Polar Bears

Proceedings of the
Ninth Working Meeting of the
IUCN/SSC Polar Bear
Specialist Group

August 1985

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9-11 August 1985

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PROCEEDINGS OF THE NINTH WORKING MEETING

OF THE IUCN/SSC POLAR BEAR SPECIALIST GROUP

EDMONTON, CANADA
9 - 11 AUGUST 1985

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1. Introductory Remarks and Organization of the Meeting

The meeting was opened at 09:00 9 August 1985 by the present chairman of the IUCN Polar Bear Specialist Group (PBSG), Ian Stirling. It was agreed that he would chair the meeting but still be able to speak freely. Members of the PBSG present were S. Amstrup, U.S.A.; R. Schweinsburg, Canada; R. Scott, IUCN; and I. Stirling, Canada. Invited specialists present were D. Andriashek, Canada; J. Baker, U.S.A.; J. Bardwell, U.S.A.; W. Calvert, Canada; M. Cattet, Canada; P. Clarkson, Canada; R. Hansson, Norway; P. Henrichsen, Denmark; M. Ramsay, Canada; S. Schliebe, U.S.A.; C. Spencer, Canada; and M. Taylor, U.S.A. Full addresses of all PBSG members and invited specialists are in Appendices 1 and 2. S. Uspenskii, a USSR delegate, had written that he would not be able to attend but would send material for the meeting; it was not received in time for inclusion in the discussions but is in Appendix 10.

Stirling noted that with the retirements of Christian Vibe of Denmark and Jack Lentfer of the U.S., and Thor Larsen of Norway possibly changing his field of research, there are now few left of the original Polar Bear Specialist Group. Consequently, it will be very important for the old and new members to work hard through the next few years to maintain the productive spirit of cooperation that characterized the earlier years.

The proceedings of the Oslo meeting in 1981 are being printed and will soon be available. Robert Scott brought several unbound copies for reference.

Stirling asked if the group wanted this meeting to be considered a workshop, as in 1983 when the USSR delegate did not attend, or a full plenary session, which has not been held since 1981. Scott, as the IUCN delegate, thought it should be a regular, plenary session, but note that the USSR was not represented. The delegates from the U.S., Denmark, Norway, and Canada agreed.

2. Election of Meeting Chairman

Stirling was elected as the meeting chairman. Wendy Calvert agreed to act as Secretary and to organize the proceedings for eventual publication by IUCN.

3. Additional Topics and Adoption of the Agenda

Several topics were added to the tentative agenda (items 15, 16 and 18) and it was adopted. Stirling proposed that items 7 and 8 be covered on Friday or Sunday, when Ray Schweinsburg would be present.

4. Summaries of Research and Management by Country

The following oral and written reports were received. In general, where information is included in the appendices, it is not elaborated upon in these minutes.

Canada

Stirling and Schweinsburg briefly reviewed polar bear management and research in Canada 1982-84 (see Appendices 3 and 4). The research on deterrents, reproductive ecology, and condition was also presented and discussed in items 6, 8, and 9 respectively. Paul Watts, Head Biologist at the Institute of Arctic Ecophysiology, based in Churchill, Canada, also submitted a report (Appendix 5).

In reviewing the surveys by A. Derocher along the Manitoba coast, there was a discussion of the efficacy of using marker darts alone, without permanently marking an animal, to assess population size. Steve Amstrup had analysed his sighting frequency in the Beaufort Sea and felt that where densities are low, it is better to catch all bears seen.

Denmark

Poul Henrichsen reported that no further work has been done on polar bears in Greenland since the 1983 meeting. Christian Vibe has retired; Erik Born is now working on small cetaceans in Greenland; and Henrichsen's work (see item 7) is only incidentally on polar bears. There is however some hope for at least part of a person-year being assigned to polar bear research in the future. In conjunction with an emphasis on oil and mineral research, the Chairman of Greenland Home Rule may approve the position.

Meanwhile, tags returned from killed bears will still be reported and collected by the Greenland authorities. Tissue samples from 21 polar bears killed by Inuit were collected in 1983-85 in Scoresby Sound, East Greenland. The samples are being analysed by the Greenland Fisheries and Environment Research Institute, Copenhagen, for contents of heavy metals, particularly cadmium and mercury. Collection of tissue samples from polar bears in Greenland will be continued until 1988. Canada offered to assist with aging techniques and exchange of data.

Norway

Rasmus Hansson submitted reports on research and management in Norway (Appendices 6 and 7). Much of the work by Norway is included in Thor Larsen's Ph.D. dissertation. An abstract of the component papers is included in Appendix 6, and the thesis is available on interlibrary loan from the University of Oslo. Larsen is presently the only official researcher on polar bears in Norway, and his job status is uncertain. Future research may include some modelling by Karl Ugland.

There was almost no ice around Svalbard during 1984. Surveys in summer and fall 1984 showed that cub-of-the-year mortality was high. Similar surveys in the spring of 1985 indicated few bears again in that year, possibly because the adult females were stranded on land and in poor condition (see Appendix 6). The PBSG discussed the possible causes of the high cub mortality and aspects of carrying capacity, food availability, and migration versus fidelity to the denning areas. It may be a good subject for further study.

There have been no major changes in management. It is illegal to go ashore on Kong Karls Land without a scientific permit. Interest in oil exploration and development is growing, and this may have some effect on the bear population of Kong Karls Land.

U.S.A.

Although John Burns of the Alaska Department of Fish and Game had been expected to attend, he was unable to come, and the State of Alaska did not submit a report. Since responsibility for polar bears still rests with the Federal Government, research on polar bears and other marine mammals has a low priority for the state.

Steve Amstrup presented a summary of research on polar bears in Alaska 1983-85 (Appendix 8). The maternity denning studies, in particular, have provided some new information: 21 of 26 dens located in 1983-85 were on the drifting pack ice. Radio telemetry was used to relocate the bears in dens. Despite some problems with radio failures, radios will continue to be used, at least through spring 1986.

The field data forms are now entered into computer files, providing quick access for reference, analysis, or plotting of movements.

Future plans (see also Appendix 8) include beginning research in the Chukchi Sea in spring 1986, in order to compare the population of polar bears there with the one in the Beaufort Sea and to determine where the boundary between them lies.

Scott Schliebe presented a summary of the native subsistence harvest of polar bears in Alaska 1980-85 (Appendix 9). In the near future, responsibility for management of the polar bear population is likely to remain Federal, but a possibility still exists that it may go to the State of Alaska. Factors influencing whether the State applies for management authority include adequate funding of a management and enforcement programme and enactment of a subsistence statute which meets Federal requirements and public opinion.

The authority for mandatory licensing of hides for polar bears, sea otters, and walrus presently rests with the U.S. Fish and Wildlife Service (USFWS). They now hope to have regulations which can be implemented by September 1986.

Jim Baker reported on work done by Jim Gilbert. Gilbert assessed methods of surveying marine mammals, especially walrus and polar bears, for population and distribution studies. After summarizing the minimum sample size required for an accurate estimate of Alaska's polar bear population and for estimating the minimum cost, Gilbert recommended that the following be considered for discussion:

a. continue and expand the programme to mark bears with radios that are monitored by satellite to define the range and boundaries of the populations in Alaska;
b. determine whether ultra-violet-sensing or thermal infra-red-sensing video cameras are more reliable by conducting tests at various altitudes over locations where bears are known to be;
c. conduct an aerial survey for polar bears in the Bering and Chukchi seas, using a strip sample procedure and the video cameras selected previously; and
d. conduct a joint census with Canada of the entire polar bear population in the Beaufort Sea.

A testing of strip-transect surveys in the Beaufort, possibly enhanced with six ultra-violet cameras, is being considered.

USSR

No delegates from the USSR attended, but S.M. Uspenskii sent a report summarizing research and management of polar bear populations in the USSR 1981-85 (Appendix 10).

5. Management of Polar Bears in the Beaufort Sea

Stirling summarized the issues. From mark-recapture studies by both CWS and USFWS and recent radio-tracking studies by USFWS, there appears to be a single polar bear population along the mainland coast of the eastern (Canadian) and western (U.S.) Beaufort Sea, possibly as far west as Barrow. There is a need to assess the size of this population and ensure that there is not an excessive kill. The International Agreement on the Conservation of Polar Bears provides for international cooperation and consultation in managing shared populations, but until now this option has not been used.

Schliebe reported on his surveys of the kill in Alaska (see also Appendix 9). The total number of bears killed is not restricted, except that the taking is to be accomplished in a non-wasteful manner for subsistence or handicraft use, and bears can be killed only if the population is not depleted. Even though the harvest occurs over a vast area throughout the year, Schliebe felt that the report is an accurate reflection of total harvest. Sex and age information have been collected from greater than 64% of the harvest. There appears to be a bias in reporting the sex of dependent animals: there is a lower average age of animals of unknown sex and a skewed sex ratio for this age class. There is evidence that females and family groups constitute a high proportion of the harvest. The Beaufort area accounts for 28% of the total state-wide harvest.

The Canadian harvest is set by individual quotas for each village. Recently, the Inuvialuit Game Council in the eastern Beaufort Sea expressed concern that the population might decline if hunting in the western Beaufort Sea continues without any form of control. They have expressed this concern to the NWT Wildlife Service and the Canadian Wildlife Service.

Baker reported that he had visited Barrow in early August 1985 to discuss these concerns with the Mayor of the North Slope Borough. He felt the Alaskan Inuit were aware of the Inuvialuit concerns and were feeling a responsibility to regulate the hunt. Meetings of the North Slope Fish and Game Management Council are scheduled for late August and October 1985, and the issue of polar bear hunting has been added to the agenda; Dale Taylor and Schliebe will be attending. A representative from the Canadian NWT government or the Inuit Tapirisat of Canada will be invited as well.

