Service Commission of IUCN with the objective of initiating and coordinating national and international research and conservation programmes for the Sasquatch and its subspecific relatives, and
further recommends that Dr. R.E. Schweinsburg of the Northwest Territories Fish and Wildlife Service be invited to form, organise, and lead this new but extremely important Specialist Group.

POLAR BEAR MANAGEMENT CHANGES IN CANDA 1974-76

Ian Stirling and Pauline Smith
Canadian Wildlife Service

Since the December 1974 IUCN meeting of the Polar Bear Specialists' Group, several legislative changes have been made by Canada and its provinces and territories. Most of the changes have resulted from Canada's ratification of the Agreement on the Conservation of Polar Bears (1973) in December 1974 and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973) in April 1975. These have led to an increased standardization of legislation within Canada. Table 1 summarizes the regulations covering polar bear management in Canada as of 30 November 1976. Stirling and Smith (1976) summarized polar bear management changes in Canada during 1972 and 1974. Stirling (in press) presented an overview of current polar bear research and conservation programs in Canada.

The Federal-Provincial Technical and Administrative Committees for Polar Bear Research and Management, representing the four provinces (Manitoba, Newfoundland, Ontario and Quebec) and the two territories (Northwest Territories and Yukon Territory) and the Federal Government, continued to meet in 1975 and 1976 to discuss research results and management recommendations. Research programs arising from these meetings are outlined by Stirling *et al.* in this proceedings.

The polar bear kill quotas, based on recommendations by the Federal-Provincial Polar Bear Committees, and the numbers of polar bears killed or captured in 1974-75 and 1975-76, are summarized in Table 2. Quotas for 1976-77 are also given.

Table 1. Summary of regulation covering polar bear management in Canada as of 30 November 1976.

CATEGORY	JURISDICTION					
	MANITOBA	NFLD./LAB.	N.W.T.	ONTARIO	QUEBEC	YUKON
Hunting season	-closed	-closed	-1 Oct. to 31 May except 1 Dec. to 31 May in Game Management Zones 24 and that portion of Zone 25 lying west of 127°W	-none	-1 Oct. to 31 May	-1 Oct. to 31 May
Who can hunt	-natives of coastal region for own use, but sale of hide prohibited	-protection only	-native Inuit -resident with licence or non-residents with special licence	-protection only -permissible kill by native Indians -need a licence	-Inuit and Indians	-Yukon resident Inuit families or with tradition of hunting on Yukon coast
Quota	-maximum of 35 annually (not exercised at present)	-nil	-quota by settlement -1976-77 limit equals 516	-permissible kill of 30 (by restricting sales over 30	-quota by zone -total quota equals 42	-2 bears/famil -total quota equals 6
Females and cubs protected	-no	-yes	-cubs and females with cubs under 1.37 m in length, prior to being stretched and and dried or 1.68 m after being stretched and dried	-no	-yes	-yes (probably as "bears")
Bears in dens	-no	-yes	-yes	-no, but dens are	-yes	-no
Proof of origin of untanned bear	-seal proposed	-verbal proof (no seal implemented to date)	-seal on hide and export permit if origin outside or if leaving NWT	-seal on hide -proof of origin required on imported hides	-seal on hide	-seal on hide

Table 1. Summary of regulation covering polar bear management in Canada as of 30 November 1976 - continued

CATEGORY	JURISDICTION					
	MANITOBA	NFLD./LAB.	N.W.T.	ONTARIO	QUEBEC	YUKON
Export permit required and cost (out of province or territory of origin)	-nil	-required -no cost	-required -$1.00	-required -no cost	-required -no cost	-required -$5.00
Export permit out of Canada	-required for all polar bears or parts thereof exported out of Canada -obtained from Province or Territory in which port of export					
Scientific Licences	-discretion of Minister	-discretion of Minister	-discretion of Superintendent of Fish and Wildlife Service	-discretion of Deputy	-discretion of Minister	-discretion of Commissioner
Selling of hide by hunter	-prohibited -skins of nuisance bears sold by Manitoba Govt. through sealed tender	-prohibited if killed in Nfld/ Lab. -allowed if legally obtained elsewhere	-yes -must be sealed	-must be sealed by Dept. staff -sale at North Bay Fur Sales	-$5.00 Royality 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 72,75, 76. 1960 Order-in-Council (Endangered Species)	-Fish and Game Act 1970	-Wildlife Conservation Act 1969 -Order-in-Council 2401-75	-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 & Trafficking Licence $10.00	-Fish and Game Act -Licence $10.00	-$50.00 licence (one location) -$100.00 licence (ambulant)	-Game Ordinance
Taxidermy	-Wildife Act licence $5.00	-legislation in preparation	-nil	-Fish and Games Act		-nil

Table 1. Summary or regulations covering polar bear management in Canada as of 30 November 1976 - continued

CATEGORY	JURISDICTION					
	MANITOBA	NFLD./LAB.	N.W.T.	ONTARIO	QUEBEC	YUKON
Tanner's authority	-licence $10.00	-legislation in preparation	-nil	-Fish and Game Act (fee currently under review)	-$50.00 tanner's license	-nil
Live Animals Capture	-Ministerial permit	-illegal	-scientific licence and/or permit to export live big game	-Ministerial authority	-Ministerial permit	-special licence
Export	-Ministerial permit	-illegal	-special permit	-Ministerial authority	-Ministerial permit	-special licence

Table 2. Quotas and known numbers of polar bears killed or captured in Canada, 1974-76.

	1974-75[1]			1975-76[1]			1976-77[1]
	Suggested quota	No. bears killed	No. bears captured	Suggested quota	No. bears killed	No. bears captured	Suggested quota
NWT	475	464	3	501	(data not available)		516
Ontario	30+	18	0	30+	15	2	30+
Manitoba	35	11	2	35	9	2	35
Newfoundland	0	0	0	0	0	0	0
Quebec	42	66	0	42	36	3	42
Yukon	6	0	0	6	2	0	6
Norway	5*	1	0	5*	0	0	5*
TOTAL	593	560	5	619	-	-	634

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

+ Permissible kill.

* Allowed to Norway for protection of life under the Agreement on the Conservation of Polar Bears (1973).

In January 1975 a quota system was proposed by Quebec. A total quota of 42 polar bears was divided between the three polar bear management zones (Figure 1 shows the present boundaries of the polar bear management zones): 15 bears between the settlements in Zone A[1], 12 in Zone B and 15 in Zone C. Up until that time no restrictions were imposed on the number of polar bears taken by Quebec hunters. The problem of enforcing the quota system remains. An agreement signed 3 November 1975 by the Quebec Government and the Inuit and Cree people of Quebec is expected to facilitate the implementation of quotas and other polar bear legislation in Quebec.

No other quota changes were made from 1973 until September 1975 when increases were given to several settlements in the NWT for the 1975-76 game management year. At that time a total increase of 26 bears was divided amongst eight settlements in four zones.

The quota for the southern Keewatin coast of the NWT, which falls within Zone A[1], was increased by 15. The quota for Eskimo Point increased by 5, from 10 to 15; Rankin Inlet by 2, from 8 to 10, and Whale Cove by 5, from 7 to 12. Chesterfield Inlet's quota was also increased by 3, from 5 to 8 with the provision that at least three of the bears were taken from within Zone A[1]. Chesterfield Inlet is located within Zone C. The marked increase in quotas in this area is justified in light of the results of the polar bear work carried out in Manitoba for the last 10 years. These results are presently being written up. Hunting of polar bears in Manitoba is not permitted although treaty Indians are allowed to take polar bears for their own use. This is not encouraged as the hides cannot be sold or bartered and apparently few bears are taken. An estimated 160 cubs are produced each year in the Manitoba denning areas. By allowing

an increase in the harvest of polar bears off the southern Keewatin coast in winter, apart from the economic asset to the NWT Inuit, additional harvesting may release some of the population pressure in the sub-population of polar bears in the western Hudson Bay area and thereby help to alleviate some of the annual fall problems in the Churchill area.

Partly in response to the quotas proposed for Quebec, an increase of three bears was given to Sanikiluaq on the Belcher Islands in Zone A[3]. The quota for Zone C was also increased by three bears which were divided between Igloolik (an increase of 2, from 16 to 18) and Cape Dorset (1, from 6 to 7).

The quota for Tuktoyaktuk in Zone H was increased by 5, from 17 to 22, with the understanding that the additional 5 bears were to be taken to the Baillie Islands areas, off Cape Bathurst. Also, the polar bear hunting season in the area west of, and including, Cape Bathurst to the Yukon border and north to 71°N (Zones 24 and 25 lying west of 127°W) was changed by regulation to 1 January to 31 May following. By providing protection to pregnant females in this way, Stirling *et al.* (1976) calculated that a population of bears could withstand slight increases in hunting.

In November 1976 several additional quota changes were made in the NWT and the opening date hunting season in Zones 24 and 25 lying 127°W was moved forward to include December. This latter regulation change was passed in order to afford trappers protection from bears while tending traplines. The quotas for three Baffin Island settlements, two in Zone C and one in Zone D, were increased by a total of 15 bears. The quota for Cape Dorset was increased by 3, from 7 to 10, Lake Harbour by 6, from 7 to 13 and Pangnirtung by 6, from 8 to 14.

Many of the quota increases resulted from pressure from native groups. However, it has been stressed to the native hunters that the quotas are flexible and could be decreased should the situation warrant it.

Through the strict operation of quota-hide tagging programs in the NWT and Yukon Territory and the closed season in Newfoundland, the harvest can be controlled and a reliable estimate of the total kill made. Due mainly to increased fur prices during 1973, overkills were made by several settlements in the NWT during 1973-74. The lack of overkills and adjusted quotas accounted for the slightly lower total polar bear harvest in 1974-75. In Ontario and Quebec hide-tagging programs are in existence but residual problems preclude accurate estimation of the total kill. No adequate safeguards exist, at present, in Quebec to prevent overharvesting. No hide-tagging program exists for Manitoba and no records exist of the number of bears, if any, killed by Indians. Records of nuisance bears killed in the Churchill area each fall are maintained.

In June 1975, a Quebec Order-in-Council established a summer closed season from 1 June to 30 September and specifically provided protection for bears in their dens, females with cubs, and cubs under one year of age. Until that time in Quebec, there were no restrictions placed on the season, age, and sex of bears that could be killed. In April 1976, the legislation was enforced when three live cubs were seized from Inuit hunters in Port Harrison, on the eastern coast of Hudson Bay. In future stricter action will be taken. It now leaved only Ontario, and possibly Mantioba, to solve the problem of native Indians taking females with cubs. No legislation specifically protects females with young or bears in dens in

Manitoba but the closed season on polar bears and the apparent lack of hunting by treaty Indians there apparently provide adequate protection at this time.

The Inuit-guided sport-hunt in the NWT has continued with a limited number of hunts. During 1974-75 only two settlements, Paulatuk and Pond Inlet, allotted a total of four tags to the sport-hunt (3 and 1 tag respectively). Each hunt costs $3,500 from Paulatuk and $4,500 from Pond Inlet. Two of the four non-resident hunters were successful. Tags allotted to unsuccessful hunts cannot be used later by a native hunter. During 1975-76, three settlements, Cambridge Bay, Paulatuk and Tuktoyaktuk alloted 3, 2 and 4 tags respectively to the sport-hunt. Of the nine applicants, six were successful. The cost varied from $3,500 at Paulatuk and Tuktoyaktuk to $4,000 at Cambridge Bay. At present the hunt has limited attraction to Americans who probably form the largest part of the sport-hunting fraternity because the importation of a polar bear hide into the U.S. is barred through the Marine Mammal Protection Act of 1972. Under the same act a U.S. citizen requires a permit from the Marine Mammal Commission to partake in a sport-hunt, or even harass polar bears (as in capture-recapture programs) even though it is legal in Canada. Without a permit prosecution is possible. To many Inuit hunters in 1974-75, the effort involved in servicing a sport-hunt and the consequent reduction of individual freedom while out on the sport-hunt did not justify the financial gain. In 1975-76 with the reduction in prices received for polar bear hides more tags were allotted to the sport-hunt. For additional information on prices obtained for polar bear hides in recent years see Smith and Jonkel (1975a and b) and Smith and Stirling (1976).

With Canada's ratification of the Agreement on the Conservation of Polar Bears (1973) in December 1974, the provinces and territories were oblidged to amend their legislation to meet the terms of the Agreement. Of the five countries involved, three (Canada, Norway and the USSR) have now ratified the Agreement which came into effect in May 1976. Only Denmark has not yet ratified. The terms specify that the taking of polar bears is restricted to nationals using traditional hunting methods and that management practices are based on the best available biological data. Canada's interpretation of the Agreement allows a native-guided sport-hunt using traditional hunting methods to take place provided that a tag has been authorized from the settlement quota. The use of aircraft and large motorized vessels during such polar bear hunts is prohibited. The hides of polar bears killed in self-defence or in defence or property are not available for commercial purposes. Illegally taken hides cannot be imported into any of the signatory states. The main problem now is one of enforcement of management practices in jurisdications where enforcement is still difficult.

In April 1975, Canada ratified the Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973) which came into effect 1 July 1975. Polar bears are included in Appendix II to the Convention ("all species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival"). In Canada, polar bears had been placed under reservation and included with Appendix III of the Convention ("subject to regulation

within its jurisdiction for the purpose of preventing or restricting exploitation and as needing the co-operation of other parties in the control of trade"). This reservation was later removed so that polar bears are now in Appendix II for all nations. Now a closer check is required for the export of polar bears, the hides and any other products thereof and export permits are now required. The existing Export and Import Permits Act, administered by the Department of Industry, Trade and Commerce, required only minor modification to accommodate the terms of the Convention. A permanent record is maintained by the Federal Government. Federal legislation applies whether or not the polar bear or parts are being exported to, or imported from, a nation not a party to the Convention.

References

Smith, P.A. and C.J. Jonkel. 1975a. Résumé of the trade in polar bear hides in Canada, 1972-73. Canadian Wildlife Service Progress Note No. 43. 9p.

Smith, P.A. and C.J. Jonkel. 1975b. Résumé of the trade in polar bear hides in Canada, 1973-74. Canadian Wildlife Service Progress Note No. 48. 5p.

Smith, Pauline and Ian Stirling. 1976. Résumé of the trade in polar bear hides in Canada, 1974-75. Canadian Wildlife Service Progress Note No. 66. 7p.

Stirling, Ian. 1976. Polar bear conservation in Canada. Symposium on Canada's Endangered Species and Habitats. Carleton University, Ottawa, 20-24 May 1976 (in press).

Stirling, Ian, Arthur M. Pearson, and F.L. Bunnell. 1976. Population ecology studies of polar and grizzly bears in northern Canada. Forty-first North American Wildlife and Natural Resources Conference, Washington, D.C., 21-25 March 1976. Vol. 41:421-430.

Stirling, Ian and Pauline Smith. 1976. Polar bear management changes in Canada. IUCN New Series Publication: Polar Bears. Supplementary Paper 42:61-67.