An amendment was made in 1981 to the Marine Mammal Protection Act to facilitate mandatory reporting and sealing of the harvest. The proposed regulations will the discussed with the Inuit in public meetings in the villages, and information and education programmes will be started in the schools. Stirling pointed out that the total kill from Canada and Alaska is presently 85 to 90 bears from that population, and that the immediate purpose of mandatory regulations in Alaska would not be to reduce the kill, but to monitor and review it, in conjunction with other work designed to assess the population size and distribution.

After extensive discussion, the group decided on two objectives:

a. Complete harvest records are needed, both from the U.S. and Canada. In Canada, the return of jaws and kill information is over 80%. In Alaska, reporting is over 64% and expected to increase once regulations go into effect. A comparative study of harvest information with and without mandatory sealing regulations is planned for the purpose of evaluating the regulation change. It was also suggested that a consultative process and information and education programme be incorporated as part of the contact in the villages when information on the hunt is collected.

b. The second objective is to further communication between the researchers, particularly the Polar Bear Technical Committee (PBTC) and the user groups, mainly the native hunters.

6. Deterrent Research

Peter Clarkson reviewed the NWT Polar Bear Deterrent Programme (see Appendix 4). In addition to researching and testing bear deterrent and detection techniques that could help to prevent or reduce bear/people problems (see also item 12), the project is conducting an education programme for people living and working near bears. Besides the deterrents listed in the summary in Appendix 4, Capsicum (red pepper) repellent spray will be tested at Cape Churchill as a close-range deterrent.

7. Population Differentiation Based on Non-metrical Cranial Traits

Poul Henrichsen presented the study he and Torstein Sjøvold made of 18 non-metrical traits in polar bear skulls collected in 12 areas of Europe and North America (Appendix 11). They felt nine of the traits were not age nor sex correlated, and were consistent enough to be used for population differentiation. However, they were not always confident of the often arbitrary boundaries they chose between areas. The preliminary results and tables are appended.

8. Reproductive Ecology in Female Polar Bears

This is the main portion of a Ph. D. study by Malcolm Ramsay (see Appendix 4). Several papers related to studies of reproductive ecology and strategy of polar bears in the western Hudson Bay area have been prepared.

Ramsay, M.A. and D. Andriashek. Long distance route orientation of female polar bears (*Ursus maritimus*) in spring. J. Zool. (Lond.) 208: (in press).

Ramsay, M.A. and R.L. Dunbrack. Physiological constraints on life-history phenomena: the example of small bear cubs at birth. American Naturalist 127: (in press).

Ramsay, M.A. and I. Stirling. Long-term effects of drugging and handling stress on free-ranging polar bears. J. Wildl. Manage. 50: (in press).

Ramsay, M.A. and I. Stirling. On the mating system of polar bears. Can. J. Zool. 64: (in press).

Ramsay, M.A., I. Stirling, L.Ø. Knutsen, and E. Broughton. Use of yohimbine to reverse immobilization of polar bears by ketamine hydrochloride and xylazine hydrochloride. J. Wildlife Diseases 21: (in press).

Stirling, I. and M.A. Ramsay. Polar bears in Hudson Bay and Foxe Basin: present knowledge and research opportunities. *In* I.P. Martini (ed.). The Canadian Inland Sea. Elsevier Scientific, Amsterdam. (in press).

9. Evaluating Condition in Polar Bears and Black Bears

Marc Cattet presented the results of the 1984 data collection in the NWT, using polar bears killed by native hunters (see also Appendix 4). The research has now been expanded to include a comparison of body condition indices in polar bears and black bears.

Fat is the most variable constituent of the body and most clearly related to nutritional condition. Techniques to determine physical condition are well developed for ungulates, and they are used to provide population trend indicators. At this time, there are no data on the physical condition of polar bears based on the ways in which fat is deposited and mobilized in the body.

The purpose of this research is to develop ways of monitoring the status of wild polar bear populations by evaluating the condition of bears killed by Inuit hunters. Comparable data from black bears will test four hypotheses regarding fat deposition and mobilization in these two species. This should strengthen our understanding of body condition indices in bears.

1. Subcutaneous fat depots vary significantly less in polar bears than in black bears: Subcutaneous fat in polar bears may provide insulation as well as energy storage. In contrast, black bears den during periods of low ambient temperature and use subcutaneous fat mainly as a source of energy.

2. Adult polar bears have a greater dependence on fat stores than do adult black bears, during periods of weight loss: In wild animals, protein reserves (muscle) may vary seasonally, or after the depletion of fat stores. Physiological studies of the serum urea and creatinine levels in bears suggest polar bears are highly efficient at maintaining protein reserves when food is scarce. Black bears appear to show this high protein-reserving efficiency only during denning.

3. In homologous tissues (bone, muscle, fat), polar bears have a higher ratio of unsaturated fats to saturated fats than do black bears: It is believed that the selective deposition of low melting point fats (unsaturated fatty acids) in tissues exposed to cold aids in maintaining flexibility of appendages at low temperatures and allows for the mobilization of fat depots as a nutrient source. Because polar bears occupy colder habitats, it is likely homologous tissues in polar bears will show a higher proportion of unsaturated fats to saturated fats than in black bears.

4. The fat depots in polar bears are characterized by concentrations of long-chain fatty acids not present in black bears: Marine food chains contain characteristic long-chain fatty acids not present in terrestrial food chains. In monogastric animals, such as bears, the fatty acid profile of body fat depots reflects the fatty acid composition of the animal's diet. Thus, polar bears, as top carnivore of a marine food chain, would be expected to contain marine long-chain fatty acids in depot fats.

A number of techniques are being used to gather the data. Morphometric measurements of intact carcasses are being correlated with measurements of total fat, muscle, and bone obtained from half-carcass dissections and used to test hypotheses 1 and 2. Analysis of fatty acid composition, required to test hypotheses 3 and 4, involves fat extraction and gas-liquid chromatography of samples collected during the half-carcass dissections.

Polar bear carcasses are being collected annually from Coral Harbour, NWT and Churchill, Manitoba. The collection in Coral Harbour is being done with the cooperation of Inuit hunters who may kill up to sixty-five polar bears each year. The bears collected from Churchill are associated with human-bear conflicts and are killed through the bear control programme.

Black bear carcasses are being collected from the Province of Alberta. These bears are also associated with human-bear conflicts and are killed by Alberta Fish and Wildlife Officers. Grizzly bear carcasses are also being provided by Alberta Fish and Wildlife, and measurements are collected when the opportunity arises. All laboratory analysis is being done in Edmonton, Alberta at facilities provided by the Northern Forest Centre, the Alberta Fish and Wildlife Division, and the University of Alberta.

10. Population Modelling

Mitchell Taylor summarized the progress on modelling polar bear populations (see Appendices 4 and 13). There was discussion of the problems in estimating some of the parameters because of capture bias, and of the best ways to model populations. A comparison was proposed between the ANURSUS model Taylor has developed and the Norwegian and Manitoba models.

11. Radio Tracking and Satellite Tracking

Although the results from the light-weight radio frequency (RF) collars have been very good, especially in the Alaskan Beaufort Sea studies, there have been some premature failures. Amstrup reported that the major manufacturer, Telonics, has found a battery formulation problem which they believe was the main cause of failure, and which they have now fixed.

Glue-on headmount radios and ear-tag radios have been used with variable success near Churchill, Manitoba. The main problem has been with the whip antenna breaking off because of metal fatigue at the attachment point. Some ear tag radios with the antennae installed internally have been relocated up to eight months later.

Amstrup reported that new models of Telonics satellite radios now weigh only 1.7 kg but can still transmit for 6 hours per day with a 15 month life. Each satellite scan covers a circle with a 2500 km radius, and can receive up to 200 transmitters per scan. This means the system could be flooded by an intensive radio-tagging programme. Two of the new satellite radios are presently on bears in the western Beaufort Sea (see maps in Appendix 8), and more are expected to be used in the 1985 and 1986 field seasons. Costs are about $3500 U.S. each for collars. Providing battery configuration and antenna direction are not affected, some modifications such as a crescent shape may be tried for new collars. USFWS is also investigating the possibility of having a local user terminal in Fairbanks which could receive readouts directly from satellites.

12. Remote Sensing

Peter Clarkson summarized preliminary work done by Compuheat Services of Canada Inc. for the NWT Wildlife Service, to find a system of detecting bears at a distance or from the air. Tests at Churchill in 1984 (see Appendix 4) used infra-red thermograph techniques. Infra-red will continue to be tested on both black and polar bears, and under different weather conditions and survey altitudes. Present problems with the system are a narrow field of view which limits the coverage, even with two cameras, and problems in detecting bears through clouds or in water. The research on detection is continuing under the direction of the NWT Bear Deterrent Programme.

13. Identification of International Priorities in Research and Management of Polar Bears

There was an extensive discussion on the last day of the session on priorities and directions for research and management of polar bears, which resulted in eight resolutions (Appendix 13).

14. Future Objectives for the IUCN Polar Bear Specialist Group

The subject of observers at PBSG meetings was raised. The policy at the last two has been to include 'associated invited specialists' when the meetings were in a location that was not too expensive for them to attend. It was noted that in the first few years of its existence, the PBSG was limited to a small group of scientists working directly on polar bears. Besides exchanging scientific information, they had the specific task of developing the International Agreement. In this circumstance, frank exchange of the viewpoints of different countries was required and this would not have functioned properly with additional participants. In more recent years however, research and management have assumed primacy, and the group felt the invited specialists have provided invaluable input to the discussions.