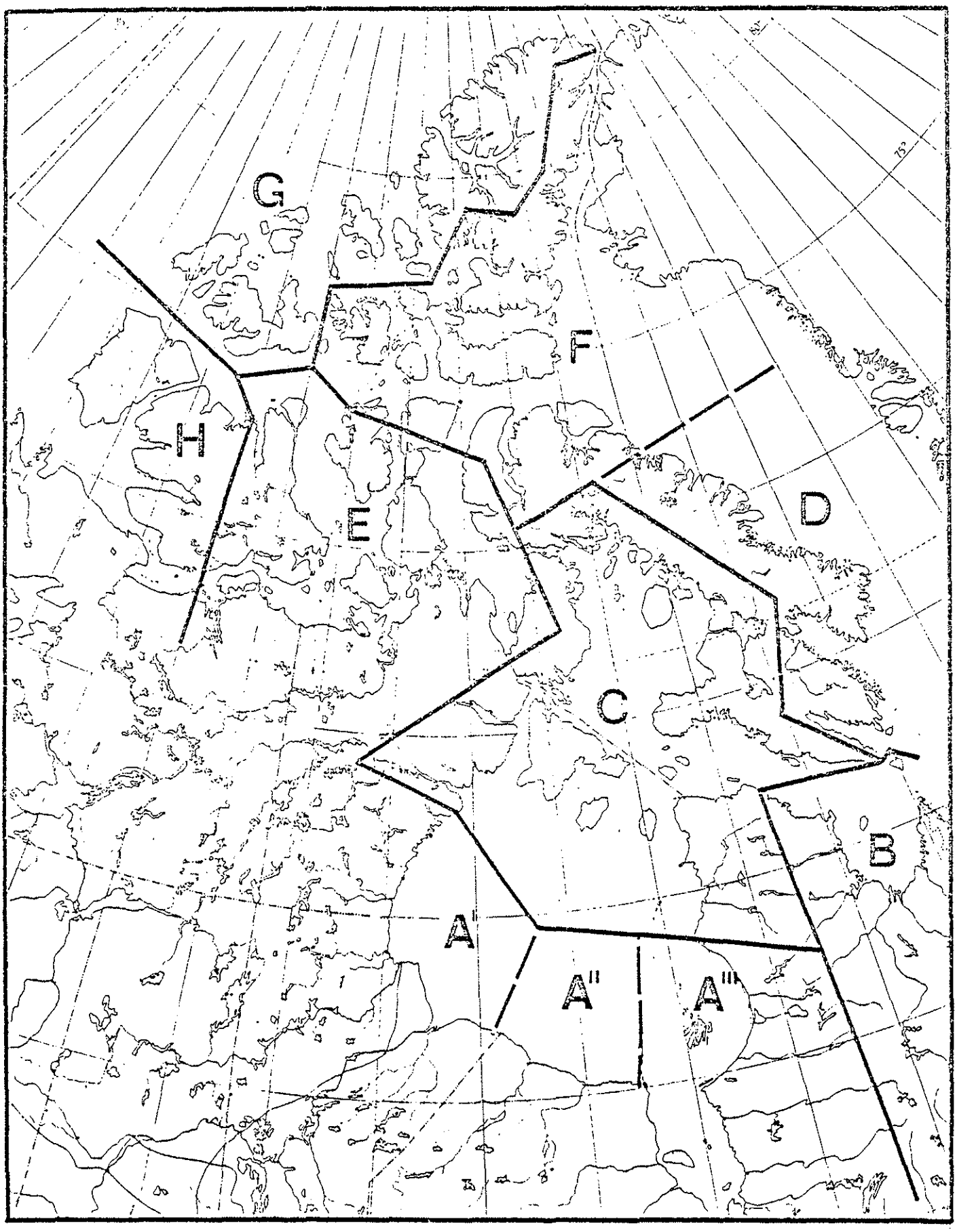


Figure 1. Present polar bear management zones in Canada.

Polar Bear Specialists
Sixth Meeting
Paper No. 2

RESEARCH ON POLAR BEARS IN CANADA 1974-76

Ian Stirling[1], George B. Kolenosky[2], R.E. Schweinsburg[3], Ian Juniper[4], R.J. Robertson[5], and Stu Luttich[6]

INTRODUCTION

Until recently, almost all polar bear research in Canada was conducted by federal, provincial, or territorial government departments, largely because of the substantial cost involved. As such, independent bodies that wished to conduct research on polar bears were largely dependent on close cooperation and support from the government agencies involved. This situation has changed greatly in the last two years with the addition of large scale independent funding for projects such as the physiological research at Churchill. Such projects are still coordinated with government research through bilateral discussions and the Federal-Provincial Polar Bear Technical Committee but are not included in this report.

Addresses: 1) Canadian Wildlife Service, 10025 Jasper Avenue, Edmonton, Alberta T5J 1S6 2) Ontario Ministry of Natural Resources, Fish & Wildlife Research Branch, Box 50, Maple, Ontario L0J 1E0 3) Fish and Wildlife Service, Government of the Northwest Territories, Yellowknife, NWT 4) Ministère du Tourisme, Chasse et Pêche, C.P. 7200, Charlesbourg, P.Q. G1G 5H9 5) Manitoba Department of Mines, Resources and Environmental Management, Box 2550, The Pas, Manitoba R9A 1M4 6) Newfoundland Wildlife Service, Box 376, Goose Bay, Labrador.

A wide variety of both coordinated and independent research projects were conducted during this period, several of which are continuing. This report will summarize the coordinated studies first, followed by a review of separate studies being conducted by individual jurisdictions, and a list of reports completed.

COOPERATIVE PROJECTS

Arctic Islands Pipeline Project

The objective of this study is to provide baseline information on polar bears, as part of an overall environmental study which the Federal Government may use to assess an application to build a gas pipeline from the high arctic islands to southern Canada. The research and report writing are being done jointly by the Canadian Wildlife Service and the Northwest Territories Fish and Wildlife Service. The field work is concentrating on seasonal distribution, movements of tagged bears, number of subpopulations affected, locations of maternity dens and feeding areas, and age structures of polar bears captured by researchers and of those killed by Inuit hunters. Particular attention will be paid to the possible effect of proposed channel crossing and staging areas on important denning and feeding areas. The cultural and economic value of polar bears to the Inuit hunters in the area affected will also be examined.

To date, over 500 polar bears have been tagged, many of which have either been shot or recaptured subsequently. Analyses of the data available up to this point are still in progress, a detailed progress report from which is due early in 1977. There will be one more season of research, designed to try to fill some of the gaps in our

knowledge before the final reports are completed.

Southern Baffin Island, northern Quebec, and northern Labrador

For some years there was concern that polar bears in the Hudson Strait, Ungava Bay, and Labrador coast were being overharvested. The status of the population was unknown and the origins of the bears being killed each year by northern Quebec Inuit was uncertain. Despite recommendations for restraint, similar numbers of bears were being killed each year. The present status of the polar bear in the Ungava Bay and northern Labrador regions was summarized by Smith *et al.* (1975). Preliminary analysis of the age structure of the polar bears captured in the area and of the few bears from which specimens were available did not support the suggestion of overharvesting. However, the sample size was too small to be conclusive and the information about the ecology of polar bears in that area was inadequate to fully interpret the results.

Thus it was agreed to coordinate efforts as much as possible between the Canadian Wildlife Service, Northwest Territories Fish and Wildlife Service, Quebec Wildlife Service, and the Newfoundland Wildlife Service, to conduct a long term study of the polar bears in that area. Since then, there has been considerable interest in offshore drilling in the area off SE Baffin Island, with the probability of research funding in that area for up to five years. The details of the latter development have yet to be worked out.

It was agreed that information was needed on the following subjects to adequately meet management and environmental assessment needs

in the area: a) discreteness of the subpopulation being harvested by the settlements in the region; b) estimate the size of the subpopulation; c) determine the seasonal movements, key feeding areas, and areas of summer sanctuary; d) locate and determine the extent of maternity denning areas; and e) determine the age structure and reproductive capability of the subpopulation.

Three years of ground surveys for maternity dens have been conducted on SE Baffin by NWT-FWS. CWS has done some preliminary tagging of polar bears and aerial surveying for maternity dens on the Labrador coast, northern Quebec and southern Baffin Island over the last three years. The Quebec Wildlife Service has conducted two years of aerial surveys of summer distribution. However, their attempts to tag polar bears in the summers of 1975 and 1976 have been extraordinarily ill-fated. In both years their helicopter crashed before any bears were tagged! Newfoundland Wildlife Service has done some gas caching on the Labrador coast, aided in some of the tagging, and is conducting a "living memory" survey of polar bear information. No results from these studies will probably be available for at least one or two more years.

Computerization of polar bear data

The data base on polar bears is now so enormous that it has become necessary to deposit all the data in a retrieval system simply to be able to have access to it. CWS and NWT-FWS are developing the SELGEM system to meet the requirements of the polar bear project and hope to have it fully operational by early in 1977. It will probably be another six months at least before basic data on all aspects of the

project can be put into the data bank. Eventually other jurisdictions in Canada will probably input their data as well. The data belonging to each agency will be protected but the mechanism for this has not been worked out yet.

SINGLE AGENCY PROJECTS

Canadian Wildlife Service

Polar Bear Ecology in the Western Canadian Arctic

The population ecology study on the polar bears in the Western Arctic, with aspects that related to the Beaufort Sea Project, was completed and reported on (Stirling *et al.* 1975a). A more extensive biological report on this project is also in preparation.

However, it was apparent from the studies of both polar bears and seals that their populations had undergone marked declines in numbers, productivity, and survival of young in 1974 and 1975. The decline apparently occurred because of natural causes that are not completely understood.

Up until the present, the numbers of seals and bears in relation to the marine ecosystem have been regarded as being fairly static. This is the first time that major changes in numbers and reproductive parameters caused by natural influences, have been documented in population of arctic seals and polar bears. For two reasons, it is of great importance to monitor these populations: 1) hopefully, monitoring of these populations will provide some baseline information on the speed with which they can recover from lowered numbers, in the absence of any additional environmental damage which might aggravate the situation. This could provide some guidelines as to what might be expected in the event of

a major environmental disaster such as an oil blowout that went unchecked for a protracted period. Milne and Smiley (1975) theorized that it might take ten years for the marine system to recover but this was only a guess based on the limited information they had in hand. Also, because it appears that offshore drilling will likely take place before the populations have recovered, and are therefore already more vulnerable to detrimental effects, it is essential that we monitor the status of those populations; 2) local management of sealing and polar bear quotas have to be dynamic and may have to be altered in response to the present biological realities.

Sixty-four polar bears were captured in April 1976 in two representative areas of the Western Arctic, north of the Tuktoyaktuk Peninsula and the west coast of Banks Island. During the course of this work, specimens were also collected from seals killed by polar bears to determine the age classes of seals being taken at that time.

In cooperation with the CWS, the NWT Fish and Wildlife Service are collecting specimens from the bears killed in the Inuit quotas to permit the very important monitoring of the age structure and sex ratio of the kill. The NWT-FWS are also collecting specimens from problem bears that have been shot in the Western Arctic. It is worth noting here that during the last winter, after numbers of the seals available to the bears were reduced so much, six problem bears were shot in the eastern Beaufort Sea area compared to one every two to three years prior to that. The implications of substantial numbers of problem bears to land-based and offshore rigs during periods of ice cover are obvious.

In late June, 1975 and 1976, aerial surveys of ringed and bearded were conducted so as to obtain results that

were directly comparable to those of past years (Stirling *et al.*, 1975b & 1977) and thus be a reliable indicator of the status of the seal populations depended upon by the bears and utilized by the Inuit. Because seals reproduce more rapidly than polar bears, and are lower on the food chain, recovery of the marine ecosystem should be noticeable sooner in the seal population than that of the bears.

The results of the bear and seal surveys indicated that both populations had increased from the 1975 levels but they were still quite low compared to pre- 1974 levels. It is hoped that this monitoring can continue for at least two more years.

The behaviour of free ranging polar bears

To date most research on polar bears has been oriented toward population ecology and has relied heavily on the use of aircraft for capture-recapture studies. Up until 1973, most of the data on behaviour were anecdotal because the bears had already been disturbed by the time they were seen. Some information had been deduced from tracks and a study of polar bears summering on North Twin Island, James Bay (Knudsen, 1973).

It is particularly important to know what polar bears do under natural, undisturbed conditions. Thus we have been conducting long-term detailed studies of the behaviour of wild polar bears which have a number of objectives. First it is necessary to simply determine how free ranging bears behave, hunt, interact and budget their time. With this baseline information we hope to be able to examine a series of questions.

1. Participation of cubs in the hunting of seals by family groups

Cub polar bears usually remain with their mother until they are about 2 1/2 years of age although some may stay longer. In the Northwest Territories, cubs are only protected until they reach 54 in (135 cm) in length at about one year of age. Thus a hunter with only one tag, or with a limited opportunity to shoot, may try to kill the largest bear in a group because its hide is worth more. As a result, the orphaning of cubs one year of age and older is both possible and legal. If females normally keep their cubs until they are 2 1/2 years of age, it is of great importance to the management of the species to determine the degree to which cubs of various ages are capable of successful hunting independently.

To study this aspect requires continuous observations of hunting by family groups to determine the variety of hunting methods used, their relative efficiencies, and the degree of participation by the cubs.

2. Diurnal rhythms of polar bear activity

The use of aircraft to survey or locate polar bears for a variety of research purposes, is most successful when the animals are active, and thus more easily seen. Although bears have been recorded as active at all times of the day and night, the data available to date indicates that during the summer at least, they are more active at "night" period of the 24 hour cycle than during the day (Stirling, 1974).

3. Proportion of time spent by polar bears in various activities

It is essential to understand at least the rudiments of the activity patterns of a population of polar bears to determine its approximate energy requirements. A local seal population must ultimately have a carrying capacity for polar bears just as a vegetated area does for ungulates. If the population of bears increased naturally to the

point where the carrying capacity was exceeded, some bears would have to seek alternate food supplies, which in many cases could be the refuse from the increasing number of temporary and permanent human settlements, resulting in a serious increase in bear-man conflicts. The same situation could develop after an environmental disaster, such as a major oil spill, which eliminated a substantial proportional of the lower levels of the food chain. This indicates the need to manage polar bears at the ecosystem level.

4. Effect of Aircraft

Inuit polar bear hunters have often complained that low flying aircraft affected the natural movements of polar bears and made them too nervous to hunt effectively. In some important polar bear areas there is a great deal of aircraft activity.

Permit regulations often stipulate minimun altitudes that must be maintained when flying over, for example, bird sanctuaries. However, the same altitude applies to all kinds of aircraft. From our observations to date at Devon Island, NWT, there appears to be a great deal of variation in the affect that different aircraft have on the same bear and that the same aircraft has on different bears. The effect of aircraft noise on a bear after being drugged and tagged using a helicopter is unknown but could be important.

Long-term observation along travelled routes will be necessary as well as some controlled experimentation is necessary.

5. Effects of drugging and handling

As a result of extensive observations and multiple recaptures of tagged bears, we have tended to discount the possibility that drugging and handling has any detrimental effects on their behaviour, movements or hunting ability. However, we will only be able to answer this question accurately after making long-term observations of the behaviour of a sample of bears after drugging and comparing the results to the behaviour of undisturbed bears.

In order to obtain the required behavioural data, three camps for long term observations have been established and, to date, several thousand hours of observations have been collected. Two of the camps are on Devon Island in the High Arctic and are for observing polar bears on the sea-ice while they are able to hunt seals. The third camp, was located at Cape Churchill to facilitate long-term observations on high densities of bears during the period they are ashore and cannot hunt seals (late summer and autumn).