After discussion, the consensus was that each country should still be limited to two full members, but a limited number of specialists who are dealing with polar bear research or management should be invited to participate in the meetings.

15. Production and Format of the Published Minutes

It was agreed that Canada will produce the minutes from this meeting and supply a camera-ready copy to the IUCN for printing and distribution. Scott said the options were available to have the minutes typeset, published in a smaller format, and with a different colour of cover. The consensus of the group was that since these are only working proceedings and not refereed, speed of publication was more important than the improved appearance of typesetting. They also preferred to stay with a red cover, but with a slightly different front which could include a picture. The IUCN are presently investigating using a floppy disk transfer to their Wang word processing system, but that would not be an option for the publication of these minutes.

16. Schedule of Meetings of the IUCN Polar Bear Specialist Group

All the representatives agreed that regular meetings should probably be scheduled, to ensure lead time for planning and budgeting, and to maintain contact with some of the countries with smaller research or management programmes. In the past, the meetings have been at two-year intervals but there may not still be a need to meet so often. One proposal was that the interval be changed to three years, and be held in conjunction with the U.S.-based International Conference on Bear Research and Management (IBA) or with the International Theriological Congress (ITC), which is more internationally located and attended.

Scott noted that elements of the USSR Government involved with UNEP Programmes had indicated willingness to host the next PBSG meeting in Moscow, and that non-convertible UNEP credits could likely be used for accommodation and Aeroflot transportation. The PBSG Chairman will notify the USSR that the PBSG wish to accept their offer; Scott will propose such arrangements, as part of a UNEP project.

17. Election of a New Chairman

Steve Amstrup of the U.S. was nominated by Taylor, seconded by Ramsay, as the new chairman of the PBSG; the group agreed unanimously. Bob Scott, speaking for the IUCN and for the PBSG as a whole, acknowledged and thanked Ian Stirling for his two terms as chairman.

18. Action on Resolutions and Concerns in 1983

The book 'Review of International Wildlife Agreements' by Simon Lyster, mentioned in Item 15 of the 1983 PBSG meeting, was recently published in Britain with considerable publicity. No one present had seen it yet.

A book on polar bears by Barry Lopez, which he was researching at the 1983 meeting, had not been seen by any at the meeting.

Item 17 from the 1983 meeting concerned the ethics and problems of working on a 'threatened' species. The IBA, which met immediately after the 1983 PBSG meeting, also covered this topic, with input from members of the PBSG. A resolution has not yet been

formulated by the IBA.

Jack Lentfer responded to a request from the SSC Newsletter (Item 19 of the 1983 meeting) for a review of the PBSG history and achievements. (Lentfer, J. 1985. Specialist Group with a Difference. IUCN Species Survival Commission, May 1985 (No. 5). pp. 7-8.)

APPENDICES

APPENDIX 1: IUCN/SSC - POLAR BEAR SPECIALIST GROUP, AUGUST 1985

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APPENDIX 3: POLAR BEAR MANAGEMENT IN CANADA 1982-84

W. Calvert[1], I. Stirling[1], R.E. Schweinsburg[2], L.J. Lee[2], G.B. Kolenosky[3], M. Shoesmith[4], B. Smith[5], M. Crête[6], and S. Luttich[7]

Since the February 1983 workshop, there have been some changes in the management of polar bears in Canada. The regulations covering polar bear management in Canada as of 31 December 1984 are summarized in Table 1 and Appendix I. Changes made prior to this 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 Federal Government, two territories (Northwest Territories and the Yukon Territory), and four provinces (Manitoba, Newfoundland, Ontario and Quebec), continued to meet annually to discuss research results and to make management recommendations. Research programmes arising from these meetings are outlined by Calvert *et al.* (1985) in these proceedings.

The polar bear quotas by jurisdiction are based on recommendations by the Federal-Provincial Committees. The quotas and numbers of polar bears killed in 1982-83 and 1983-84 are summarized and recommended quotas for 1984-85 are also given (Table 2). Changes in the boundaries of some zones have been proposed for discussion but no action has yet been taken.

Manitoba

Polar bears are classified as big game animals in Schedule A of the Manitoba Wildlife Act (October 1980). The Cape Churchill and Cape Tatnum Wildlife Management areas, established in 1978 and 1973 respectively, afford adequate protection to the polar bear denning and staging areas between Churchill and the Ontario border. The Cape Churchill Wildlife Management Area Plan is being completed.

The Manitoba Department of Natural Resources continued the annual Polar Bear Control Programme during the fall period in 1983-84 and 1984-85.

In 1983, the Polar Bear Control Programme began in late August and continued until early December. Bear numbers in the Churchill area were extremely high during the

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Table 1. Summary of regulations covering polar bear management in Canada as of 31 December 1984.

Category	Jurisdiction					
	Manitoba	Newfoundland	Northwest Territories	Ontario	Quebec	Yukon
Hunting	-closed	-none at present -reopening under consideration	-01 Oct. to 31 May in Keewatin, Foxe Basin and Grise Fd; 15 Nov. to 31 May for 12 tags in Repulse; 01 Oct to 31 May for 4 tags in Lake Harbour; 01 Dec. to 31 May all others	-closed	-none	-01 Oct. to 31 May in GMZ1 only
Who can hunt	-Treaty Indians for own use, but sale of hide prohibited	-no one legally	-residents and non-residents with Wildlife Certificate if HTA provides necessary tag	-permissible kill by Treaty Indians	-Inuit and Indians	-Inuit only who are issued polar bear tags
Quota	-maximum of 35 annually (not exercised at present)	-4 possible but not yet allocated	-quota by settlement -1983-84 limit equals 614	-permissible kill of 30 (by restricting sales over 30)	-none	-total quota of 6, 5 of which are presently included in NWT total
Females and cubs protected	-no	-yes	-cubs and females with cubs under 1.5 m in length, prior to being stretched and dried or 1.8 m after being stretched and dried	-no	-no	-yes
Bears in den protected	-no	-yes	-yes	-no	-no	-yes

Table 1. Continued

Category	Jurisdiction					
	Manitoba	Newfoundland	Northwest Territories	Ontario	Quebec	Yukon
Proof of origin of untanned bear	-seal proposed	-documented proof (no seal implemented to date)	-seal on hide and export permit	-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)	-required -no cost	-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 Chief of Wildlife Service	-discretion of District Manager	-discretion of Minister	-discretion of Conservation Officer (Wildlife Research Permit)
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 Ministry staff	-$15.00 Royalty fee -must be sealed	-permit required from Conservation Officer
Basis of Regulation	-Wildlife Act 1970	-Wildlife Act 1970 -classified as big game	-Wildlife Ordinance and Regulations; 1960 Order-in-Council (Endangered Species)	-Game and Fish Act 1970	-Wildlife Conservation and Management Act 1983 -Order-in-Council 3234 - 1971 -Bill 28 - 1978	-Wildlife Act, 1981: Wildlife Regulations

Table 1. Continued.

Category	Jurisdiction					
	Manitoba	Newfoundland	Northwest Territories	Ontario	Quebec	Yukon
Fur Dealer Authority	-$10.00 restricted -$25.00 general -$25.00 travelling	-$2.50 for each store -$2.50 travelling	-$150.00 Fur Dealer's Licence for each of the first 2 consecutive years, then $10.00 for each year after -$200.00 Travelling Fur Dealer's Licence for each of the first 2 consecutive years, then $100.00 for each year after	-$10.00 licence	-$200.00 licence -Order-in-Council 1274 - 1984	-$25.00 Resident, -$300.00 Non-resident, -$5.00 Agent, -$25.00 Non-resident restricted
Taxidermy	-$5.00 Wildlife Act Licence	-legislation in preparation; legal if obtained legally elsewhere	-$25.00 Taxidermist Licence	-see Tanner's Authority		-$25.00 Resident Licence, -$30.00 Non-resident Licence
Tanner's Authority	-$10.00 licence	-no legislation at present	-$25.00 Tanner's Licence	-Game and Fish Act (fee currently under review)	-$150.00 Tanner's Licence	-$2.00 Resident, -$10.00 Non-resident
Live Animals Capture	-Ministerial permit	-illegal unless authorized by permit from Minister for scientific purposes	-$5.00 licence to capture live wildlife -$100.00 - $5000.00 licence to export live wildlife	-District Manager	-Ministerial permit	-free Wildlife Research Permit, -$5.00 fee for capture of live wildlife
Live Animals Export	-Ministerial permit	-Wildlife Export Permit	-Wildlife Export Permit	-District Manager	-Ministerial permit	-Special permit

Table 2. Quotas and known numbers of polar bears killed in Canada, 1982-83 and 1983-84.

	Manitoba	Nfld.	NWT	Norway	Ontario	Quebec	Yukon	Total
1982-83[1]								
Suggested quota	35	4	614[2]	5[4]	30[3]	*	1	689
Bears killed[5]	9	0	630	0	18	36	1	694
Bears captured, held in zoos	0	0	0	0	0	0	0	0
1983-84								
Suggested quota	35	4	614	5	30	*	1	689
Bears killed[5]	18	0	597	0	33	42	0	690
Bears captured, held in zoos	2	0	0	0	0	0	0	2
1984-85								
Suggested quota	35	4	616	5	30	*	1	691

[1]Management year extends from 1 July to 30 June the following year
[2]Includes 5 tags from the Yukon quota distributed by NWT
[3]Permissible kill
*The allowable kill has not yet been set
[4]Allowed to Norway for protection of life under the Agreement on the Conservation of Polar Bears (1973)
[5]Includes quota and sport-hunt kills, problem kills, illegal kills, bears found dead, and handling deaths.

last three weeks of the period. By December 4, the sea ice had formed and most of the bears had left.