Ecological Relationships

This aspect has three basic components, assessment of the size of seal stocks in various areas, the physiological requirements and utilization of seals, and the influence of ice conditions on seal and bear distributions. At present, knowledge of the size of seal stocks is rudimentary. This is partly a result of the lack of standardization in the methods of survey (e.g. McLaren, 1961; Burns and Harbo, 1972; Smith, 1973, Stirling *et al.*, 1975b & 1977). Estimation of numbers is further confounded by the fact that no one yet knows what the relationship

is between the number of seals present on the ice and the total number of seals in the area, some proportion of which are in the water at the time of counting. The proportion varies with the time of day. Further confusion has resulted from recent work which indicates that there may be considerable annual variation in seal productivity (Smith and Stirling, 1975; Stirling *et al.*, 1975b) and the possibility of large scale movements of significant portions of the population (Smith, 1976; Stirling and Smith, 1976). The greatest amount of predation takes place within the younger age classes. The number of seals that a bear population requires cannot simply be calculated from its physiological requirements because there is considerable variation in the degree of utilization of carcasses (Stirling and McEwan, 1975). Studies are continuing on these aspects of the basic ecology of polar bears and the importance of seal distribution and numbers and ice conditions on bear movements, reproduction, and survival.

Ongoing physiological research being cooperatively funded by World Wildlife Fund and grants to the Universities of Guelph, Montana, and Oslo, is delineating the metabolic requirements of individual polar bears in a variety of activity regimes and thermal conditions. We hope that the results of the physiological and behavioural studies can be combined to determine the metabolic requirements of a polar bear population.

Northwest Territories Fish and Wildlife Service

In 1976, NWT-FWS hired a full-time polar bear biologist, Dr. R.E. Schweinsburg. He has taken over the work begun by Sam Miller as well as initiating new studies of his own. They will be hiring a permanent polar bear technician shortly and are currently equipping a

laboratory in which they will be able to conduct their analyses which until now have been done in the CWS laboratory in Edmonton.

Central Arctic (Hadley Bay, M'Clintock Channel, and Victoria Strait)

During the springs of 1975 and 1976, 69 polar bears were captured and tagged in this area. Although no maternity dens have been located, there is little doubt, based upon the presence of females and cubs of the year, that north Stefansson Island, Hadley Bay, and Wynniatt Bay are maternity denning areas.

Recaptures and hunter returns indicate that the Hadley Bay bears may be separate from those of M'Clintock Channel. However, two bears were killed by hunters at considerable distances from where they were tagged. One, a female that was probably marked near Stefansson Island, (the tags were broken and identification was not certain) was killed near the west-central coast of Greenland. The other was marked near Gateshead Island in M'Clintock Channel and killed near Arctic Bay on northwest Baffin Island.

Data from the five years of research in this area are presently being analysed to determine future research requirements.

Northern Baffin Island

In response to the lead-zinc mine currently being developed in Strathcona Sound and the proposed deep water hydrocarbon well in Lancaster Sound, the NWT-FWS initiated studies of the polar bears of northern Baffin Island and southern Lancaster Sound. To date 91 bears have been captured and a summer retreat has been defined on the northern ends of Brodeur and Borden Peninsulas, the whole of Bylot Island, and the northeast

coast of Baffin Island from Pond Inlet to Buchan Gulf. Spring aerial surveys of productivity and denning were conducted during 1976. However, they were inconclusive because of poor tracking conditions. Spring concentrations of polar bears were located at the mouth of Admiralty Inlet and along the northeast coast of Bylot Island. Ground surveys conducted by Inuit hunters during the springs of 1975 and 1976 confirmed the concentration area along the northeast coast of Bylot Island and indicated that the north and east coasts of Bylot Island are denning areas.

Preliminary reports of the surveys are available and are presently being incorporated into one report that will summarize what is known about polar bears in the Lancaster Sound and northern Baffin Island area.

Committee Representation

The NWT-FWS is increasing its profile on concerns of industrial impacts to polar bears through representation on the Arctic Waters Oil and Gas Advisory Committee, the Land Use Advisory Committee, the Federal/Territorial Lands Committee, the Technical Committee of the NWT Water Board, and any *ad hoc* committees relevant to environmental management programs that may be site specific or broader in nature. These committees serve to manage and regulate short term land use, land tenure agreements, inland water use, and offshore activities north of 60° latitude to ensure exploration and development proceeds within acceptable environmental guidelines.

Information Dispersal

In co-operation with the Canadian Wildlife Service the NWT-FWS is producing a map of known and probable critical polar bear habitats

(denning areas, feeding areas, and summer retreats) in the Canadian Arctic and sub-Arctic. These maps should be ready for distribution by January, 1977, and will be updated on a regular basis as new information becomes available.

Polar Bear Ear Tag

We have developed a round aluminum disc tag, similar to the polyethylene ones being used in Alaska. The tag is attached to a peg that passes through the bear's ear and is locked into place with another disc of polyethylene. We hope that these tags will eliminate the problem of broken and lost tags.

Monitoring of Pollutant Levels in Polar Bear Tissues

A sample of polar bear tissues was collected from the bears killed during the polar bear hunting season from Arctic Bay and Pond Inlet. The purpose of this collection was to determine predevelopment levels of heavy metals in polar bear tissues prior to full scale operation of the Nanisivik Mine in Strathcona Sound. Analysis is currently under way and the results will be reported when available. The collection of tissues for baseline research on pollutants and heavy metal is regarded as a high priority by NWT-FWS.

Ground Productivity and Denning Surveys

Ground surveys by motor toboggan have been conducted in certain areas for the past several years by Fish and Wildlife Service personnel and Inuit hunters. The results of these surveys are currently under review to determine ways to improve the quality and relevance of the data collected. We intend to expand the program of ground surveys, partly to

obtain additional information for management but also because this sort of program allows direct participation by Inuit hunters.

Ontario Ministry of Natural Resources

The annual aerial surveys along the Hudson Bay coast of Ontario were conducted in early September 1975, and late August 1976. In 1975, the total of 136 sighted between Anabusk Islands, Manitoba and Hook Point, James Bay, represented the second highest total recorded for the coastal area since inception of the surveys in 1963. Numbers recorded in 1976 were somewhat lower, but since the flight was conducted as part of a waterfowl survey, there was less time available to actively check preferred sites for bears. Distribution during both years was similar to previous years with major concentrations in the Cape Henrietta Maria and Pen Islands areas.

The paucity of cubs along the coast during the autumn flights remains unexplained. It appears that most females with cubs must continue to travel inland following their arrival on the coast as the sea ice melts. The presence of large males along the coast area may cause the females with cubs to move from the coast as instances of intraspecific strife between certain sex and age classes at that time of year have been reported (Jonkel, pers. comm.).

Approximately 50 skulls have been collected from Indian hunters for taxonomic and aging purposes.

Maternity Denning and Productivity Studies

Aerial surveys with fixed-wing aircraft to determine the distribution and extent of maternity denning in northern Ontario were conducted in early March 1975 and 1976. Estimated cub production for both years was 80 to 100. Based on actual sightings and track counts, the average litter size for both years was 2.00. Maternity denning occurred in a broad band that extended from 20 to 120 km inland across the entire coast of northern Ontario. Concentrations of dens such as have been reported in the areas of the species' range (Harington, 1968; Uspenski and Kistchenski, 1972; Larsen, 1972) were not found in Ontario. However, the region between Ministik Creek and Gooseberry Brook has consistently contained the greatest number of emerging family groups.

The major criterion for a maternity den appeared to be sufficient snow to completely cover the occupants. In Ontario, most dens were situated in open, or treed bog habitat where snow accumulation was the greatest. However, dens were also recorded in thick spruce, adjacent to a rock outcrop and at the base of a small esker. Intricate internal structures such as separated rooms reported for dens on Southhampton Island (Harington, 1968), or the presence of earthen chambers recorded in Manitoba (Jonkel *et al.*, 1972) were not observed in the dens inspected in Ontario. However, numbers examined on the ground were small because of the restricted landing capabilities of the fixed-wing aircraft.

Patterns of behaviour after emergence were similar to those reported for polar bears elsewhere. Immediately after emergence, family groups remained in the den vicinity for periods that may have lasted as long as 2 to 3 weeks. At this time the female often dug through the snow searching

for grass, sedges and any other available food items. Once movement to the sea started, the path of travel was usually quite direct. In some instances, groups had to move over 100 km to reach the coast.

Denning also occurred on Akimiski Island. A minimum of eight and six cubs were produced there in 1975 and 1976, respectively.

Apparently some family groups move great distances, as a female and two cubs were observed out on the ice in Hudson Bay, 240 km north northeast of Winisk on 9 April 1975.

The pattern of emergence indicated that polar bears in Ontario emerge approximately 2 to 4 weeks earlier than polar bears in more northerly sections of their circumpolar range.

Manitoba Department of Mines, Resources, and Environmental Management

The annual fall coastal surveys and spring denning surveys were carried out in 1975 and 1976. In the spring of 1975, 160 cubs were estimated. Tagging of polar bears continued as part of the bear control program at Churchill. Forty bears were tagged in 1975. A resource management station has been started at Churchill and two biologists and two technicians have been hired to conduct research there as required on waterfowl, caribou, and polar bears. Manitoba staff continue to be extremely generous with their time to assist everyone working on polar bears in the Churchill area.

Quebec Wildlife Service

In the spring of 1975, an aerial survey was flown to count all denning areas on the SE coast of Hudson Bay from Cape Jones to the Inuit community of Inoucdjouac and adjacent islands. No polar bears were

observed. However, tracks observed and plotted on a map suggested a possible denning area in the Long Island region (lat 55°N).

In July 1975, 14 polar bears were counted on Akpatok Island (Ungava Bay) and 19 on the Twin Islands (James Bay). In August 1976, 22 polar bears were counted on Mansel Island (NE Hudson Bay) and 12 on Akpatok Island (Ungava Bay). Efforts to tag polar bears in northern Quebec were particularly ill-fated. Research planned in July 1975 and 1976 was cancelled because the helicopter crashed. A further attempt to tag polar bears in October 1975 was also cancelled, this time because of poor weather.

Newfoundland Wildlife Service

Polar bear observations have been recorded during aerial surveys along the coast during the spring and summer surveys along the Labrador coast by boat. A "living memory" survey of local knowledge of polar bears is being conducted. A small camp has been constructed near the coast north of Saglek and fuel has been cached for use in spring tagging of polar bears.

LITERATURE CITED

Burns, J.J. and S.L. Harbo, Jr. 1972. An aerial census of ringed seals, Northern coast of Alaska. Arctic 25(4):279-290.

Harington, C.R. 1968. Denning habits of the polar bear (*Ursus maritimus* Phipps). Canadian Wildlife Service Report Series, Number 5. 30 p.

Jonkel, C.J., G.B. Kolenosky, R.J. Robertson, and R.M. Russell. 1972. Further notes on polar bear denning habits, p. 142-158. *In*: Bears-their biology and management. International Union for Conservation of Nature and Natural Resources, IUCN Publication New Series No. 23.

Knudsen, B.M. 1973. The ecology of polar bears on North Twin Island, Northwest Territories, M.S. thesis, University of Montana, Missoula. 70 p.

Larsen, T. 1972. Polar bear den surveys in Svalbard in 1972. Norst Polarinstitutt Årbor 1972. Oslo:73-82.

McLaren, I.A. 1961. Methods of determining the numbers and availability of ringed seals in the eastern Canadian Arctic. Arctic 14(3):162-175.

Milne, A.R. and B.D. Smiley. 1975. Offshore drilling for oil in the Beaufort Sea: A preliminary environmental assessment. Beaufort Sea Project, Rept. of Environment, Victoria, B.C. Technical Report No. 39. 43 p.

Smith, P.A., I. Stirling, C.J. Jonkel, and I. Juniper. 1973. Notes on the present status of the polar bear (*Ursus maritimus*) in Ungava Bay and northern Labrador. Canadian Wildlife Service Progress Note No. 53. 8 p.

Smith, T.G. 1973. Censusing and estimating the size of ringed seal populations. Fish. Res. Board Canada Tech. Rep. No. 427:1-18p.

Smith, T.G. 1976. Predation of ringed seal pups (*Phoca hispida*) by the arctic fox (*Alopex lagopus*). Can. J. Zool. 54:1610-1616.

Smith, T.G. and I. Stirling. 1975. The breeding habitat of the ringed seal (*Phoca hispida*): birth lair and associated structures, Can. J. Zool. 53:1297-1305.

Stirling, I. 1974. Mid-summer observations on the behaviour of wild polar bears (*Ursus maritimus*). Can. J. Zool. 52:1191-1198.

Stirling, I. and E.H. McEwan. 1975. The caloric value of whole ringed seals (*Phoca hispida*) in relation to polar bear (*Ursus maritimus*) ecology and hunting behaviour. Can. J. Zool. 53:1021-1027.

Stirling, I., D. Andriashek, P. Latour, and Wendy Calvert. 1975a. The distribution and abundance of polar bears in the eastern Beaufort Sea. A Final Report to the Beaufort Sea Project. Fisheries and Marine Service, Dept. of Environment, Victoria, B.C. 59 p.

Stirling, I., R. Archibald, and D. DeMaster. 1975b. Distribution and abundance of seals in the eastern Beaufort Sea. Project Completion Report to the Beaufort Sea Project, Fisheries and Marine Service, Victoria, B.C. 59 p.

Stirling, I., R. Archibald, and D. DeMaster. 1977. The distribution and abundance of seals in the eastern Beaufort Sea. J. Fish. Res. Board Canada. (in press).

Uspenski, S.M. and A.A. Kisrchinski. 1972. New data on the winter ecology of the polar bear (*Ursus maritimus* Phipps) on Wrungel Island, 181-197. *In*: Bears-their biology and management. International Union for Conservation of Nature and Natural Resources, IUCN Publication New Series No. 23.

REPORTS PRODUCED

Published

Bowes, G.W. and C.J. Jonkel. 1975. Presence and distribution polychlorinated biphenyls and subarctic marine food chains. J. Fish. Res. Bd. Canada: 32(11):2111-2123.

Geraci, J.R. and T.G. Smith. 1976. Direct and indirect effects of oil on ringed seals (*Phoca hispida*) of the Beaufort Sea. J. Fish. REs. Bd. Canada. 33:1976-1984.

Jonkel, C.J. 1975. Of bears and people. Western Wildlands. 2(1):31-37.

Jonkel, C.J. 1975. Polar bears in their natural habitat. Proc. 51st. Ann. Conf. Amer. Assoc. of Zool. Parks and Aquariums, Calgary. 3 p.

Jonkel, C., I. Stirling, and R. Robertson. 1975. The polar bears of Cape Churchill (abstract). Proceed. 3rd Intern. Bear Conf., Binghamton, N.Y. (1974). IUCN Publ. New Series, Morges Switzerland, Suppl. Paper. 3 p. (in press).

Jonkel, Charles, Pauline Smith, Ian Stirling and George B. Kolenosky. 1976. The present status of the polar bear in the James Bay and Belcher Islands area. Canadian Wildlife Service Occasional Paper No. 26. 42 p.

Jonkel, C.J., and I. Stirling. 1975. Polar bear management. Proceedings of the Symposium on Endangered and Threatened Species, Washington 1974. 12 pp.

Jonkel, C., J. Lentfer, S., Uspenski and C. Vibe. 1975. Problems in the circumpolar study of polar bears (*Ursus maritimus* Phipps). Proc. of Circumpolar Conf. on Northern Ecology Ottawa 15-18 September 1975. (in press).

Kiliaan, H.P.L. 1974. The possible use of tools by polar bears to obtain their food. Norsk Polarinstitutt Arbok 1972- Oslo: 177-178.

Knudsen, B. 1975. Researching to protect our polar bears. Canadian Geographical Journal. 90:4-11.

Lavigne, D.M., and N.A. Øritsland. 1974. Ultraviolet photography: a new application for remote sensing of mammals. Canadian Journal of Zoology 52(7):939-941.

Lavigne, D.M., and N.A. Øritsland. 1974. Black polar bears. Nature 251 (5472):218-219.

Øritsland, N.A. 1974. A windchill and solar radiation index for homeotherms. Journal of Theoretical Biology 47:413-420.

Øritsland, N.A., K. Rona'ld, and C.J. Jonkel. 1973. What are the effects of human activities on the polar bears? Sci. Forum. 36 6(6):10-11.

Russell, R.H. 1975. Summer and autumn food habits of polar bears (*Ursus maritimus*) of James Bay and southwest Hudson Bay. Arctic 28:117-139.

Schweinsburg, R.E. and I. Stirling. 1976. More research needed to minimize conflicts between men and polar bears. Oilweek 27(5):54-55.

Smith, P.A. and C.J. Jonkel. 1975. Résumé of the trade in polar bear hides in Canada, 1972-73. Canadian Wildlife Service Progress Note No. 43. 9 p.

Smith, P.A. and C.J. Jonkel. 1975. Résumé of the trade in polar bear hides in Canada, 1973-74. Canadian Wildlife Service Progress Note No. 48. 5 p.

Smith, Pauline and Ian Stirling. 1976. Résumé of the trade in polar bear hides in Canada, 1974-75. Canadian Wildlife Service Progress Note No. 66. 7 p.

Smith, Pauline, Ian Stirling, Charles Jonkel and Ian Juniper. 1975. Notes on the present status of the polar bear (*Ursus maritimus*) in Ungava Bay and northern Labrador. Canadian Wildlife Service Progress Note No. 53. 8 p.

Smith, T.G. 1975. Ringed seals in James Bay and Hudson Bay: Population estimates and catch statistics. Arctic 28:170-182.

Smith, T.G. 1976. Predation of ringed seal pups (*Phoca hispida*) by the arctic fox (*Alopex lagopus*). Can. J. Zool. 54:1610-1616.

Smith, T.G. 1976. The icy birthplace of the ringed seal. Can. Geog. J., 93:58-63.

Smith, T.G. and F.A. Armstrong. 1975. Mercury in seals, terrestrial carnivores, and principal food items of the Inuit, from Holman. J. Fish. Res. Bd. Canada 32:795-801.

Smith, T.G. and G.J.R. Geraci. 1975. The effect of contact and ingestion of crude oil on ringed seals of the Beaufort Sea. Final Report to the Beaufort Sea Project. Fisheries and Marine Service, Victoria. 66 p.

Smith, T.G. and I. Stirling. 1975. The breeding habitat of the ringed seal (*Phoca hispida*): The birth lair and associated structures. Can. J. Zool. 53:1297-1305.

Stirling, I. 1977. Polar bear conservation in Canada. *In:* T. Mosquin (Ed.) Proceedings of a Symposium on Canada's Endangered Species and Habitats. Ottawa. May, 1975. (in press).

Stirling, I. and E.H. McEwan. 1975. The caloric value of whole ringed seals (*Phoca hispida*) in relation to polar bear (*Ursus maritimus*) ecology and hunting behaviour. Can. J. Zool. 53:1021-1027.

Stirling, I., D. Andriashek, P. Latour, and Wendy Calvert. 1975. The distribution and abundance of polar bears in the eastern Beaufort Sea. A Final Report to the Beaufort Sea Project. Fisheries and Marine Service, Department of the Environment. Victoria, B.C. 59 p.

Stirling, I., R. Archibald, and D. DeMaster. 1975. Distribution and abundance of seals in the Eastern Beaufort Sea. Project Completion Report to the Beaufort Sea Project, Fisheries and Marine Service, Victoria, B.C. 59 p.

Stirling, I., R. Archibald and D. DeMaster. 1977. The distribution and abundance of seals in the eastern Beaufort Sea. J. Fish. Res. Bd. Canada. (in press).

Stirling, I. and T.G. Smith. 1976. Interrelationships of arctic ocean mammals in the sea ice habitat. Circumpolar Conference on Northern Ecology, Ottawa. 15-18 September 1975. (in press).

Stirling, I., A.M. Pearson and F.L. Bunnell. 1976. Population ecology studies of polar and grizzly bears in northern Canada. Trans. 41st North American Wildlife Conference 41:421-430.

Unpublished Reports

Archibald, R. 1976. Polar bear tagging and seal collecting, May 12-27, 1976. 14 p. (typed).

Calvert, W., P. Latour, and I. Stirling. 1975. Age determination of polar bear teeth collected in the Central Arctic, 1972-1974. Unpublished Report to the Fish and Wildlife Service of the NWT. 10 p. (typed).

Cross, D. 1976. Polar bear denning survey 1976. 2 p. & 5 Appendicies. (typed).

Cross, D. 1975. Churchill polar bear control program 1975. 7 p & 6 Appendicies. (typed).

Cross, D. 1975. Polar bear denning survey 1975. 3 p & 5 Appendicies. (tuped).

Jonkel, C.J. 1975. Lancaster Sound. Admiralty Inlet polar bear studies. CWS Strathcona Sd. Proj. Rpt. No. 1: 40 p. (typed).

Jonkel, C., Ellis Land and Robert Redhead. 1976. An estimate of the productivity of polar bears (*Ursus maritimus* Phipps) in the area of southeast Baffin Island, Northwest Territories. 7 p. (typed).

Jonkel, C.J., S. Miller, and I. Juniper. 1974. James Bay-Belcher Islands and Ungava Bay polar bear studies. James Bay Environmental Assessment Impact Panel: 28 p. (typed).

Kiliaan, H.P.L. 1975. Polar bear tagging, Northern Labrador, 21-23 May, 1975. 9 p. (typed).

Kiliaan, H.P.L. 1975. Polar bear tagging, March-April-May 1975, Peel Sound-Prince Regent Inlet. 17 p. (typed).

Kiliaan, H.P.L. 1975. Polar bear productivity studies in western Barrow Strait area. 24 p. (typed).

Kiliaan, H.P.L. 1975. Polar bear studies, Viscount Melville Sound and adjacent areas 6-13 August 1975. 15 p. (typed).

Kiliaan, H.P.L. 1976. Polar bear tagging Northern Labrador, 23-30 March 1976. 10 p. (typed).

Kiliaan, H.P.L. 1976. Polar bear studies, High Eastern Arctic, 8 April-7 May, 1976. 32 p. (typed).

Kolenosky, G. 1975. Polar Bear Survey Flight along Hudson Bay Coast of Ontario and Manitoba, Sept. 3-5, 1975. Ont. Min. Nat. Res., Fish and Wildlife Branch. 10 p. (typed).

Kolenosky, G.B. 1975. Polar bears in Ontario - maternity denning and cub production. Ont. Min. Nat. Res., 31 p. (typed).

Kolenosky, G.B. 1975. Polar bear survey, Hudson and James Bay, April, 1975. Ont. Min. Nat. Res., 13 p. (typed).

Kolenosky, G.B. 1976. Productivity and maternity denning of polar bears in Ontario. Ont. Min. Nat. Res. 31 p. (typed).

Latour, P. 1975. Report of field work on polar bears in the Banks Island region from July 15th to July 27th, 1975. (typed).

Latour, P. 1975. Report of field work on polar bears in the Eastern Beaufort Sea, March 11th to March 27th, 1975. (typed).

Ransom, S. 1976. Polar bear survey 1976. 9 p. & 1 Appendix. (typed).

Redhead, R. 1976. 1976 Hoare Bay polar bear (*Ursus maritimus* Phipps) survey report. 5 p & 2 Appendicies. (typed).

Schweinsburg, R.E. 1975. Work report of polar bear research on and around Boothia Penn., July, 1975. NWT Polar Bear Special Report #1. (typed).

Schweinsburg, R.E. 1976. Work report of polar bear research in and around Admiralty Inlet, July-August 1975. NWT Polar Bear Special Report #2. (typed).

Stirling, I., and C.J. Jonkel. 1975. Polar bear research in the NWT Proceedings of the NWT Marine Mammal Conference, 1974. 20 p. (typed).

Stirling, I., R.E. Schweinsburg, and H.P.L. Kiliaan. 1976. Polar bear research along the proposed arctic islands gas pipeline route. Progress Report to the Environmental Management Service, Department of the Environment, Edmonton, Alberta. 32 p. (typed).

Polar Bear Specialists
Sixth Meeting
Paper No. 3

CLIMATIC AND ECOLOGICAL CHANGES IN THE ARCTIC EXPLAINED BY FLUCTUATIONS IN THE OCCURRENCE OF SPRING-TIDE IN RELATION TO THE LATITUDE OF THE SUN. Preliminary report.

Christian Vibe
Denmark

During the previous centuries the ecological conditions under which the polar bear lived have changed much in Greenland. The drift-ice situation is now very different from what it used to be, and so are the conditions for the people of Greenland.

The cultural periods of Greenland are fairly well known. All invasions of people have come from northern Canada. The first people came about 5000 years ago during a climatical period very unlike that of today. They hunted caribou and musk oxen in North Greenland. They may not have been Eskimos; they may have come from the steppe region of Central Asia from where people went north-east to Siberia, North America and Greenland in favourable periods. Three waves of invaders at intervals of about 1000 years consisted mainly of caribou and musk ox hunters.

The people living in Greenland today are Eskimos, and they are whale and seal hunters. They came as the fourth invasion from the west a thousand years ago. It seems to have been a shift towards a colder climate that has created the present drift-ice situation and the present ecological conditions for seals and polar bears. The cooling of the climate continues.

Simultaneous with the increasing summer drift-ice, there were animal invasions to Southeast Greenland, coming with and on the drift-ice: polar bears, Arctic foxes, ringed seals and ivory gulls. From where do they come? The only answer to me seems to be Siberia, by the way of the drift-ice route.

Today we thus have two types of invasion coming into Greenland. One is from Canada to Northwest Greenland: whales, seals, walruses and polar bears, foxes and wolves, caribou, musk oxen and man. They come in, stay in Greenland for some time, some months or some years. The polar bear may sometimes return to Canada. That we do not know, but the Thule area and Ellesmere Island seem to be a common territory.

The other type of invasion arrives in Southeast Greenland. The polar bears coming from the east presumably have no chance of getting back again to their place of origin in the Siberian Arctic. They rarely breed in Southeast Greenland where they go ashore when the drift-ice melts. Small cubs are very rarely seen, although between 50 and 100 bears are shot here every year. When small cubs are seen by the Eskimos, people tell me that the mother bear loses first the one and then the other by diving under thin ice. The winter too is often wet with rain, and not stable enough for dens.

Like all other animals in Greenland, polar bears fluctuate considerably in number. We find fluctuations of 3-4 years, similar to those for the lemming and the arctic fox. We also find fluctuations of 8-11 years, similar to those of the Canadian snowshoe hare and the lynx. And we find fluctuations of about 58 years, similar to those of the caribou in West Greenland, and the cod, harp seal and many others.

These fluctuations in animal occurrence and numbers must be caused by similar fluctuations in the North Atlantic climate. Each fluctuation in climate causes an alteration in the balance of ecology. This is especially remarkable in the Arctic and in the former glaciated areas around the North Atlantic. The territory of the polar bear has varied in size through the centuries.

The animal fluctuations seem to be rhythmical, and the fluctuations in climate must be the same. We cannot reach a solution of this problem by studying one animal only. It is necessary to take into consideration all arctic animals - and also other geographical regions, as well as historical events.

As for the steppes of Asia we notice a clear similarity in developments on the steppes and in the Arctic. At the time when the people of the steppes thrived and expanded their territories, new invaders came into North America and North Greenland. And when the flourishing of the steppes decreased and the Mongolian movements stopped, the Arctic also became unfriendly to people, and they migrated south; in Greenland they often died from starvation.

By studying these great events it becomes striking that they have much similarity with what happens to the caribou, the lynx and the lemming within the short intervals we notice today. The nature of the glacial age, the shift between glacial and interglacial periods, between Boreal and Atlantic periods, between rise and decline of great cultures, between periods of good herring fishing in Scandinavian waters and bad fishing, etc., the nature of all those fluctuations, long or short, is

the same as that of the lynx and lemming cycle, that also affects the polar bear we are studying in this group.

The study of the caribou population in West Greenland has led to an explanation. In the years 1930-50 the caribou in West Greenland managed to survive only in the dry regions near the inland ice.

After 1950 a climatic change to less wet winters suddenly opened for the caribou a large new country between the inland ice and the sea. The population increased in number.

In the high Arctic region, along the north coast of Greenland, as well as in northern Canada, the situation is the reverse. Here, and in the tundra regions with stable winters, much precipitation means much vegetation and many animals. Little precipitation means little vegetation and few animals.

A similar situation exists on the steppes of Central Asia and eastern Europe.

In climatical periods with ample precipitation, the animals and peoples of the steppes can occupy large new areas. They multiply rapidly and will in the coming centuries expand and invade Europe. And - what is very interesting - this happens in the same periods when the arctic animals and peoples invade the tundra regions along the Polar Sea - and each time at intervals of about 1052 years.

To me, no doubt exists that simultaneously something happens in the Polar Sea: melting of ice and exchange of water between the Polar Sea and the North Atlantic.

Beside this long climatic cycle of about 1052 years (or 2 x 526) we are able to point out a shorter one of about 116 years (or 2 x 58) which is very important for Greenland as well as for the whole North Atlantic region. We reached a peak of that cycle in 1824, and the next one in 1940. In both cases the ringed seal nearly disappeared along the west coast of Greenland - and was replaced by the harp seal - and by the cod and other Atlantic species. Since 1940 the climate has got colder, the populations of harp seal and cod are decreasing and that of ringed seal is increasing again.

The balance of evidence shows that the explanation to all the biological cycles is to be found in the physical factors that influence the breaking up of ice, melting of ice and pulsation of ice into the Atlantic and the influence of the drift-ice or the arctic surface water on the North Atlantic low pressure area.

(1) The melting of drift-ice in the Polar Basin must be caused mainly by penetration of warm, Atlantic deep water to the surface and simultaneous outlet of Arctic water to the Atlantic.

(2) The sun and the tide forces are the main sources of energy in these processes.

(3) The occurrence of maximum tide simultaneous with the highest latitude of the sun must be supposed to give the greatest effect in the exchange of water between the Polar Basin and the Atlantic.

(4) Maximum tide simultaneous with summer solstice occurs with intervals of certain years only. In some years the majority of the tide forces occur in the summer half-year, and in other years this happens in the winter half-year.

(5) This shift in the majority of tide force from the summer to the winter is rhythmic in the same way as the known biological fluctuations in the North Atlantic regions.

The following spring tides are known: approx. 14 days, approx. 8.85 years, 18.61 years, and 179.33 years.

The nature of the biological cycles shows that the tide has the greatest effect on climate and ecology in the North Atlantic - Arctic region where it coincides with the highest latitude of the sun (summer solstice). Thus the climatical periods are different from (and much longer) than all the known tide periods.

Below, in the left column, is stated the length of the tide periods, and in the right, the length of the corresponding climatical and biological periods:

A.	approx. 14 days	19 years.
		11 + 8 years.
		4 + 4 + 3 + 4 + 4 years.
B.	approx. 8.85 years	522 years.
		58 years (average of 62 + 53 + 62 + 53 + 62 + 53 + 62 + 53 + 62).
		29 + 29 years.
C.	approx. 18.61 years	1396 years (divided in several periods of 56 and 93 years and combinations hereof).
D.	approx. 179.33 years	7,890 years.
		3,945 years.
		1,052 years.
		526 years.
		263 years.

For all periods it is valid that a culmination of the tide force simultaneous with the summer solstice means a mild climate in the Arctic (the top of the curves). When the tide force is out of step with the summer solstice, the climate of the Arctic gets cold. This main conclusion may give different results in different geographical areas of the Arctic and North Atlantic, due to drift-ice movements in warm periods and drift-ice stagnation in cold periods.