Nearly 300 man-days were required to respond to 191 calls (76 in 1982) regarding polar bear problems. From November 24 - December 1, 84 calls were received. Only three incidents resulted in property damage totalling $1050. However, two incidents resulted in personal injury and death. The arm of a photographer from Wisconsin was severely mangled by a bear during a tour to Cape Churchill. About two weeks later, a Churchill resident was killed by a bear near the burned ruins of the Churchill Hotel.

Problem bears were captured at the garbage dump, in Churchill, and at Camp Nanuk. Of the total 41 problem bears live-captured and placed in D-20, 19 were culvert-trapped (compared to 5 in 1982) and 22 free-ranged (1 in 1982). Nine problem bears were moved north of Churchill by helicopter in order to make more room in D-20.

Known polar bear mortality in Manitoba July 1, 1983 - January 1, 1984

1.	Quota kill	0
2.	Non-quota kills	
	Protection of life and property	10
	Illegal kill by Inuit	1
	Scientific Research	2
	Natural mortality	4
	Destroyed by DNR during darting	1
	Sent to zoos	2
	Total:	20

In 1984, the Polar Bear Control Programme season in Churchill was from 1 September to 2 November, more than a month shorter than the 1983 season. There were 69 reported incidents, and 200 man-days expended. There was one serious encounter - a mauling in which there appeared to be extenuating circumstances.

Revisions to the Polar Bear Control Programme now define three zones: the Churchill inhabited area, which includes the townsite, dump, and cottages; the Churchill periphery, which is the area accessible by road; and remote areas such as the coastal region. In the priority area - the Churchill inhabited zone and in the Churchill periphery, all bears, including family units, will be placed in D-20 or flown out of the area. Bears identified as chronic problem bears with three or more incidents will be either sent to zoos or destroyed to remove them from the population.

In addition, there will be regular meetings with the Local Government District before and after the control period, and there will be an increased public information and education programme. The emphasis will be on brochures, signs, colouring books, a newsletter, VCR cassette programmes for schools, and local radio spots.

To minimize attractants and problems, the existing bylaws and regulations will be enforced. There is now a provincial regulation prohibiting baiting other than by research permit. In addition, the status of polar bears may be changed from 'big game' to 'protected'.

Of 373 bears tagged in the accessible area near Churchill from 1966 to 1983, 25 were considered to be chronic problem bears. Seven of those problem bears are expected to return, and will be removed from the population if they do. The emphasis in problem bear control will be on females that return to the Churchill inhabited area with each new litter.

Known polar bear mortality in Manitoba July 1, 1984 - January 1, 1985

1.	Quota kill	0
2.	Non-quota kills or to zoos	
	Protection of life and property	6
	Illegal kill	1
	Scientific Research	3
	Natural mortality	2
	Polar Bear Control Programme	3
	Sent to zoos	8
	Total:	23

Newfoundland

Although there is still no intent of taking a harvest, Newfoundland will retain their quota of four for problem bears.

Northwest Territories

Zones and Quotas

The only management change which has actually been placed into law is the assignment of two regular quota tags to Baker Lake.

The boundaries of management zones (Fig. 1) and some of the regulations affected by them are likely to be modified and updated, to reflect current understanding of polar bear distribution. Changes in opening dates and in geographical restrictions on some red tags are pending, but have not yet been passed. Both the Technical Committee and the Administrative Committee have approved the zone changes. The proposed zone regulation changes have been sent to Regions for community consultation. Special quota stipulations for Sachs Harbour and Frobisher are likely to be eliminated and the Melville Island quota of 12 will be permanently assigned to the Western Arctic and shared between Sachs Harbour and Holman.

If management of polar bears is returned to the State of Alaska, consultation between NWT, Yukon, and Alaska should take place before quotas in some of the Zone H communities are set.

Special Licence (Sports) Hunts

The sport-hunt in the NWT continued in 1983 and 1984 with a limited number of hunts. Under the 1968 NWT Game Ordinance, these Inuk-guided sport-hunts, using traditional hunting methods, have been allowed since January 1970. Tags used for the sport-hunt must be taken from the settlement quotas. Tags allocated to unsuccessful sport-hunters cannot be used later by Inuk hunters. The time period during which sport-hunting can be carried out is from 1 February to 31 May.

Since 1977-78, the NWT government has not organized the sport-hunts. Instead, private firms now arrange bookings and expediting for these hunts. Qaivvik Ltd. of

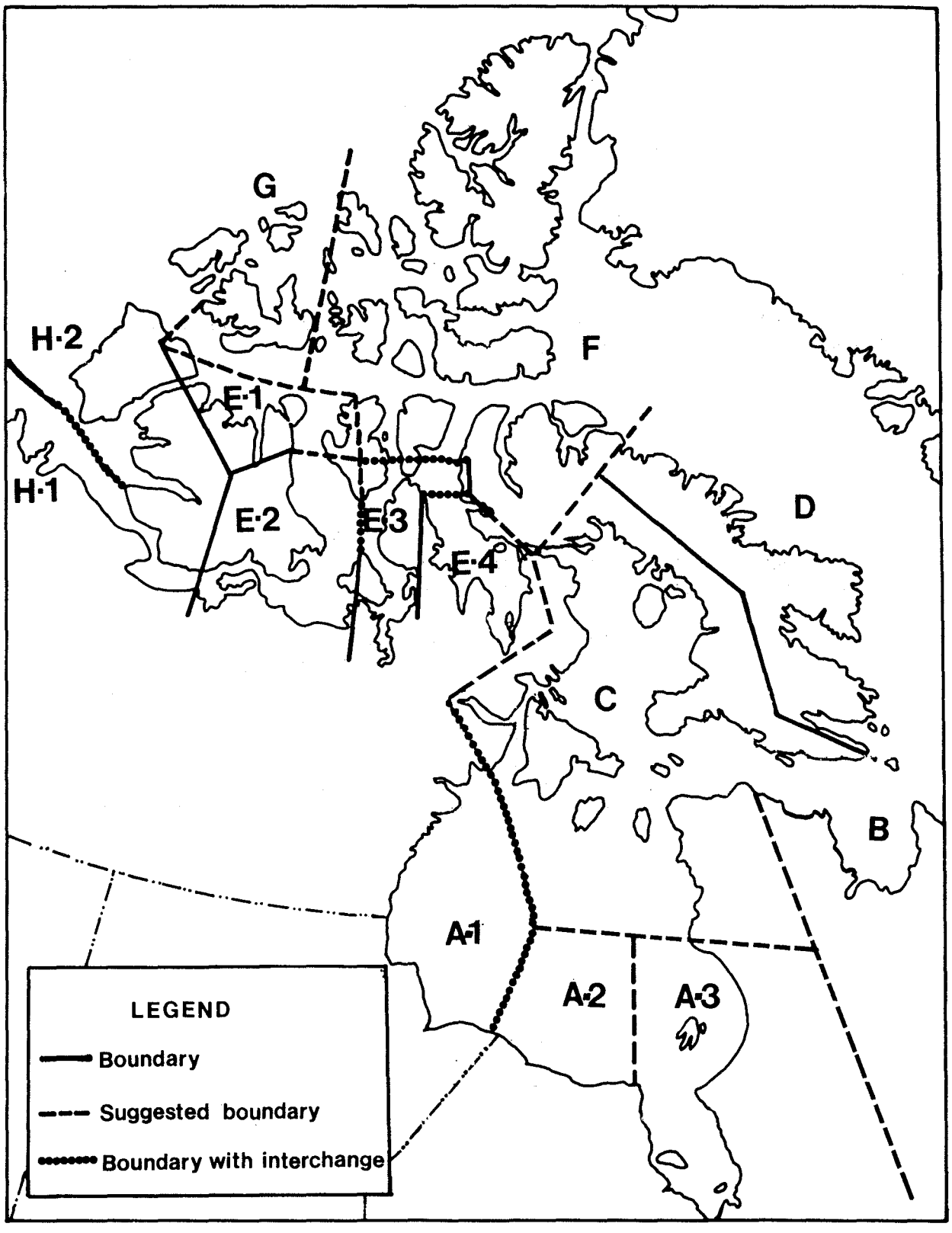

Figure 1. Proposed zone boundary changes in the NWT, Canada

Yellowknife sponsored hunts in the Central Arctic, the Inuvialuit Development Corporation of Inuvik offered hunts in the Western Arctic, and Canada North Outfitters from Waterdown, Ontario organized hunts in the Eastern Arctic. At present, these firms are not routinely required to provide statistical information, reports, or biological specimens from the polar bears killed.

As in previous years, the number of applicants for the sport-hunt has been greater than the number of tags made available for such hunts by the settlements. 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-hunts and this provision has been added to the NWT wildlife regulations. Because of the ubiquitous use of snowmobiles, there are few trained and conditioned sled dogs and few experienced dog handlers. Consequently, sport-hunts are not licensed unless enough suitable dogs are available in the settlements requesting the permission. Also, although the number is becoming fewer, many hunters are unwilling to give up their polar bear tags in exchange for the sport-hunting fee, and the relatively high prices paid for polar bear hides may discourage hunters from committing a substantial portion of their time to this activity.