The 58-year period (valid for cod, herring, seals, polar bears, caribou, etc.) has a different effect every other time. Thus cod in Davis Strait seem to appear in great numbers at intervals of 116 years only. Every other period is exceptional for caribou numbers in West Greenland; the same applies to the harp seal. The maximum of polar bears shift between northwest and southeast Greenland in a 116-year period. The herring fishery shifts between Norway and Sweden in the same period.

This double-period effect may also apply to the other greater and minor cycles.

CONSERVATION REPORT OF NORWAY 1974-76

Approximately 40% of the land area on Svalbard was protected by Royal Decree of June 1973. Three national parks, two nature reserves and 15 bird sanctuaries cover 27,000 sq kms altogether. In 1976 the North-East Svalbard nature reserve was appointed a biosphere reserve under Unesco's Man and the Biosphere Programme. Most of the denning areas and habitat for polar bears on Svalbard are protected in this connection.

Norway ratified the Agreement on the Conservation of Polar Bears in 1974 and the Convention on International Trade in Endangered Species of Wild Fauna and Flora in 1976.

The Ministry for Environment is now working on a proposal for new hunting regulations on Svalbard. The basic principle of these regulations will be that all animal species are protected, except certain listed species, for which a period in which hunting is allowed is specified. The polar bear will continue to be totally protected throughout the year.

Polar Bear Specialists
Sixth Meeting
Paper No. 5

RESEARCH PROGRESS REPORT - NORWAY, 1974-76

Thor Larsen
Norsk Polarinstitutt, Norway

After the implementation of a total prohibition of polar bear hunting in Norway in 1973, efforts have been made to monitor the bear population and its reproduction in Svalbard through den counts. Previous investigations showed that in particular Kong Karls Land and Nordaustlandet were important polar bear denning areas (Larsen, 1974). In 1973, an effort was made to determine the absolute number of dens in Kong Karls Land (Larsen, 1975).

In 1976, ground counting of polar bear dens was performed along the north coast of Nordaustlandet. Snowmachines, sledges, gasoline and other field equipment were put ashore in Kinnvika, Murchisonfjorden, in the summer of 1975. The author and one assistant were flown out to the depot in mid-March 1976. Surveys and counts started on 17 March. Each man had a snowmachine and sledge, and we could therefore work relatively independently of each other, although for security reasons we always searched the same general areas together. Each man carried with him field binoculars and a spotting scope with 20-60 times enlargement. The spotting scopes were mounted on tripods with a device which permitted horizontal and vertical scanning by use of microscrews. Possible den sites were scanned at short intervals, from hilltops and other points in the terrain which permitted a good view. Particular attention was paid to valleys, passes, riverbanks and other areas where we knew from experience that the polar bears prefer to den. The area from Murchisonfjorden in the west, to Rijpdalen and Kapp Platen in the east, was surveyed repeatedly during the 44 days' fieldwork period. Seventeen days were satisfactory for observation. During this period, 45 bears were observed, as follows: 7 adults, 5 subadults and 12 family groups. The family groups consisted of 4 females with two yearlings or two-year olds, 1 female with one yearling or two-year old, 4 females with two cubs and 3 females with one cub. Observations of females with cubs, of dens, tracks, and resting pits used by family groups, indicate that at least ten different

maternity dens were located in the observation area. Four dens were actually located: two on Botniahalvøya, and two in the bottom of Rijpfjorden.

Den emergence seemed to follow the general pattern of previous observations in Svalbard, namely that dens are opened and abandoned during late March and early April. The first female with cubs was observed on 17 March, but one maternity den which was still occupied was found as late as 26 April.

Nordaustlandet is probably an important denning area for polar bears, but not as important as Kong Karls Land, which in 1973 had a den density of 1.5 per sq km of habitat suitable for denning (Larsen, 1974).

Efforts were made in 1976 to capture bears with the use of snowmachines and immobilizing equipment. Christian Vibe has suggested that bears in Southeast Greenland may come from the northern Svalbard waters, and only markings and recoveries can, at present, possibly confirm this theory. Live captures of polar bears from snowmachines were tried in Edgeøya in Svalbard in 1968-69 and in East Greenland in 1973 (Vibe, 1973). However, field conditions were difficult in Nordaustlandet during the spring of 1976. Many pressure ridges, hummocks and icebergs were frozen into the fjord ice and made driving with the snowmachines difficult and sometimes dangerous. Only two efforts were made to pursue and capture bears. In the first case, the bear was lost in an area with many pressure ridges, which prevented an effective pursuit. The second time, a female bear was successfully captured, marked and studied, but one subadult bear was killed because of a difficult and bad shot, and consequent penetration of the abdomen. After that, further live capturing attempts were abandoned.

Skulls from polar bears which probably died from natural causes were collected in Svalbard in 1974 and 1976, in Kong Karls Land and Nordaustlandet respectively. Skulls were found in areas where polar bear hunting has not taken place in recent years. Because rodents are lacking in Svalbard, skulls and other bone material remain in good shape for many years. So far, 29 skulls have been collected, with an estimated age and sex composition as shown in Table 1.

Planned research

Den surveys and counts will be given priority also in the future in Svalbard. A field expedition is planned to Kong Karls Land, in order to repeat the 1972 and 1973 surveys there. Plans are made for a repeated survey on Nordaustlandet in 1978, but with a bigger field effort than in 1976.

Mr. Jørn Thomassen, who is a graduate student from the University of Oslo, plans to study polar bear behaviour in Svalbard. His study will focus particularly on the effects upon polar bears of disturbances by motorized vehicles, but will also pay attention to other aspects, such as intraspecific agression and dominance patterns, polar bear hunting techniques, activity patterns, etc. If possible, Mr. Thomassen's study will be coordinated with similar research already undertaken in the Canadian High Arctic under Ian Stirling; the same observation techniques will be used, and the same parameters measured.

Preparations for a joint Russian/Norwegian polar bear research program have been underway for several years now. A concrete plan has been submitted by the Norsk Polarinstitutt to the authorities in the USSR through the Norwegian Foreign Department, and further consultations are expected to take place in the near future.

References

Larsen T., 1974. Polar bear den surveys in Svalbard in 1972. Norsk Polarinstitutt Årbok 1973: 73-82.

Larsen T., 1975. Polar bear den surveys in Svalbard in 1973. Norsk Polarinstitutt Årbok 1973: 101-111.

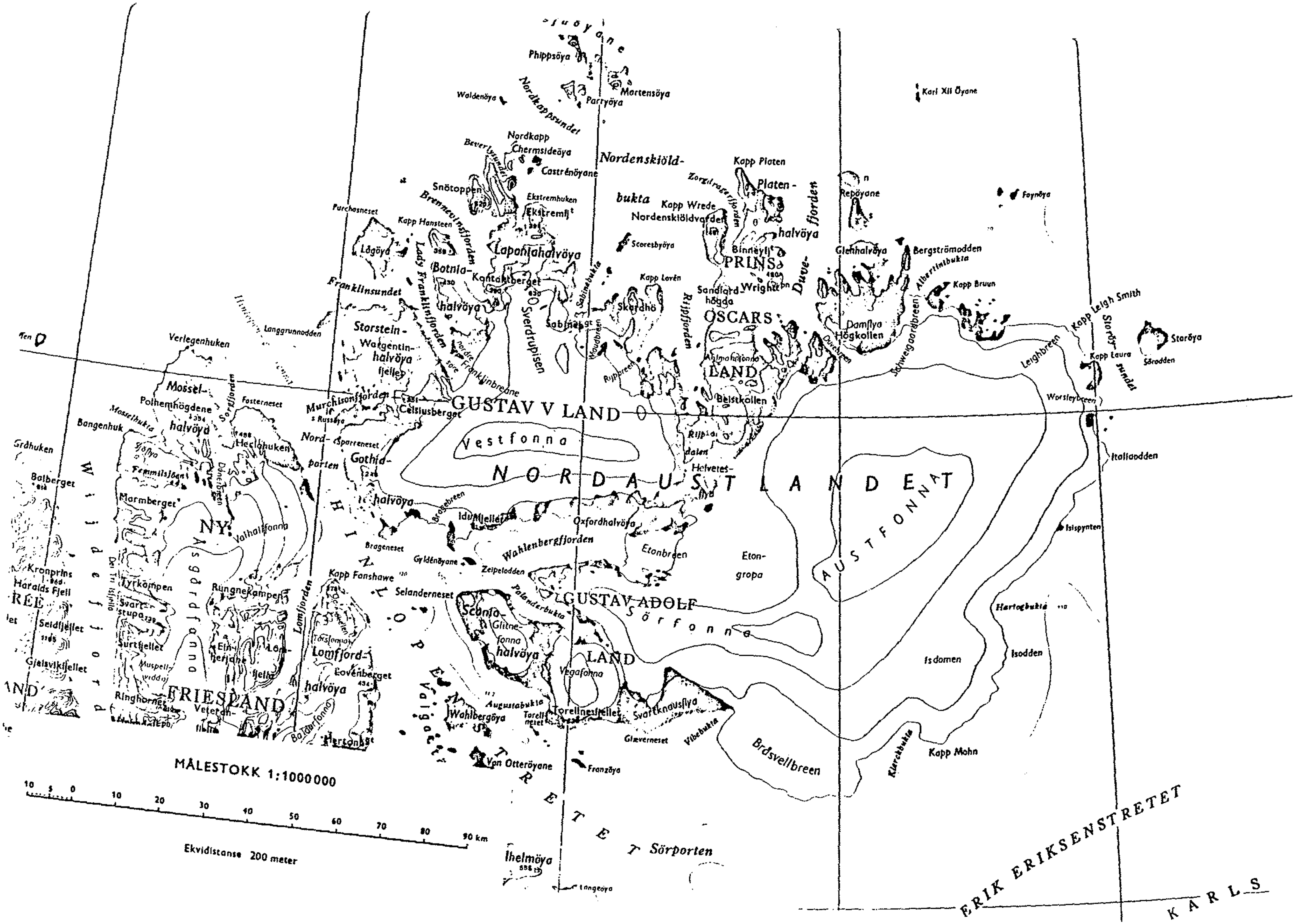
Vibe C., 1973 Preliminary report of the first Danish Polar Bear Expedition to North East Greenland 1973. Mimeo. 8 pp.

Table 1

Age of polar bears found in Kong Karls Land and Nordaustlandet, 1974 and 1976. Age estimated from skull growth, cranial sutures, tooth wear and enamel line.

Age	Males	Females
1	--	--
2	--	2
3	2	1
4	1	1
5	1	2
6	--	2
7	--	3
8	1	--
9	--	--
10	1	3
Older	8	1
Total	14	15

In addition, skull fragments of a female, whose age could not be determined, and a canine from a male which has not been aged, were found. Two remains of a half-year old and a two months old cub were found, but their sex could not be determined.



Phippsöya
Mortensöya
Parryöya
Waldenöya
Nordkappsundet
Karl XII Öyane
Nordkapp
Chermsideöya
Castrénöyane
Nordenskiöld-
bukta
Kapp Platen
Platen-
halvöya
Repöyane
Föynöya
Snötoppen
Ekstremhuken
Ekstremfj.
Purchasneset
Kapp Hansteen
Lågöya
Lady Franklinfjorden
Botnia-
halvöya
Laponiahalvöya
Kontaktberget
Sverdrupisen
Scoresbyöya
Kapp Lovén
Kapp Wrede
Nordenskiöldvarden
Zorgdragerfjorden
Duvefjorden
Binneyfj.
PRINS
Wright
OSCARS
LAND
Sandfjord
högda
Glenhalvöya
Bergströmodden
Albertinibukta
Kapp Bruun
Kapp Leigh Smith
Storöya
Storöysundet
Sörodden
Kapp Laura
Franklinsundet
Langgrunnodden
Storstein-
Wargentin-
halvöya
fjellet
Verlegenhuken
Mossel-
halvöya
Polhemhögdene
Mosselbukta
Sorgfjorden
Fosterneset
Murchisonfjorden
Celsiusberget
Russöya
GUSTAV V LAND
Vestfonna
NORDAUSTLANDET
Austfonna
Belskollen
Rijpfjorden
Rijpdalen
Helvetesflya
Worsleybreen
Leighbreen
Schweigaardbreen
Damflya
Högkollen
Duvebreen
Italiaodden
Isispynten
Bangenhuk
Heclahuken
Nordporten
Sparreneset
Gothia-
halvöya
Idunfjellet
Brageneset
Oxfordhalvöya
Wahlenbergfjorden
Etonbreen
Eton-
gropa
Gråhuken
Balberget
Marmberget
NY
FRIESLAND
Valhallfonna
Åsgårdfonna
Kronprins
Haralds Fjell
Tyrkompen
Svartstupa
Runenkampen
Lomfjorden
Lomfjord-
halvöya
Kapp Fanshawe
Selanderneset
Gyldénöyane
Zeipelodden
Scania-
halvöya
Glitnefonna
Palanderbukta
GUSTAV ADOLF
LAND
Sörfonna
Vegafonna
Isdomen
Hartogbukta
Isodden
Seidfjellet
Gjelsvikfjellet
Ringhornet
Lovénberget
Valgåtta
Wijdefjorden
HINLOPENSTRETET
Augustabukta
Wahlbergöya
Torellineset
Torellnesfjellet
Svartknausflya
Glæverneset
Vibebukta
Bråsvellbreen
Kapp Mohn
Kiærbukta
Von Otteröyane
Franzöya
Sörporten
Ihelmöya
Langeöya
ERIK ERIKSENSTRETET
KARLS
MÅLESTOKK 1:1000000
10 5 0 10 20 30 40 50 60 70 80 90 km
Ekvidistanse 200 meter

POLAR BEAR RESEARCH AND CONSERVATION IN THE USSR 1975-1976

S.M. Uspenski, S.E. Belikov, A.G. Kupriyanov
Central Laboratory on Nature Conservation, USSR Ministry of Agriculture

As in previous years, the Central Laboratory on Nature Conservation of the USSR Ministry of Agriculture carried out and coordinated polar bear research in the USSR during the period under review. Research was also undertaken and conservation measures implemented by the workers of the Institute of Animal Morphology and Ecology of the USSR Academy of Sciences (Moscow); the Institute of Parasitology and Parasitic Diseases of the USSR Academy of Medical Sciences (Moscow); the Arctic and Antarctic Research Institution of the USSR Hydrometeorological Service (Leningrad); the Main Administration for Nature Conservation, Reserves and Game Management of the RSFSR Council of Ministers, and other organizations and departments.

In carrying out the research programme, priority was given to analysis of population numbers and the relative dynamics; population structure; ecology and behaviour; morphology and parasitology. Results of the research will be published in the collection of articles "Polar Bear Research and Conservation in the USSR" in 1977-1978.

Polar Bear Ecological Studies

In 1975-76 the Central Laboratory on Nature Conservation completed a number of studies in Wrangel Island on the ecology and behaviour of the polar bear. On Wrangel Island, in the control area (Drem-Head Mountains, Northwestern part of the island), we continued tagging animals in the maternity dens (the tagging programme started in 1969); the distribution and structure of the maternity dens are dependent on the climatological and ice conditions of the year. Other ecological peculiarities of the species were studied; population dynamics were analysed; conservation measures were worked out and developed. In the same area instrumental investigations of the thermal regime in the inhabited den continued in 1975. The daily rhythm of the female and her cubs in the den was studied in 1976, using sound recording equipment. Different devices were tested in Wrangel Island in 1975-76 for polar bear capture.

During the two years under review 68 bears were tagged: 27 of them, lactating females; 38 cubs that were born during the current year; 2 females that do not breed; and 1 adult male (Table I). The tags have not been returned. In 1976 we found a lactating female in the den with the remains of a red plastic tag in the left ear. We assume that this tag was fixed by US researchers. In 1975-76 teflon ear tags were used in the tagging programme.

Table II contains a number of indices characteristic of the breeding section of the population (average weights of females and cubs) and their habitat (average depth and density of snow) and of the number of dens in the model area from 1973 until 1976. Analysis of these data enables us to draw the following conclusions:

(1) The number of dens in the model area fluctuates in a considerable range and is not directly connected with the average depth of snowcover registered at the end of the denning period.

(2) In the last four years females and cubs were observed to lose weight. Great attention should be paid to this phenomenon which has not yet been fully explained. It could be that the weight loss is caused by changes in the forage reserve of the bears in the area.

Analysis of the distribution of bears in the model area in 1971-76 (Table III) shows that the choice of slopes of varying steepness, and of absolute and relative height is subject to change from year to year, and depends mainly on the distribution of snow in autumn. At the same time, after the denning period the distribution of dens may undergo radical changes as a result of the redistribution of snow. This phenomenon is more vividly apparent in years when the depth and density of snow is lower than "average", and most vividly when the direction of the dominant winds changes radically.

Although the bears give preferance to slopes with sufficiently deep snowdrifts (however, in the deepest snowdrifts, dens very seldom occur), they may be found every year on slopes with little snow, sometimes less than 1.5 m. It is quite possible that some of these slopes had deeper snow cover in the autumn and winter, but that some of the snow was blown away. In some cases, when the depth of the den roof becomes thinner, dens are revealed. Females often leave these dens and dig out temporary refuges or occasionally occupy the dens abandoned by other females. The temporary dens increase in number when there is little snow in winter (Table III); the number of "unhappy" dens increases in conjunction.

Based on the absolute height of the mountains, dens are located from the foot and up to the top of them. More than half of the dens (average 59% in 1972-76) fall within the altitude range of 101-300 m. Changes in the number of dens from year to year occur mainly in the lower and upper parts of the mountains.

A distinctive feature of the Drem-Head Mountains is the terraced character of their relief. The terrace-steps are not high and the slopes not steep; they are thus favourable for the accumulation of snow, and it is here that most of the dens are located. Of all the dens mapped in 1971-76, 87% were found at a relative height of 0-50 m; and 81% on slopes with a gradient of 11-30^{o}. Dens seldom occur on either gently sloping or the steepest (about 40^{o}) slopes, as there are very few places suitable for bedding.

By comparing data on the distribution of dens in the lower, middle and upper regions of the slopes, it is seen that bears prefer the middle and especially the upper parts to the lower. It was in the upper region that about half of the dens found (47%) were located. We conclude that the depth and to some extent the density of the snow cover, which are variable throughout the snow period, define both the initial distribution and the following redistribution of dens.

Telemetric observations of the thermal regime inside an occupied den were conducted in 1976 (to ensure safety at the beginning of the experiment the entrance to the den was covered with snow). Our observations confirmed the ideas expressed in our report to the previous Polar Bear Specialist Group Meeting. During the observations in 1976 the temperature outside the den fluctuated from -14.3 to -27.5^{o}C; the temperature inside the den from -5.6 to +1.5^{o}C and from -0.2 to +6.5^{o}C (the two transmitters were installed about 10 cm from the roof of the den).

In 1976, the respiration rate of a lactating female was recorded with the help of remote sound recording machines. The respiration rate of the sleeping animal was in the range of 3-4 per minute, less frequently 4-5 per minute.

In March and April 1976, S.M. Uspenski and J.P. Yazan made regular counts of polar bear dens on Wrangel and Herald Islands; standard methods were used (twofold aerial counts along the model route on Wrangel Island - 650 km long, flight altitude - 250 m; concurrently all-round terrestrial counts were made by S.E. Belikov and A.G. Kupriyanov on the key plot, with an area of 25 km^{2}).

It is assumed that bedding in Wrangel Island of an extremely low number of females (the final count does not exceed 100-150) was caused either by unfavourable ice conditions or by the low depth of snow cover during the denning period in the autumn of 1975. It was also noted that on Herald Island in the same period much snow had accumulated and the dens were numerous, not less than 100-150 (in 1970 and 1975 the number of dens in this area did not exceed 20-30). Thus in the winter of 1975-76 about 250-300 maternity dens were constructed in this area.

The counts made testify that, notwithstanding the annual climatic changes, the number of polar bears (the indirect proof being the number of maternity dens) has been growing progressively during the last decade. It is assumed that the reasons behind this growth are the conservation measures taken at the national (in the USSR) and international levels.

It may be the effect of the International Agreement on the Conservation of Polar Bears that entered into force as far back as 1973. The counts prove also a "compensating" importance of Herald Island as a polar bear reproduction area in the Northeast of the Soviet Arctic. Mathematical analysis of the results of den counts in the last 4-6 years on Wrangel Island is being carried out.

Censuses on the vast territories

As in previous years, during the period under review data on distribution, number, age and sex structure have been gathered during ice reconnaissance flights in the Soviet Arctic. On the basis of responses to appropriate questionnaires, the Central Laboratory on Nature Conservation and the Hunting and Fur-farming Institute obtain similar information from hunters, workers in polar stations, and other observers.

Polar Bear Morphological Studies are carried out at the Institute of Evolutionary Morphology and Animal Ecology of the USSR Academy of Sciences under the guidance of Academician V.E. Sokolov.

In 1976 research was completed on the ancient ritual altars of the Nenets people in the North of the Yamal Peninsula. As a result, new areas of concentrations of polar bear skulls were discovered and described. In addition to those gathered in 1972, about 40 skulls of adult animals were brought to the Central Laboratory on Nature Conservation (in all, this unique craniological collection from animals taken in a very small area of the Arctic, amounts to 100 specimens).

Polar Bear Behaviour Studies were conducted on Wrangel Island. Observations were made of females with cubs in the dens and of groups of animals forming part of the population. Data were gathered on the daily regime and the behaviour of females in their dens in the period of their opening in spring and their leaving the dens. In 1975 we became aware of two cases of the female killing her cubs during the period of leaving the dens. Observations of those animals which are included in the vagrant part of the population were made mainly on Cape Blossom (the Southwest of Wrangel Island). It is on Cape Blossom that, in the second half of the summer, under favourable ice conditions the largest congregation of walruses along the USSR shore is formed. The carcasses of walruses whose death was caused by different reasons, attract polar bears during the greater part of the year; sometimes great numbers of polar bears are attracted (up to 10-20 or more bears are attracted concurrently). Data on the rudiments of the "hierarchic" inter-relations in the temporal groupings of bears, their daily activity, etc. were gathered.

It is here that on 22 April 1975, the copulation of polar bears was observed; during the first half hour the animals copulated three times; the first copulation lasted about 10 minutes, the second and third - 3-4 minutes.

Polar Bear Conservation Measures

The USSR Council of Ministers has ratified the International Agreement on the Conservation of Polar Bears and the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

All ministries and departments of the USSR concerned with all kinds of activities in the arctic area in 1975-76 issued and distributed special orders bringing into effect full and strict conservation of polar bears. One of the important effects of the above-mentioned government orders was the organization of the state refuge on Wrangel and Herald Islands (1976); preparatory measures for the organization of the refuge have been taken since the beginning of the year.

As in previous years the population of the USSR, especially in the northern areas, was informed about the prohibition of polar bear hunting, by means of press, radio, TV, etc.

Research Plans for the future

A series of polar bear studies on Wrangel Island having been completed (1969-76), the status of Wrangel Island having undergone definite changes (namely the organization of the refuge in this area),

the Central Laboratory on Nature Conservation is planning to work up the field data, to prepare appropriate publications, and to start studies in the field (analysis of population structure, number and its dynamics, biocenotic links, development of conservation measures) of the polar bear in the central and western parts of the Soviet Arctic.

Table I

Results of Polar Bear Tagging on Wrangel Island in 1975-76

Years	Date	Adults		Cubs		Note
		Left ear	Right ear	Left ear	Right ear	
1975	9.3	937	937	938	938	female with
				939	939	cubs
	10.3	940	940	941	941	" "
				942	942	
	18.3	944	944	945	945	" "
				949	949	
	19.3	947	947	946	946	" "
				948	948	
	20.3	950	950	951	951	" "
				952	952	
	24.3	953	953	954	954	" "
				955	955	
	25.3	956	956	957	957	" "
	28.3	958	958	959	959	" "
				960	960	
	1.4	961	961	962	962	" "
	2.4	963	963	964	964	" "
				965	965	
	6.4	966	966	967	967	" "
				968	968	
	9.4	969	969	970	970	" "
				971	971	
	10.4	972	972	973	973	" "
				974	974	
	14.4	975	975	976	976	" "
	March	971	972			females with-
	March	973	974			out cubs
	30.4	835	836			caught with
	2.5	939	940			snares;
	27.4		977			male
1976	13.3	750	750	751	751	female with
	21.3	752	752	753	753	cubs
				754	754	" "
				755	755	
	22.3	756	756	757	757	" "
				758	758	
	24.3	759	759	760	760	" "
				761	761	
	1.4	762	762	763	763	
				764	764	" "
				765	765	
	6.4	766	766	767	767	" "
				768	768	
	March	990	991			cubs taken
	March	992	993			for zoos
	March	994	995			" "
	March	996	997			" "
	March	998	999			" "

Note: Tags - 835, 836, 939, 940 - plastic for saiga tagging.
971-974 and 990-999 - metal with teflon disks; the others are teflon tags.

Table II

Data on the average weights of the females and cubs, on the number of dens, snow depth and density in the model area (Drem-Head Mountains) in 1973-76

Year	Average weight of the females (in kg)	Average weight of the cubs (in kg)	Number of dens in model area mat.	temp.	Average depth of snow cover (cm)	Average density of snow cover (g/cm^3)
1973	246 (n = 8)	12.1 (n = 13)	33	2	186 (n = 23)	0.400
1974	224 (n = 13)	11.5 (n = 19)	39	3	160 (n = 34)	0.410
1975	172 (n = 14)	9.1 (n = 28)	53	10	113 (n = 34)	0.353
1976	185 (n = 6)	10.1 (n = 13)	13	4	137 (n = 27)	--
Average	207 (n = 41)	10.7 (n = 73)	35	5	149 (n = 118)	0.387

Table III

Distribution of dens in the model area (Drem-Head Mountains) in 1971-76

Note: The number or percent of the temporary dens is shown in brackets.

Year	1971		1972		1973		1974		1975		1976		average
Location of the den	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%	%
Absolute height (m)													
0-100			5	25	2	6	9(1)	21(2)	14(4)	22(6)	6(3)	35(18)	22
101-200			5	25	7	20	14(2)	33(5)	25(4)	40(6)	4(1)	23(6)	28
201-300			4	20	15	43	12	29	20(2)	32(3)	5	30	31
301-400			6	30	11(2)	31(6)	7	17	4	6	2	12	19
Steepness in degrees													
0-10	3	17	1	5	4(1)	12(3)	1	2	2(1)	3(2)	1	6	8
11-20	5	28	11	55	8	23	13	31	20(3)	32(5)	3	17	31
21-30	8	44	5	25	22(1)	62(3)	21(3)	50(7)	40(5)	63(8)	10(3)	59(18)	50
31-40	2	11	3	15	1	3	7	17	1(1)	2(2)	3(1)	18(6)	11
Relative height (m)													
0-25	4	20	16	84	24(2)	73(6)	15	37	43(10)	71(16)	10(3)	59(18)	58
26-50	11	58	3	16	5	15	13(1)	32(2)	13	21	6(1)	35(6)	29
51-75	2	11	-	-	2	6	5(1)	12(2)	1	2	-	-	5
76-100	2	11	-	-	1	3	2(1)	5(3)	2	3	-	-	4
100 -	-	-	-	-	1	3	6	14	2	3	1	6	4
Position on the slope													
lower	5	22	4	20	7(1)	20(3)	13(1)	31(2)	14(4)	21(6)	5(3)	30(18)	24
middle	7	30	6	30	8	23	10(2)	24(5)	17(4)	27(6)	7(1)	40(6)	29
upper	11	48	10	50	20(1)	57(3)	19	45	32(2)	52(3)	5	30	47
Total no. of dens	23		20		35(2)		42(3)		63(10)		17(4)		

Polar Bear Specialists
Sixth Meeting
Paper No. 7

POLAR BEAR MANAGEMENT AND RESEARCH IN ALASKA 1974-76

Jack W. Lentfer
National Fish and Wildlife Laboratory
U.S. Fish and Wildlife Service

MANAGEMENT

Harvest Characteristics

Regulations promulgated under the Marine Mammal Protection Act of 1972 remained in effect through 1976. These prohibited the harvest of polar bears except by Alaskan Eskimos who were allowed to take bears without restriction for subsistence or for manufacture into clothing or handicraft items for sale, provided waste did not occur. Natives could not sell or transfer skins to non-Natives.

There was a shift in areas where bears were killed with more animals taken along the west coast than in previous years (Table 1). Several factors contributed to this. Both 1975 and 1976 were "heavy" ice years. Bears traveled south to the southern Chukchi Sea and northern Bering Sea with a movement of heavy ice south early in the winter of these years. Unusually high kills occurred on St. Lawrence Island and near the villages of Wales and Shishmaref in areas where bears are seldom encountered. Cessation of aircraft hunting and resulting reductions in harvest may have caused the population to increase and eliminated disturbing factors which formerly tended to keep bears away from the coast. Also, Eskimos from villages in the west area who had seldom encountered bears were more prone to shoot them than residents of villages along the north coast where bears are fairly common. The kill in areas adjacent to north coast villages was limited somewhat by the fact that wage earning opportunities kept many hunters in villages, and the opportunity to sell skins no longer existed. In both areas, there was some hunting specifically for bears, but also a significant number of animals killed incidental to other activities.

Prior to the Marine Mammal Act, skins from nearly all bears taken by Eskimos were sold. Now skins are being used for mittens, boots, parka ruffs, and sled and sleeping pads. Most of these items are for personal use but a few mittens and boots are being sold to non-Natives.

Table 1. Alaska polar bear harvest, 1975 and 1976.

	1 July 1974 - 30 June 1975				1 July 1975 - 30 June 1976			
	West Area	North Area	Total No.	% 2/	West Area	North Area	Total No.	%
Females with young	3	1	4	7	9	-	9	8
Young	5	2	7	13	28	-	28	25
Cubs	-	-	-	-	-	-	-	-
Yearlings	1	1	2	4	9	-	9	8
2-year-olds	4	1	5	9	19	-	19	17
Females older than 2 years without young 1/	10	2	12	22	21	2	23	21
Males older than 2 years	12	12	24	44	33	9	42	38
Sex or age unknown	4	3	7	13	3	7	10	9
Total known kill	34	20	54	100	94	18	112	100
Estimated additional kill	4	2	6		35	20	55	
Estimated total kill	38	22	60		129	38	167	

1/ A few females with young that were not identified as such may be included here.

2/ Percentages are based on the known kill.

Proposal to Waive Marine Mammal Act Moratorium and Return Management to the State of Alaska

The State of Alaska in January 1973 requested waiver of the moratorium on taking and return of management to the State of Alaska for nine coastal marine mammal species including polar bears. Regulations proposed by the State if the moratorium were waived and management returned would provide for both recreational and "subsistence" hunting. The open season for both types of hunting would extend from 1 January through 31 May. Hunting with use of aircraft would be specifically prohibited. The closed season during the summer would preclude use of boats. The bag limit for recreational hunters would be one bear every 4 years by permit only. Residents utilizing bears for food could take one bear each year without a permit. Young and females accompanied by young would be protected. Skins from bears taken by subsistence hunters could be sold.