There were 36 sport-hunts in 1983 and 50 in 1984, up from 23 in 1982, and more settlements were involved (7 in 1983 compared to 5 in 1982). It appears that more and more Hunters' and Trappers' Associations, which are usually poorly funded, are beginning to see the economic benefits of sponsoring sport-hunters.

Details of settlement quotas in the NWT and the conditions attached are given in Appendix I of this submission.

Ontario

Management policies and allowable harvest limits remained unchanged during 1983 and 1984.

Quebec

Polar bear populations harvested by Quebec Inuit, and the maximum sustained yields they can provide, are not well studied. The bear harvest is regulated by the James Bay and Northern Quebec Agreement, which gives exclusive hunting rights to native people. According to the Agreement, hunting regulations must be approved by the Hunting, Fishing and Trapping Coordinating Committee; this committee has delegates from native people, and the Federal and Quebec governments. In May 1984, the Coordinating Committee adopted the following hunting regulations:
-polar bears may not be killed between June 1 and August 31;
-female polar bears accompanied by cubs may not be killed at any time;
-cubs less than 2-years-old may not be killed at any time;
-when a bear is skinned, a government seal must be attached to the hide.

Females with cubs and bears under two years, which represent an important segment of the total bear population, are thus now protected from hunting. Polar bear harvests in Quebec should not endanger the conservation of this species; should signs of overharvest appear, bear specialists should prove to the Coordinating Committee that hunting regulations must become more conservative.

Yukon

Yukon has six quota tags, five of which are loaned to the Government of NWT for distribution through the Aklavik Hunters and Trappers Association.

Industrial development activities on the Yukon coast are accelerating with oil company interest in harbour facilities and possible quarry sites. Inuit and Indian land claims previously held up development, but with these apparently being completed, the potential for development increases. National Park status appears likely for a large tract of land west of the Babbage River, north to the height of land. Hearings into the development of shore-based facilities on the Yukon coastline resulted in a pro-development position by the Federal and Yukon governments and an anti-development position by the NWT government. Implications of the native claims settlements to polar bear management cannot yet be determined. A more aggressive role in land use planning and monitoring is proposed for the future, given the increasing industrial development and claims settlement. Harvest patterns will be closely monitored to determine methods to reduce female vulnerability.

Northern Oil and Gas Action Plan (NOGAP) funds were used to develop two educational programmes to address management concerns in this area. An 'Arctic Bear Fieldguide' was developed and reviewed by Canadian and American biologists and a slide/tape programme was developed.

Harvest Management

Discussions about the research directions for the Beaufort Sea population in 1984 caused concerns about the harvest management of this population. The following concerns were brought to the attention of the Administrative Committee:

a) Failure of the U.S. Government to meet the terms of the International Polar Bear Agreement in their Marine Mammal Act. Under this act, the U.S. cannot enforce the collection of harvest statistics, regulate the sex composition and magnitude of the harvest, nor investigate potential illegal hide sales. Harvests in eastern Alaskan communities are currently constrained by attitudes of respected elders but this is subject to change. If population projections indicate declines are probable, we should do something.

b) Potential exists for increased defence of life or property kills associated with petroleum exploration and extraction. At present there is no system to include these kills in community quotas.

c) The potential for jurisdictional problems in the management of this population is large, given self-determination efforts by native, state, community and territorial governments. Northern Yukon wildlife will soon be managed by a board consisting of representatives from Parks Canada, the Yukon Territorial Government, the Council for Yukon Indians, and the Committee for Original Peoples Entitlement. This means a management board for the Beaufort Sea population could potentially become unwieldy and ineffective. There is a need to calculate an interim population estimate for management purposes (until the research results are complete), calculate total female kills that can be sustained within portions of the area and then let representatives from the communities come to agreement over female or total kills per community (including northeast Alaska)

and decide how industrial kills are to be accommodated.

d) High female vulnerability along the mainland coast and from communities near denning areas. Given the high vulnerability, some coordinated system to restrict hunter harvest of females is required.

Federal

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973) has 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 products legally exported or imported. Data for 1975-81 were included in the management reports prepared for the previous two IUCN meetings. The 1982 and 1983 data are summarized in Table 3. Most of the exported hides were destined for Japan.

Table 3. Number of permits issued for polar bears, polar bear hides, and polar bear parts to be legally exported from Canada, 1 January 1982 to 31 December 1983 (from McLean and Robillard 1983 and 1984).

	1982	1983	Total
Live polar bears[1]	3	6	9
Polar bear hides[2]	370	264	634
Skulls/jaws	1	4	5
Pieces of fur	-	6	6
Claws	50	-	50
Gall bladders	-	102	102
Muscle, pad specimens	-	5	5

[1]for zoos
[2]includes some hides with skulls and some as whole mounts

References

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McLean, R.S. and J.R. Robillard. 1983. 1982 annual report for Canada. Can. Wildl. Serv. CITES Rep. No. 10. 54 pp.

McLean, R.S. and J.R. Robillard. 1984. 1983 annual report for Canada. Can. Wildl. Serv. CITES Rep. No. 11. 63 pp.

Appendix I: NWT SETTLEMENT QUOTAS AND CONDITIONS - December 31, 1984

Bear, Polar

(a) General hunting licence holders: May hunt polar bears, other than cubs, that are not accompanied by a cub, in accordance with the number of polar bear wildlife tags held;

(b) Other persons: May, subject to paragraph (d) and with the approval of the Hunters' and Trappers' Association, hunt polar bears, other than cubs, that are not accompanied by a cub, in accordance with the number of polar bear wildlife tags held;

(c) The respective number of polar bears that may be killed in any one-year period commencing 1st July and, where applicable, the conditions attached to the hunting, shall be in accordance with the following quotas and conditions:

Wildlife Management Unit/Zone	Hunters' and Trappers' Association	Regular Quota	Special Quota	Conditions
B	Arctic Bay	12		See paragraph (e). See Baffin Island A Special quota conditions.
B/4	Baffin Island A		8	The Superintendent may vary special quotas by 8 for the Hunters' and Trappers' Associations in Arctic Bay and Pond Inlet. These Hunters' and Trappers' Associations may divide the special quota of 8 between them on the joint recommendation of both. Special quota bears must be hunted in Prince Regent Inlet, south of Cape York, and north of Cape Kater.
I	Baker Lake	2		
D	Beaufort		5	All of which must be taken west of 135° 00'W. and the lower jaw of each must be given to an officer.
B	Broughton Island	22		Lower jaw of each must be given to an officer.
B	Cambridge Bay	10	5	See paragraph (e).

B	Cape Dorset	10		
I	Chesterfield Inlet	8		See paragraph (e). See Keewatin A Special quota conditions.
B	Clyde River	45		The lower jaw of each must be given to an officer.
B	Coppermine	2	4	See paragraph (e).
J	Coral Harbour	65		
J	Eskimo Point	15	5	See paragraph (e). See Keewatin A Special conditions.
B	Frobisher Bay	18		8 of which must be taken north of 62° 30' n. and west of 65° 10' W.
B	Gjoa Haven	9	5	See paragraph (e).
A	Grise Fiord	33		At least 6 of which must be taken from Norwegian Bay.
B	Hadley Bay	4	4	See paragraph (e).
I	Hall Beach	7		
B	Holman Island	16	4	See paragraph (e).
I	Igloolik	18		
J/1	Keewatin A		10	The Superintendent may vary special quotas by 10 for the Hunters' and Trappers' Associations in Chesterfield Inlet, Eskimo Point, Rankin Inlet and Whale Cove. These Hunters' and Trappers' Associations may divide the special quota of 10 between any two or more of them on the joint recommendation of all.
B	Lake Harbour	13		4 of which may be taken after Oct. 1 and before Dec. 1 and 9 of which must be taken after Dec. 1.
A	Melville Island	12		alternates yearly between Sachs Harbour and Holman
B	Pangnirtung	14		
C	Paulatuk	13	4	See paragraph (e).

I	Pelly Bay	10	5	See paragraph (e).
B	Pond Inlet	15		See paragraph (e). See Baffin Island A Special quota conditions.
J	Rankin Inlet	10		See paragraph (e). See Keewatin A Special quota conditions.
I	Repulse Bay	20		12 must be taken after 15 November and the remainder after 01 December.
A	Resolute Bay	34	4	See paragraph (e). At least 2 special quota polar bears must be taken in Creswell Bay south of Fury Point.
B	Sachs Harbour	18	4	See paragraph (e). Special quota polar bears must be hunted north of 73° 00' N.
J	Sanikiluaq	20	5	See paragraph (e).
B	Spence Bay	22	5	See paragraph (e).
C	Tuktoyaktuk	22	4	See paragraph (e). Special quota bears must be hunted west of 135° 00' W.
I	Wager Bay		4	See paragraph (e). Quota is divided between Chesterfield Inlet and Repulse Bay
J	Whale Cove	12		See Keewatin A Special quota conditions.
	Total	531	85	

(d) Commercial tags: The meat of polar bears taken under paragraph (c) may be sold commercially under the authority of a commercial tag;

(e) In paragraph (c), the expression "See paragraph (e)", shall be construed in accordance with the following:

(i) no special quota polar bear tags will be distributed by an officer to an HTA unless:
(A) the lower jaw, and
(B) all information requested by an officer pertaining to each polar bear killed on the regular polar bear quota, has been provided to an officer.

(ii) Subject to subparagraph (i), an officer will distribute quota tags to an HTA on the condition that:

(A) all lower jaws, and

(B) all information requested by an officer pertaining to each polar bear killed on the special polar bear quota, will be provided to an officer.