A relatively small segment of the bear population would be subjected to hunting because hunting would be confined to a relatively narrow strip along the coast; most present day hunters limit their activities to the shorefast ice and do not go onto drifting ice. One of the greatest benefits of the proposed management plan would be to protect an important segment of the population from all harvest, i.e., females accompanied by young and pre-parturient females, because of the closed season in the fall. The proposed management program provides for recreational hunting of polar bears from the ground and could cause guided hunting to develop. Nearly all guides would be coastal residents and most money expended for guide fees would remain in coastal villages.

Hearings on the proposed action were held in Anchorage, Bethel, and Nome, Alaska in June and July 1976 and in Washington, D. C. in October 1976. The U. S. Fish and Wildlife Service, the Alaska Department of Fish and Game, and the Marine Mammal Commission favored waiver of the moratorium and return of polar bear management to the State of Alaska. There was only slight opposition in the form of statements by Natives who did not want restrictions which a management program would impose.

The timing of future events is uncertain. The administrative law judge who conducted the hearings must now review testimony and in the case of polar bears make recommendations to the Secretary of Interior. Recommendations could include waiver of the moratorium and return of management to the State with provisions of the proposed management plan or modifications. The administrative law judge will be recommending to the appropriate Secretary, i.e., Interior or Commerce, for other species at the same time that he recommends for polar bears. Possibly this will occur by April 1977. The Secretaries of Interior and Commerce must then review testimony and the administrative law judge's recommendations. Final decisions would probably not be made before late summer of 1977. It appears that a good case was made for waiver of the moratorium and return of management of polar bears to the State and it is quite likely that this will eventually occur.

International Polar Bear Agreement

The U. S. Senate ratified the Agreement on Conservation of Polar Bears on 15 September 1976. Ratification was deposited with Norway and entry of the United States into the Agreement became effective 1 November 1976. Denmark is the only country that has not yet entered into the Agreement.

Development

Human activity related mainly to oil and gas development is increasing along Alaska's north coast and could affect polar bears in several ways. Disturbances could cause bears to stay away from preferred denning areas and den in less desirable areas where denning success might be lower. Human activity could also cause bears that were already in winter dens to leave dens earlier than they normally would and could result in loss of cubs. Oil spills and discharges of contaminants associated with drilling could also have an effect. Oil could reduce insulating value of fur, cause adverse effects if ingested, and affect organisms in the short arctic marine food chain and thereby affect bears. The problem is intensified because there is no known method to contain or clean up oil under the ice and because of high pressures which may exist in the Beaufort oil formations. Another adverse effect would result from direct interaction of bears with humans. There will be more encounters with a resulting loss of animals as more people spend more time in bear habitat and as bears are attracted to human settlements because of their curiosity and by garbage.

The problem is accentuated because there is potential for development along much of Alaska's north coast. Development is occurring in the area between National Petroleum Reserve-Alaska (formerly Naval Petroleum Reserve No. 4) and the Arctic National Wildlife Range on lands owned by the State of Alaska adjacent to Prudhoe Bay. The State is also considering leasing additional land in this area for oil and gas development. The Federal self-sufficiency energy policy which has developed during the past few years is causing accelerated exploration on Naval Petroleum Reserve-Alaska. Exploratory work by the Department of Navy during the past 2 years was conducted without meeting requirements of the National Environmental Policy Act and with little concern for the environment. This is changing with transfer of jurisdiction of the Petroleum Reserve from the Department of Navy to the Department of Interior, effective July 1977, although oil and gas development will also occur under Interior jurisdiction. A gas pipeline is proposed from Prudhoe Bay through the Arctic National Wildlife Range. Gravimetric surveys, preliminary to seismic surveys, were conducted offshore from the Wildlife Range in 1976 and exploratory work has been proposed for the Wildlife Range. West of Naval Petroleum Reserve-Alaska, much of the coastal area has been classified as a native deficiency withdrawal by the Native Claims Settlement Act. Lands so classified could come under Native ownership with economic development a prime objective. The Beaufort Sea Outer Continental Shelf is of prime interest for oil and gas development. Thus there is potential for development along the entire north arctic coast and offshore from Point Hope to the Canadian border.

A number of actions can be taken to protect bears and their habitat. In doing this, an ecosystem approach over a large area should be followed rather than a species by species approach in restricted zones. Thus, effects of human activity along the coast and offshore from Bering Strait to the Canadian border should be considered, and if possible, expanded to include Soviet and Canadian activities in bordering areas. For Alaska this would require cooperation by several land owners and managers including the State, the Interior Department (Bureau of Land Management and Fish and Wildlife Service), the Department of Navy, the Naval Arctic Research Laboratory, Native regional corporations, Native villages, and oil and gas lease holders. A concept that might be considered by these various land managers is establishment of alternating zones of fairly large size of activity and no activity. Exploration and extraction could proceed in an activity zone for a number of years until extraction was complete. There would be no exploration or development in the zones on either side. After extraction was complete, activity could then transfer to a zone of no activity and the zone where extraction had been completed would then become a zone of no disturbance.

There should be "one time only" seismic exploration on public lands. This could be accomplished by treating information from seismic surveys as public property and making it available to all who might want to evaluate oil potential on public lands. Nearshore seismic exploration should be with the use of reduced charges from boats during summer rather than from fast ice during late winter.

Seismic lines, pipelines, and roads should be routed at right angles to rather than parallel and adjacent to the coast.

Spilled oil, fuel, chemicals, and drilling muds should be contained in lined, bermed sumps and storage areas.

A legal ruling should be sought on the location of the seaward boundary of Naval Petroleum Reserve-Alaska. The Secretary of Navy may have exceeded executive authority in extending Reserve boundaries seaward in 1972, and title to economically valuable oil-bearing lands adjacent to the coast could be disputed by the State of Alaska (Skladel 1974). Jurisdiction should be clearly established so that the agency responsible for environmental protection can implement protective measures in the near future.

The coastal area of National Petroleum Reserve-Alaska should receive special area designation for protection of wildlife values as provided for in the National Petroleum Reserves Production Act of 1976. Similar protective measures should be considered for other sections of the coast and also for offshore areas with high wildlife values.

Other measures apply more specifically to polar bears. Studies should be conducted to delineate areas of critical polar bear habitat, especially for denning. The relation of denning along the coast to denning on drifting sea ice should also be determined.

Effects of disturbance on individual bears, particularly denning females, should be quantified to the extent possible. This would require observing effects of disturbance, either artificial or actual, during the pre-denning, denning, and post-denning periods.

Studies are needed to determine effects of human activity and oil spills on ringed seals and other organisms in the food chain supporting polar bears.

Camps to support oil and gas activities should be established inland rather than on routes of bear travel along the coast. Garbage should be properly incinerated. Camps should be equipped with scaring devices for bears and deterrents as they are developed (Schweinsburg and Stirling 1976).

There should be reduced activity along the coast during the late October-early November period when bears are coming ashore to den. There should also be reduced activity during the period from late December through mid-April when disturbance could cause bears to desert dens after cubs are born.

"No activity" zones around active polar bear dens should be established. This must be in conjunction with other measures to assure that there are dens to protect.

Specific development proposals, including plans for removal of snow from drift areas for roads, pads, and liquid water, should be reviewed by wildlife specialists, including a polar bear biologist. Such plans would be subject to additional specific stipulations.

RESEARCH

Mark and Recapture

The U. S. Fish and Wildlife Service continued its polar mark and recapture study in the Barrow area in the springs of 1975 and 1976. The Alaska Department of Fish and Game captured bears in the Cape Lisburne area in the spring of 1976 in conjunction with a study of polar bear predation on ice pinniped populations. A total of 901 bears have now been captured of which 151 have provided long-term recovery data. By far, the greatest recovery has been of bears originally tagged in Alaska. There has been some interchange of Canadian and Alaskan bears, however, and one recovery of an Alaskan-marked bear on Wrangel Island.

Sea ice was heavier than usual and heavy ice extended further south than usual in 1975 and 1976. This may have caused a movement of ringed seals, the principal food of bears, to the west and south (Burns et al. 1976) and a similar movement of some bears. In both years significantly fewer seals were killed by bears in the Barrow area than in years when ice had not been so heavy. Also, perhaps related to reduced availability of seals, the first instance of predation by an adult bear, a male, on cubs was noted.

Both cubs in a litter were nearly completely consumed on 13 April 1976.

Tagged bears and also harvested bears have provided data on sex and age composition, minimum breeding age, average length of interval between breeding, maximum breeding age, and litter size. Preliminary modeling using these data with a population model developed by Dr. Jack Gross at the University of Colorado provided preliminary population estimates for the area west of Alaska and the area north of Alaska for inclusion in testimony regarding waiver of the Marine Mammal Act moratorium and return of management to the State (Lentfer 1976a). Data are now being analyzed in greater detail so that a more refined population estimate can be obtained from computer modeling.

Searching for bears for marking in 1976 was along predetermined transect lines to provide complete random coverage in the Barrow intensive study area. A Global Navigation System navigational aid installed in the Cessna 185 fixed wing cover aircraft for the helicopter from which bears were marked provided constant readout of position. Dr. James Gilbert, marine mammal census and population specialist, assisted and provided an evaluation of four single-season population estimates based on mark-resighting data. Seber-Jolly analysis is the best available method of analyzing polar bear mark-resighting data because bears move into and out of a study area throughout the season. In the 3,600 square nautical mile study area the number of family groups and single bears in the area at any one time was estimated to be between 20 and 40. From 5 to 15 groups appeared in the area every 3 to 4 days. An estimated 118 groups used the area at some time during the season of which 52 were marked. Mark-recapture data for several seasons are now being analyzed for population estimates.

Denning and Reproductive Biology

Field studies were continued in 1975 and 1976 to locate and examine dens to determine areas which should receive special protection. Results were: five verified maternity dens on land or shorefast ice, six possible but not verified dens on land or shorefast ice, one newborn cub on land, and twelve cub litters on drifting ice for which the exact maternity den site was not determined. A denning report was prepared based on information from 34 overwintering maternity dens and 92 sightings of females with cubs recently out of den (Lentfer 1976b). Dens were located inland as far as 40 kilometers from the coast, along the coast, on offshore islands, on shorefast ice, and on drifting sea ice as far as 164 kilometers offshore. Two areas tentatively identified as important for denning are between the Colville Delta and Canning River and between the Jago and Sadlerochit Rivers. A significant number of cubs were also reported and tagged north of Barrow but it is not known if this indicates an area of concentrated denning in this region or if cubs occur at about the same density over a large portion of the sea ice north of Alaska.

The assessment of denning thus far has been primarily in the area east of the Colville River because this is where oil and gas development first started. Studies are proposed for the near future to evaluate the importance of Naval Petroleum Reserve-Alaska for denning. These will include extensive surveys for dens in the coastal zone of NPR-A and offshore for approximately 30 kilometers to attempt to determine the relative importance of the coastal zone of NPR-A and drifting sea ice for denning.

A preliminary report on reproductive biology was prepared (Lentfer 1976b). Polar bears have a seasonally constant estrus extending from late March to about mid-July. Minimum breeding age for females averaged 5.4 and ranged from 3.5 to 8.5 years. Most females are probably sexually mature by 6.5 years. Maximum breeding age is probably between 20 and 25 years. Mean litter size of cubs, yearlings, and 2-year-olds was 1.68, 1.66, and 1.5 years, respectively. For females 4 years old and older the average reproductive cycle was 4.13 years and the reproductive rate was .407 young per year. Mark-recapture data have been put on tapes for computer analysis which will provide a refinement of these figures based on a more thorough analysis of larger samples.

A case of adoption of a cub by a female already with a cub was noted. Adoption may have some relevance to cub survival and litter size. A cub whose mother was killed by Eskimo hunters on 1 April 1975 was kept in captivity until 11 April when it was released with an adult female that had been immobilized for tagging and her cub. The female appeared to accept the orphan cub as she recovered from immobilizing drugs. Adoption was verified when the female and both cubs were sighted on 24 April. Both cubs were in good health with a strong bond between them and the female.

Parasites and Environmental Contaminants

A report was prepared on parasites and environmental contaminants in polar bears (Lentfer 1976c). Organochlorinated hydrocarbons including the DDT group, hexachlorobenzene, dieldrin, and endrin were at such low levels (less than 0.1 ppm) that they probably have a minimal effect on bears. The mean PCB level in fat was 1.9 ppm. This is a relatively low value compared to levels, apparently nonlethal, reported in some other mammals. Samples did not show differences in levels of organochlorinated hydrocarbons or PCB's between age groups of bears or different areas, one west and one north of Alaska, where bears were killed by hunters.

Polar bears from the north hunting area contained almost 30 micrograms per gram mercury in the liver and bears from the west hunting area contained slightly more than 4 micrograms per gram. Levels in liver were 100-175 times greater than in muscle. Levels in muscle were below maximum levels considered safe for human consumption. There is no known industrial use of mercury in Alaskan polar bear habitat. A possible reason for differences in levels in bears in the two areas is that ringed seals, their principal food, have different levels because of different food habits in the two areas.

Percent incidence of masseter muscle tissue with Trichinella larvae was 64.4, and mean number of larvae per gram in positive samples was 4.15. There was no significant difference in level of incidence or mean number of larvae per gram between sexes, age groups, or west and north hunting areas.

AIDJEX and Wrangel Island Studies

The U. S. Fish and Wildlife Service and the Canadian Wildlife Service planned cooperative studies using camps of the Arctic Ice Dynamics Joint Experiment (AIDJEX), a joint Canadian-U. S. study, as bases of operation. AIDJEX was operational from 12 March 1975 when its first camp was established at 76° 19' N, 148° 48' W to 8 May 1976 when its four stations were between 72° 56' N and 73° 39' N, and 138° 48' W and 148° 04' W. Satellite-interrogated data buoys continued to provide ice drift information as floes drifted to the west after camps were abandoned. Observations in 1975 indicated so few polar bears and seals that field teams with aircraft support were not moved to AIDJEX as originally planned. Instead AIDJEX personnel were contacted for information on bears and seals. Neither were common and it appears that the area traversed by AIDJEX is not nearly as productive as areas closer to shore.

It is assumed but has not yet been determined that many of the bears that occur along the northwest coast of Alaska are born on Wrangel Island under jurisdiction of the U.S.S.R. One bear tagged in Alaska has thus far been recovered on Wrangel Island. Knowledge of the relationship of bears in the two areas and their general life history would aid both the United States and the Soviet Union in establishing unilateral or bilateral management programs. One approach to determine relationships of bears in the two areas is a large scale mark and recapture program in the Wrangel Island area and offshore from the northwest Alaska coast. The U.S.-U.S.S.R. Environmental Protection Agreement provides the framework for a cooperative study. Preliminary plans for initiation of cooperative field studies on Wrangel Island in the spring of 1976 were cancelled and it is not known when studies will start.

Radio-Tracking

Radio-tracking a few selected polar bears will supplement the presently available mark and recovery movement data which have limitations because only a few location fixes are obtained for any one animal. Traditional means of tracking from ground stations and aircraft have limitations because of the polar bear's mobility and adverse flying conditions throughout the year over sea ice. Tracking from an earth orbiting satellite is an alternative. The National Aeronautics and Space Administration has approved tracking polar bears from the satellite, Nimbus 6, which is in orbit.

Handar Company of Santa Clara, California, in 1976 provided a prototype system which would transmit a location fix to Nimbus 6 every fourth day. A back-up transmitter provided for tracking from aircraft. Antenna and components other than batteries were contained in a lexan package carried on the back above the shoulders. Batteries (inorganic lithium) were carried in a lexan package between the front legs. Both packages and the lead between them were fastened to the animal with a harness.

An adult female bear was transported to Barrow and held so that the prototype transmitter could be attached and tested. The bear was released when it was determined that accurate satellite location fixes were being obtained and that the bear had accepted the transmitter package. Accurate location fixes were obtained via satellite during the first and third transmission periods, i.e., on the day the bear was released and on the eighth day following. Tracking by means of the backup transmitter and aircraft provided movement data for 10 days. The bear was released 29 nautical miles north of Barrow on 7 April 1976. It moved 58 nautical miles to the north by 15 April and then 13 miles to the south. The bear was observed visually on 6 different days during this period and each time the radio pack was in position and riding well. The reason for equipment failure is unknown. The weakest appearing link was the external lead between batteries and transmitter.

Accuracy of location fixes from the Nimbus satellite requires extremely stable transmission frequency which in turn requires a stable temperature during transmission. Temperature is a major consideration for polar bears which during a short time can subject a radio pack to temperatures ranging from near freezing in sea water to minus 40° C in air. The prototype model contained an oven oscillator to maintain a constant temperature for the transmitter during its intermittent periods of operation. Temperature data obtained along with location fixes in the spring of 1976 indicate that an oven oscillator may not be required. A simplified lighter and smaller transmitter is now being designed and constructed. The antenna is also being redesigned and made smaller. The unit to be tested in the spring of 1977 will consist of a neck collar with package on top of the neck 14 centimeters x 14 centimeters x 5 centimeters which contains the antenna and components other than batteries. The batteries will consist of four single D inorganic lithium batteries carried in the collar beneath the neck. The lead between the batteries and transmitter will be contained within the collar. The collar will be prevented from sliding forward over the bear's head by a harness of plastic covered steel cable. Calculated life will be more than 1 year with a location fix provided by satellite every fourth day and constant transmission for tracking from aircraft.

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Many people and organizations deserve recognition for valuable assistance they have provided. These include the Naval Arctic Research Laboratory; Alaska Department of Fish and Game, especially Tom Eley and Terry Hall; Larry Kolz of the U. S. Fish and Wildlife Service Denver Research Center; Jim Gilbert of the University of Maine; Jack Gross of the U. S. Fish and Wildlife Service at Fort Collins, Colorado; Ave Thayer, Don Frickie, Ted Schmidt, and Don Ross of the Arctic National Wildlife Range; and pilots Jim Aikens, Jim Campbell, Dick Delafield, Jim Hoffman, Bill Overway, Buster Points, Chuck Poulos, Pat Walters, and John Wise. Special recognition is due project personnel Dick Hensel, Fred Sorensen, Marge Walker, and Pat Liba.

LITERATURE CITED

Burns, J. J., L. H. Shapiro, and F. H. Fay. 1976. The relationships of marine mammal distributions, densities and activities to sea ice conditions. Annual report to NOAA on Outer Continental Shelf Research Unit 248/249.

Lentfer, J. W. 1976a. Statement on polar bears presented at hearings on proposed waiver of Marine Mammal Act moratorium and return of management to the State of Alaska.

Lentfer, J. W. 1976b. Polar bear reproductive biology and denning. Alaska Federal Aid in Wildlife Restoration Final Report, Projects W-17-3 and W-17-4.

Lentfer, J. W. 1976c. Environmental contaminants and parasites in polar bears. Alaska Federal Aid in Wildlife Restoration Final Report, Projects W-17-4 and W-17-5.

Schweinsburg, R. E., and I. Stirling. 1976. More research needed to minimize conflicts between men and polar bears. Oilweek, March 15.

Skladel, G. W. 1974. The coastal boundaries of Naval Petroleum Reserve No. 4. Alaska Sea Grant Report No. 73-12. University of Alaska.

Polar Bear Specialists
Sixth Meeting
Paper No. 8

POLAR BEAR MODELLING: AN APL-PROGRAMMED POPULATION PROJECTION

N.A. Øritsland[1], K. Ronald[2], and C. Jonkel[3]

Introduction

The coupling of a polar bear energetics model to a model of population dynamics must be established via age and sex specific weight distributions. Aiming at describing polar bear energetics at the population level we have produced a simple population projection programmed in APL (Gilman and Rose, 1970). While it is not our intention to use the present projection for detailed analysis of population dynamics we hope that interactive use and discussion of the model by the IUCN Polar Bear Specialist Group will provide the demographic values of a realistic population. Such values will be a necessary part of starting up analysis of polar bear energetics.

Model description

A compressed version of the model is presented in Figure 1. It is a Leslie projection utilizing age specific mortalities in lieu of survivorship. The model is basically the same as described in "BEAR MODELS, Version 1: A population projection model" (Anonymous, U.B.C., C.W.S.) and the model from REUNIT 1973. Input definitions are given below (Appendix A).

The complete flowchart with APL statements is presented in the report for 1976 for the Norwegian MAB Programme (Norsk Polarinstitutt, Oslo Lufthavn, Norway). For the present version a special subroutine was made to generate input, i.e. the initial proportion of cubs and age and sex specific age structures from the lx-series of a life-table.

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[1]Institute of Zoophysiology, University of Oslo, Blindern, Norway.
[2]College of Biological Science, University of Guelph, Guelph, Ontario, Canada.
[3]School of Forestry, University of Montana, Missoula, Montana, USA.

Also a function was produced to describe the relative change between each year's population size in the projection together with the average change over the whole projection.

Initial runs

The lx series:

1000 889 886 871 779 657 497 395 239 228 165 133 110 90 76 65 54 44 34 25 16 10 51 (Brooks, 1972)

was used together with a productivity of 0.283 for females five years and older to run the model. The above values resulted in a 11.7% reduction per year of the population size after 30 years of projection. The age structure after 30 years was:

1000 1130 1260 1279 1222 1045 937 938 690 568 519 490 457 441 430 409 378 331 271 192 134 76 18,

and the population ended up to contain only 15 animals from an original 700. Obviously the above population cannot sustain itself.

It would be useful if realistic lx, mortality and productivity values could be made available through the present meetings.

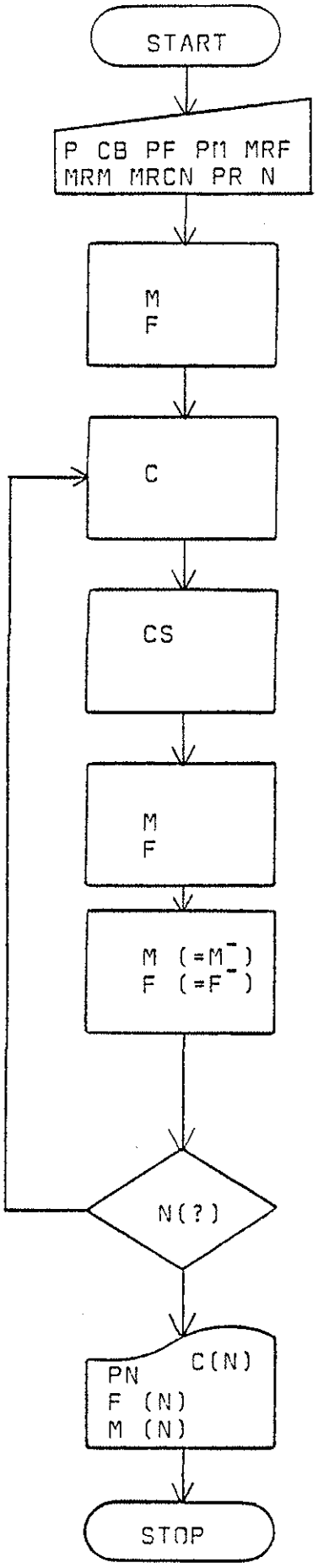
References

Brooks, J.W. (1972). Polar bear investigations in Alaska. Proc. IUCN Polar Bear Specialist Group, 1110 Morges, Switzerland.

Gilman, L. and Rose, A.J. (1970). APL 360 An interactive approach. John Wiley & Sons.

Bø, K. et al (1973). A simulation model for cervide herds. REUNIT report number STF14 A73052. University of Trondheim, Norway.

Figure 1



Late fall, prior to birth of cubs

Input is specified by the user. Input describes population size, age structure etc.

The initial population is split into cohorts of males (M) and females (F)

New cubs are "born" by multiplying the females with the corresponding productivity

Cubs surviving till spring are calculated

The age classes are regenerated i.e.:
Cubs are added as 0^+ and the other animals are put forward one year in age. The oldest ageclasses are erased.
Mortality among adults is applied and the age classes are regenerated (without shifting age)

A year of projection is counted and the calculations are looped back to calculate the cub production of the "new" population

Output after the wanted number (N) of years of projection is displayed or printed:
PN= = population size for each year
F(N)= age distribution for females the last year
M(N)= age distribution for males the last year
C(N)= number of cubs the last year

INPUT variables (specified by the user)

P = the initial size of the population (number of animals).

CB = the fraction ($0 \leq CB \leq 1$) of cubs in the initial population.

PF = age frequency of females in P (cubs not included). PF is a vector (string of numbers) where each element (number) is the fraction of females of that cohort in P. The dimension of (number of elements in) the vector equals the maximum age of the females. PF may be reduced to be only <u>one</u> "ageclass" e.g. "adult females".

PM = as above, but for males.

PR = "productivity". A vector that by multiplication with the female vector F (to be defined later) gives the number of cubs born each spring.

MRF = yearly mortality of the females. As for PF, PM and PR, MRF is a string of numbers (vector) giving the age specific mortality.

MRM = mortality of the males.

MRCSN = cub mortality during the first few months of life. This may be a vector where each element is the mortality of a given year. MRCSN may also be kept constant or your choice be disregarded (= 0):

MRCN = cub mortality for the rest of the year.

N = number of years ahead to be calculated.

OUTPUT

a) Population size for the coming N years: (Total number of animals each year).

b) The age-distribution of females after N years.

c) Age distribution of males after N years.

d) Total number of males, females and cubs after N years.

LOCAL variables (used only by (inside) the programme)

I = number of years the calculations have gone through.

NY = the population size for the last value of I.

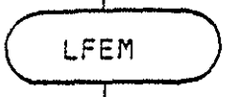
M = male vector, i.e. a string of numbers giving the number of males in each ageclass. First element in M represents the 0^+, second element represents 1^+, etc.

F = female vector.

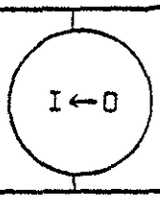
CS = number of cubs surviving until spring.

C = number of cubs that survive the first year.

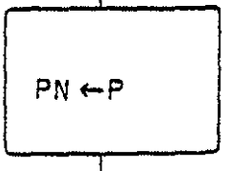
Input values to be specified by the user



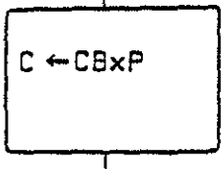
Start. (Late fall prior to birth of cubs)

[1] 

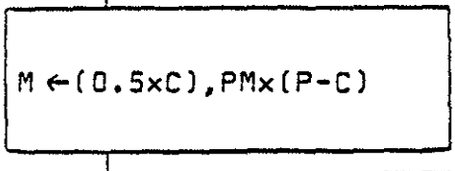
Year-counter is set to zero

[2] 

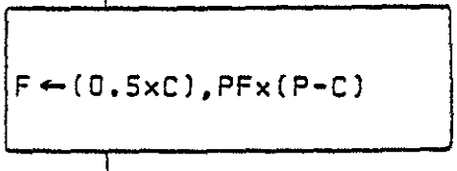
Projection (yearly population size) is initiated with size P

[3] 

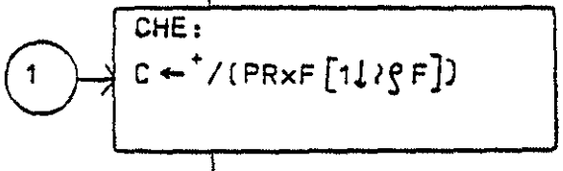
Number of 0^+ animals in the initial population is determined

[4] 

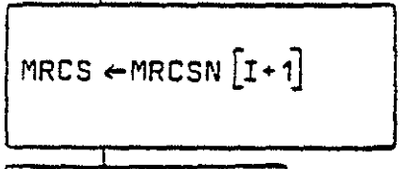
Total number of males is distributed to form an age distribution

[5] 

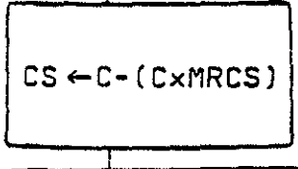
As above, but for female animals

[6] 

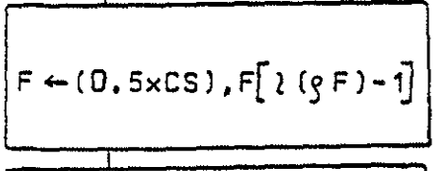
Production of newborn is determined

[7] 

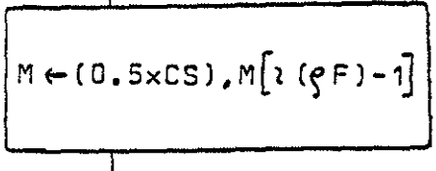
Mortality among newborn during the first few months is taken as element I+1 in the mortality-vector

[8] 

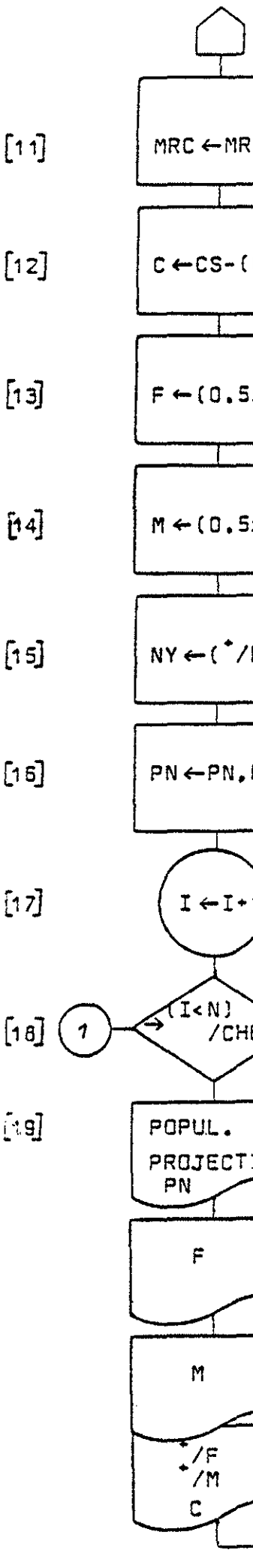
The surviving newborn animals are placed in CS

[9] 

Females: cohorts are made one year older and the newborn are placed as first cohort (0^+). The earlier oldest cohort is erased

[10] 

Movements and calculations as above are made for the males



The mortality valid for the rest of the year of the 0^+ cohort is taken as element I+1 of the mortality vector.

Surviving 0^+ animals are redefined to be C

ALL surviving females are determined and placed in vector F

Calculations as above are made for the males

All cohorts are added together to form the "new" population NY

NY is included as last element in the population projection storage vector PN

A year is added to I

If I (number of year projected) is less than the wanted number of years (N) calculations are restarted at 6 using latest C,F and M. If I=N output is printed and the programme stops.

Population projection is printed

Female "vector" of the last year of projection is printed

As above, but for the males

Total number of males, females and calves are printed