APPENDIX 4: RESEARCH ON POLAR BEARS IN CANADA 1982-84

W. Calvert[1], I. Stirling[1], R.E. Schweinsburg[2], L.J. Lee[2], G.B. Kolenosky[3], M. Shoesmith[4], B. Smith[5], M. Crête[6], and S. Luttich[7]

INTRODUCTION

Most polar bear research in Canada is conducted by Federal, Territorial, and Provincial governments. This is largely because of the cost involved, but also because of the management responsibilities of those governments. Some research projects are conducted by universities and coordinated with government research through bilateral discussions and the Federal-Provincial Polar Bear Technical Committee (PBTC). This report summarizes the research conducted, and lists reports completed, between 1982 and 1984.

COOPERATIVE STUDIES

Computerized Data Base and Modelling

Tagging and hunter-kill data continue to be entered into the computer in Edmonton as they are collected, edited, and corrected. There are now more than 13 000 separate records on file, including the mark-recapture data from all jurisdictions and data on all the native kills. A copy of the formatted data file is also on the Government of NWT computer in Yellowknife and is accessible with various statistical packages.

After a modelling workshop in Vancouver in February 1984 in conjunction with the PBTC meeting, the population analysis and modelling package ANURSUS was developed to the point where it could be used to help plan research and management directions. The first "use" workshop was held in Yellowknife in August 1984, the second that December, and a third in February 1985 in Edmonton, following the PBTC meeting.

The workshops investigated the data in hand and used them to project harvest levels for each management zone. Working with the ANURSUS models also pointed out weaknesses in the data and made obvious the next steps in research and data analysis.

[1] Canadian Wildlife Service, 5320 - 122 St., Edmonton, Alberta T6H 3S5
[2] NWT Wildlife Service, Government of NWT, Yellowknife, NWT X1A 2L9
[3] Ministry of Natural Resources, Box 50, Maple, Ontario L0J 1E0
[4] Department of Natural Resources, 1495 St. James St., Winnipeg, Manitoba R3H 0W9
[5] Y.T.G. Wildlife Branch, Box 2703, Whitehorse, Y.T. Y1A 2C6
[6] Direction de la faune terrestre, 150, St-Cyrille Est, 5e étage, Québec QC G1R 4Y1
[7] Labrador Wildlife Division, Box 488, Station C, Goose Bay, Labrador A0P 1C0

Among other points, the first two workshops indicated that:

1. overharvest appears to be occurring in some, if not all, of the zones, the most severe occurring in D-1;
2. research should be directed toward a population estimate because even a good estimate of adult survivorship will be too imprecise to project population growth;
3. we should be looking for a number or "constellation" of indices, particularly in our harvest data, that would sum to a population trend indicator;
4. the present ANURSUS package should be "frozen" and documented as ANURSUS I. Subsequent versions can then be documented and identified differently.

The workshop in February 1985 had several objectives:

1. review of the report from the December workshop;
2. zone by zone consideration of the data sets for uniformity and consistency;
3. zone by zone determination of parameters in ANURSUS I;
4. priorize zones for projection model comparisons with several other available models; and
5. review of analysis, modelling, and data needs.

Research on New Immobilizing Drugs

Summer tagging in hot weather is necessary for obtaining certain information on distribution, but overheating as a side-effect of the drug or as a result of being chased during tagging has always been a problem. Injecting drugs in the more vascular areas of the neck and shoulders speeds induction. The rectal temperature is monitored, and water is poured over bears to cool them if necessary. Ketamine and Rompun, which are currently used in a 1:1 ratio, cause the head to drop quickly, making it difficult to tell when a bear is sufficiently drugged to be safe to approach.

Telazol (tiletamine hydrochloride and a tranquilizer, zolazepam hydrochloride), also known as CI-744, was tested at Churchill in fall 1983, and in Manitoba and Ontario during summer 1984. The results continue to be very promising. Induction is rapid, as is initial recovery, though complete recovery takes longer, and boosters can be used to prolong induction. High doses did not significantly increase induction or recovery times, but the bears were groggier. Temperature was depressed slightly on the captive bears in D-20, and it did not increase as much as with other drugs on the bears chased by the helicopter. Although most bears were able to thermoregulate, the very fat pregnant females were unable to dissipate heat quickly, even with panting. Ketamine-Rompun, with a yohimbine antagonist, may be the better drug combination for them.

It is not known how stable Telazol is. The amounts used in Churchill were mixed from powder at the veterinary laboratory at 300 mg/ml and used at 5 mg/kg. It was suggested that a study, probably costing 10-20K, should be done to thoroughly test Telazol, and to answer questions such as time for it to be fully metabolized, when the meat would be safe to eat.

Warner-Lambert/Parke-Davis, which holds the patent for Telazol, hope it will be commercially available from an affiliate in Germany or France in about a year. It may be available for further experimental use sooner.

Another drug, yohimbine, was tested as an antagonist to Ketamine-Rompun in August 1984. It was usually injected sublingually to induce recovery after processing of the

bear was completed. It had the additional effect of lowering core temperature. Recovery was rapid, and there was no evidence of re-induction. The NWT Wildlife Service (NWTWS) also injected yohimbine intra-muscularly to raise breathing rate. Although it is possible one handling death may have resulted from yohimbine, several other bears were probably saved because it was used. Yohimbine has been readily available to veterinarians, but its status is presently being reviewed, and availability may become more restricted.

Collection of Reproductive Tracts

The NWTWS, in conjunction with the Canadian Wildlife Service (CWS), continued the collection of reproductive tracts from several arctic settlements in 1983 and 1984. The information from Clyde River and Broughton Island will be compared to samples from Coral Harbour for a CWS study of polar bear reproductive biology in Keewatin and will also augment productivity information from mark-recapture studies in the Clyde River region. The analyses will now be done by NWTWS rather than CWS.

Collection of Blood Samples

Blood samples were collected in 1983 and 1984 from captured bears at several sites, including Baffin Island, Churchill, Ontario, and the High Arctic. Under contract with the NWTWS, Dr. J.C. Haigh of the Western College of Veterinary Medicine, University of Saskatchewan, is analyzing blood samples from several sites for indications of antibodies to *Leptospirosis* sp. or *Trichinella spiralis*, or viruses of other diseases.

Phylogenetic investigations by Dr. J. Clayton, Department of Fisheries and Oceans, Winnipeg, have produced some evidence that there may be a genetic polymorphism for LDH in polar bears. Clayton is collecting blood from several different populations with the hope of demonstrating geographic stocks. He is also interested in racemization analysis of eyeballs from polar bears killed by Inuit hunters. These studies are continuing and reports will ultimately be produced.

The Western College of Veterinary Medicine has also conducted progesterone analyses on blood sera. As a result of this analysis, M. Ramsay has shown that a practical and inexpensive ($5/sample) method of pregnancy diagnosis is available which is very accurate if the blood samples were taken in July or later. The method may even be useful for determining pregnancy as early as late May.

Preliminary urea/creatinine determinations by Dr. R. Nelson of the Carle Foundation Hospital at the University of Illinois show clear differences among bears feeding at the dump, those in the denning area, and those at the coast. Nelson is interested in metabolic changes through the year. A paper is in preparation on the urea/creatinine ratios of fasting versus feeding bears.

Monitoring of Pollutant Levels in Polar Bear Tissue

The NWT Wildlife Service, in conjunction with the Dr. R. Norstrom of the CWS Toxicology Laboratory, began a collection of tissues for pollutant analysis in the spring of 1982. Samples of liver, fat and hair were collected from most areas across the arctic (Beaufort Sea, Amundsen Gulf, north, central and southeast Baffin Island, Lancaster Sound-Barrow Strait, the Central Arctic, Foxe Basin-Hudson Strait, and Western Hudson Bay) to be analysed for heavy metals and organochlorides.

Norstrom is maintaining a tissue bank of liver and fat from polar bears, and is considering making more collections from other animals in the food chain. The Eastern Arctic collection is completed and is now being analysed. It will be published in due course.

The results of the Western Arctic collection are in two recently completed papers; portions of their abstracts follow. The first, "Heavy metals and essential elements in livers of the Polar Bear (*Ursus maritimus*) in the Canadian Arctic" has been submitted to Science of the Total Environment.

Polar bear livers (67) from six management zones in the western and central Canadian Arctic were analysed for 22 elements. Several (Ba, Be, Co, Mo, Ti, V, and Zr) were near the detection limit in all cases. Baseline data were obtained for the remaining elements: Ag, As, Ca, Cd, Cu, Fe, Hg, K, Mg, Mn, Na, P, Se, Sr, and Zn. No statistically significant effect of age, sex or geographical location was found for any elements except Cd, Hg and Se, for which age and geographical location effects were found. The frequency distribution of Zn levels was bimodal. The second peak in the distribution appeared to be related to elevated levels of Cu. Average level of Cu was 104 mg/kg (dry wt.), higher than other marine mammals. Average levels of Cd were significantly higher in the eastern zones, but were always 1.0 mg/kg (dry wt.), significantly lower than their prey species. This may be due to the preference of polar bears to eat seal skin and fat which is low in Cd. Levels of Hg tended to be higher in the western zones bordering the Beaufort Sea, which may be related to a higher proportion of bearded seals in their diet. Mean Hg levels ranged from 20 mg/kg in the eastern zones to 70 mg/kg in the western zones. Levels of mercury in the eastern zones were related to age by the expression: Hg (mg/kg dry wt.) = 15.7 + 8.0 Age (years). Mercury levels in the most northerly zone near Melville Island were very high: Hg (mg/kg dry wt.) = 18.4 + 27.5 Age (years). Levels of Hg and Se were very highly correlated, with a molar ratio of 1.27:1, Hg:Se.

The other paper, given at the International Conference on Arctic Water Pollution Research, is "Long-range transport and accumulation of organochlorine pollutants in arctic marine mammals".

It has been known since the late 1960s that the organochlorine (OC) compounds DDT and PCBs were present in arctic marine mammal at mg/kg levels. These relatively high concentrations in a supposedly pristine environment were at first surprising. However, bioaccumulation factors were large because of the high fat content of arctic mammals, thus OC concentrations at the fish, invertebrate and planktonic trophic levels were much lower. In the early 1970s, research on global distribution of OCs showed that vaporization from land and plant surfaces occurred, and that these compounds were scavenged by the oceans through dry deposition and washout. Subsequent studies showed that ocean currents and exchange between the atmosphere and ocean caused widespread movement of OCs to

even the most remote areas of the earth.

There have been few systematic studies of OC levels in arctic biota, and none at all on levels in the physical environment. Another weakness in our understanding of the nature of OC contamination in the arctic is the limited number of compounds determined. For example, Atlantic Ocean water and air samples have been shown to contain higher levels of chlordane and toxaphene than DDT or PCBs, but no arctic samples have been analysed for these compounds. We discovered a number of other compounds by a gas chromatography/mass spectrometric analysis of polar bear fat and liver samples taken from the area between the Beaufort Sea and Barrow Strait in 1982. Technical chlordane-related residues were as predominant as PCBs. The metabolite oxychlordane had the highest residue level of any single compound. Other compounds identified included dieldrin, heptachlor expoxide, alpha-hexachlorocyclohexane and hexachlorobenzene.

Residue levels in polar bear, ringed seal, narwhal and beluga tissues from across the Canadian arctic will be discussed in terms of their respective food webs, and hypotheses put forth on the sources and vectors of contamination. Preliminary analysis of the data suggests that North American continental air masses are the main source, and Atlantic/Arctic Ocean currents are the vectors, giving a lag time of five to six years for arrival of contamination in the Canadian Arctic archipelago.

Telemetry

Several of the bears observed at the Churchill dump and along the Manitoba coast were again instrumented with ear tag radios in 1983. The main problem encountered was metal fatigue in the free antennae, causing them to break off after about three weeks. If a different antenna system can be developed, the radios may be very useful for following bears which are too large to be fitted with collars. In 1984, radios were also glued on the head of adult males too big to be fitted with collars.

The NWTWS, CWS, the Yukon Territorial Government (YTG) Game Branch, and the U.S. Fish and Wildlife Service have been cooperating on a telemetry study in the Beaufort Sea. Research in that area over the past 15 years suggested that bears along the mainland coast are a fairly discrete subpopulation. However, there was no detailed information on how much movement occurs between the east and west portions of the Beaufort Sea. Radio-telemetry was initiated in Alaska in 1980, and there was an indication that most of the bears tagged north of Alaska spent some time in the eastern Beaufort Sea. In March 1983, 19 female bears, mostly adults, were instrumented by the CWS in the eastern Beaufort, in conjunction with the Alaska work. Those bears, plus ones fitted with transmitters in Alaska, have been monitored from a high-flying fixed-wing aircraft and a high percentage have been relocated several times.

Preliminary results indicate most of the bears tagged north of Alaska spend some time in the eastern Beaufort Sea. In 1984, radio-tracking continued from Alaska, and more bears were instrumented and followed. In 1985, studies will include additional radio-tagging in conjunction with a mark-recapture programme, depending on funding. See also the section on the NOGAP study.

Several satellite radio packages which are smaller than those tested in 1982 are being developed by various companies: 2-kg packages may be available in the next few years. The most weight is still in the battery pack, where there have been no recent improvements, but Argos, for example, is now willing to allow changes in the power

needed to transmit. This may facilitate further decreases in weight.

Oil Spill Contingency Plan

A report on the effects of crude oil on polar bears published in 1981 recommended a contingency plan be developed to deal with potential oil spills or blowouts. Ray Schweinsburg has completed the contingency/action plan and has copies available. The plan has the positive aspect of allowing the agencies to be prepared and able to investigate all possibilities. The various jurisdictions or agencies may have a subsection for more specific contingency plans, detailing which organizations and staff will be involved, and identifying funding and logistic support. Manitoba, for example, has completed a summary sheet for their area. The plan will be submitted as an NWT report to the PBTC.

Research in Foxe Basin, Hudson Strait and Hudson Bay

Gordon Stenhouse and Nick Lunn began the Foxe Basin polar bear programme on 13 September 1984 based out of Coral Harbour, Southampton Island. Due to problems with fuel caching, the work was confined to the southern half of Southampton Island and Coats Island. During the first two weeks, very few bears were seen or handled. By 24 September, three of five bears seen on Coats Island and two bears on Southampton Island had been tagged after 12 days and 25 flying hours. There was also one handling death near Leyson Point. Operations were stopped until more bears concentrated along the southern coast of Southampton Island as the season progressed.

When tagging resumed, the numbers of bears along the coast had increased, perhaps because bears had moved down from the northern half of the island. From 4 October through to 11 November, 55 bears were caught in 86.3 h. Most of these bears were either between Cape Low and Hut Point or between Seahorse Point and Gore Point. By the end of the first week of November enough ice had formed to allow the polar bears to move offshore and no more were seen ashore.

Of the total of 60 bears tagged, 36 were males and 24 females. In a similar ratio to the kill, 60% of the captured bears were seven years or younger. Of 11 females captured with cubs, 6 had COYs, 4 had yearlings, and 1 had 2-year cubs. Four of the six COY family groups were in poor shape. With two of these groups, COYs were found dead, and in the other two groups the COYs weighed less than 30 kg. However, the other family groups were in good condition and overall all bears caught were in good shape.

One 23-year-old male in poor shape had recently killed an adult female. After examining both bears it was evident this was not a case of a bear scavenging, but rather a case of cannibalism. At the other end of the scale, one captured male weighed 803 kg (1767 lbs).

The coverage of Southampton Island will be expanded during the next field season. Some work will be done near Wager Bay and on Coats Island.

NOGAP-funded Studies in the Western Arctic

External funding from the Northern Oil and Gas Action Plan (NOGAP) became available for a three-year study and re-assessment of polar bear populations in the Beaufort Sea beginning in 1985. Since the initial studies in the 1970s, hunting quotas have risen and hydrocarbon exploration has increased. The following priorities were set:

1. support of the present cooperative telemetry studies with the U.S. Fish and Wildlife Service, CWS, the Yukon Government and the NWT Wildlife Service;
2. a mark-recapture study in the Beaufort Sea, both in Canada and the U.S., in order to improve the estimate of population size; and
3. data analysis.

The USFWS and YTG are cooperating in a survey of maternity denning sites, especially in comparing the numbers of dens found onshore versus in the pack ice.

Fourteen bears were instrumented on the west coast of Banks Island and in Amundsen Gulf in spring 1985. If a large enough sample can be marked for three years, and the same methods are used, the estimate of population size can be compared to the estimate from the tagging done 1971-79 by CWS in the Beaufort. Stirling will coordinate the mark-recapture in the Canadian Beaufort, while Amstrup will coordinate all the radio-telemetry work and the tagging off the Alaska and Yukon coasts. Data analysis will be coordinated jointly by Alaska and CWS.

The NWTWS feel that it is still necessary to evaluate capture bias if possible. There was consensus that this should be investigated further, and NWT, possibly with assistance from Mitch Taylor, will follow up.

SINGLE AGENCY RESEARCH

Canadian Wildlife Service

The long-term goal of the Canadian Wildlife Service (CWS) with respect to polar bears is to ensure the conservation and management of viable populations throughout the Canadian range of this species, consistent with the public interest as well as the interests of those who rely on harvesting this resource on a sustained yield basis. This is done by conducting managementoriented research on the population dynamics, movements and size of polar bear populations; baseline and monitoring studies of polar bear populations and their ecological requirements; and process-oriented research on polar bear populations, their habitat and the consequences of different management options. The CWS also provides a central coordinating point for storage and retrieval of polar bear research data, and for planning interjurisdictional studies between the Federal Government, the Provincial and Territorial agencies, and other national agencies.

Ecological Interrelationships

This project is concerned with the ecological relationships between polar bears, seals, sea ice conditions, and polynyas. The major efforts have concentrated on field observation studies of the activities of polar bears and pinnipeds around the Dundas polynya in the early spring and in Radstock Bay, Devon Island in the summer; evaluating

the use of underwater vocalizations as a tool for studying the distribution and abundance of overwintering seals in the High Arctic; the correlation between vocalizations and behaviour of walruses at the Dundas Island polynya; and an M.Sc. study on the vocalizations of bearded seals.

The biological importance of polynyas to overwintering populations will be evaluated by studying winter and early spring distribution and abundance in and out of polynya areas. Under-ice seal vocalizations were recorded, and data were collected on seal habitats to study the distribution of overwintering populations in relation to polynyas, ice conditions, freeze-up patterns, distribution of pupping areas, polar bear distribution, and shipping lanes.

Specific studies of the influence on polar bears of ice conditions, of seal distribution and abundance, and of polynyas continued in the High Arctic at Dundas Island in April 1983, 1984, and March and April 1985, and at Radstock Bay in July 1983. Behaviour observations on polar bears yield data on habitat utilization, hunting efficiency of different age and sex classes, effect of harassment, man/bear conflicts, bear interactions, movements, and time budgets to facilitate a deeper understanding of the management and impact assessment studies. These data have not been analysed.

In all three years, good series of under-ice walrus vocalizations were recorded and data collected on walrus and bear behaviour. Analyses of these data are continuing, and preliminary results are expected to be available in 1985.

Limited monitoring of polar bears continued in 1984, with some mark-recapture work in the area of the polynya. However, the amount of mark-recapture data that it has been possible to collect in this area is too little to draw any conclusions.

Reproductive Biology of Polar Bears in Western Hudson Bay

This project, a Ph.D. study by M. Ramsay, is designed to study the fidelity of adult female polar bears to maternity denning areas and the reproductive cycle of female polar bears. These two aspects of the reproductive biology of polar bears are critical to the sound conservation and management of the species.

From 1980-1984, bears were captured or recaptured in northeast Manitoba, including many family groups. Data were gathered on age-specific productivity, breeding interval, time of first litter production, time of reproductive senescence, time of weaning, and cub mortality rates.

There is now a good sample of individual females through time, and it appears that there is a 2-year breeding interval for about 40% of the bears in this population. The western Hudson Bay population has a larger litter size and shorter breeding interval than Western and High Arctic populations. The age of first birth is about the same as in the other areas.

Additional information was gathered on site-specific fidelity of adult females within the denning region in Manitoba, on the general movements of bears, by age and sex class, while ashore from the melting sea ice in summer, and on the orientation ability of female bears leaving the denning region in spring. Fidelity to the denning area south of Churchill is high, though not to specific den sites.

Blood chemistry analyses have resulted in a method of determining pregnancy of females in autumn prior to the onset of winter denning and confirmation of on-land fasting for the majority of polar bears in Manitoba between August and November. Reproductive organs of 53 female and 56 male polar bears were collected by Inuit hunters during the 1982/83 hunting season but analyses are inconclusive, in part because the specimens had been frozen.

The mean weight of polar bears handled in Manitoba during summer and fall 1983 was between 10% and 25% lower, by age and sex class, than mean weights recorded in the same seasons over the preceding three years. Mean calculated weights of presumed pregnant bears in 1983 were down 15% overall from weights in previous years. Field studies in spring and fall 1984 were carried out primarily to determine what effects an apparently poorer nutritional condition in autumn would have on subsequent reproductive success of females. Although mean size of litters in spring remained unchanged in 1984, mean weights of cubs at that season were about 20% lower than those in the previous few years. Survival of cubs between spring and autumn was shown to be directly related to body weight. It is too early to know whether the observed weight changes will affect the long-term survival of the 1984 cohort in western Hudson Bay.

This long-term study is nearly complete, and the results will be presented in a series of papers as part Ramsay's Ph. D. thesis.

Ecological Significance of Supplemental Food Sources to Polar Bears Summering on Land

The final year of a two and a half year study, investigating the importance of supplemental food to polar bears, was completed during 1983. Hudson Bay completely melts by the end of July, causing polar bears to come ashore for three or four months. Most bears fed very little while ashore. However, a small proportion of bears fed at a supplemental food source - the Churchill, Manitoba dump. The objectives were

1. to document the age and sex structure of polar bears feeding in the Churchill dump;
2. to determine possible factors that may cause some polar bears to feed in the dump; and
3. to determine the benefits and costs, in terms of nutrition and survival, to bears that use the dump and to bears that do not use the dump.

Results from this study indicated that young bears and adult female bears with cubs were the main users of the dump. Adult females tended to return to the dump only in the years when they had offspring. Many of their cubs, once weaned, returned on their own to feed in the dump, indicating that these bears had learned the dump habit. Unlike black bears and brown bears, male polar bears did not return to the dump once they reached six or seven years of age. Individual bears that fed in the dump gained weight ashore while, not surprisingly, bears not in the dump lost weight. However, a significantly higher proportion of polar bears that have been killed, either as problem bears or as part of the Inuit harvest, had fed in the dump. This suggested that some bears that fed in the dump may have become habituated to people, resulting in a higher mortality of dump bears. This work was summarized in the 1984 M.Sc. thesis of N. Lunn.

Deposition and Utilization of Fat in Polar Bears

This is an M.Sc. study by M. Cattet. At present, there are no data with which to determine the physical condition of polar bears by using the ways in which body fat is deposited and mobilized. Such techniques are well-developed for ungulates and have great value to the management of wild populations. In fall 1984, research was initiated on the deposition and utilization of fat in polar bears. In spring 1985, similar research will be conducted on black bears to provide a comparison to polar bear data.

In 1984, data collection on hunter-killed polar bears was conducted out of Coral Harbour, where a large quota of polar bears is taken during a short period in the fall each year, and where there is a high degree of cooperation from the Inuit hunters. Techniques were developed for field measurements of the distribution and partitioning of fat within the bodies of bears of all conditions. As well, the relationship of muscle and bone tissues to fat reserves was emphasized. Finally, laboratory analysis of fat, muscle and bone tissues collected in the field will measure their fatty acid composition.

After the techniques have been refined, other sites such as Clyde River and Resolute, where polar bears are killed in spring, will be considered for comparative work. The objective of the study is to develop techniques for monitoring the status and health of wild polar bear populations by evaluating the condition of individual bears killed each year by Inuit hunters.

Distribution and Abundance of Polar Bears in Western Hudson Bay

The 1984 field study was conducted by A. Derocher, as part of an M.Sc. study. It centred on determining the distribution and abundance of the different age and sex classes of the population of polar bears utilizing the western coast of Hudson Bay during the summer when they are ashore. Of 155 bears captured and marked along the coast, 45 were radio-tagged to determine the distribution, movement patterns, and population discreteness. About 84% of the bears were relocated at least once. Over 650 relocations of radioed and marked bears were obtained from incidental sightings and from 5 aerial surveys spaced about 2 weeks apart between August and November. The data will be analysed in conjunction with data collected in previous years to design an accurate and unbiassed method of estimating the population size. Efforts will be made to design a system applicable to other areas where polar bears spend the summer on land.

The development of two new types of radios (glue-on and ear-tag) by F. Anderka of CWS Ottawa permitted radio-tracking adult male polar bears to gain new information on the summer movements of that segment of the population. Radioed animals returning to the study area in summer 1985 should aid studies of site fidelity.

The 1985 work will include a survey for radio-tagged bears along the offshore leads in March, and an intensive mark-recapture programme along the coast in June-July.

Manitoba

The Manitoba Department of Renewable Resources did not conduct any research in 1983 or 1984, but they provided logistical assistance and man power to the tagging programme conducted by the Canadian Wildlife Service. Results of the annual Polar Bear Control Programme at Churchill and some analysis of the statistics collected are given in

the management summary for the IUCN by Calvert *et al.* 1985.

Institute of Arctic Ecophysiology, Churchill

P. Watts completed his doctoral research in 1983 on the ecological energetics of denning bears. The reduction of metabolism during denning was less in polar bears than in black and grizzly bears, though these results might be complicated by the sex of the study animals. Polar bears attempted to regulate the micro-climate within natural dens.

Studies of body composition showed that the weight changes observed through the year are mostly due to changes in fat and water. However, not all the body fat is available for metabolism, since some is needed for thermoregulation. It may be possible to calculate a critical weight necessary for pregnant females to successfully reproduce.

Future work will probably concentrate on the micro-climate of dens near Churchill and possibly on Southampton Island; calculations of critical weight; selective feeding; and physiological regulation and protein metabolism. The energetics of cubs should also be explored, in relation to recruitment.

Newfoundland

There were no research programmes in 1983 or 1984.

NWT Wildlife Service

Northeast Baffin Island, Clyde River - Broughton Island

This study began in 1981 with objectives

1. to determine population size, range and distribution
2. to assess quotas for Clyde River and Broughton Island
3. to assess the impact of oil development.

Initial results to the end of 1982 indicated a low density of bears, long movements of marked bears into the study area, and possible over-hunting reflected by a relatively large number of tagged bears in the kill. It was decided larger samples were needed to clarify these findings.

After further studies in 1983 and 1984, a population of 420 $\pm$ 120 was calculated. The capture data and hunter-kill information indicated an overharvest and discussions on quota reduction and management options are underway with the communities.

The tagging effort was increased in spring 1985 to increase confidence in the population estimate obtained from the capture sample. Radio collars were put on a sample of female bears in an attempt to study seasonal movements and evaluate the discreteness of the polar bear population in Baffin Bay.

Marking Dyes

Several 1 ft^2 pieces of raw dried polar bear hide were marked with various dyes, then weathered and periodically rinsed in salt water. They were then sent to a tannery for normal tanning and the results assessed when the hides were returned. Dyes used were food colouring, blue-kohl, tattoo dye, all-weather Paint-stik, meat marking dye, hair and hoof polish, Tintex cloth dye, and Raidex animal marking crayon.

Of the three dyes that persisted well during washing and weathering, Doc Brannons Black Magic hair coloring was removed the easiest during tanning. The other two dyes, Raidex animal marking crayon and the green all weather paint-stik, although not removed as easily as Doc Brannons, were removable according to the tannery. However, when Doc Brannons was used in the field at Coral Harbour, it was not reliable and in some cases disappeared from bears within a few weeks. The crayon sticks may be usable, but have yet to be thoroughly tested in the field.

The National Research Council of Canada was contacted by the Polar Bear Administrative Committee with a request "to consider researching the development of a dye". The council approached several cosmetic and dye companies for dyes, and the NWT Wildlife Service for fur samples. Wella Canada tested several dyes and sent the fur swatches to Yellowknife for further testing. One other company has sent dyes and a third may reply as well. Once all the dyes are available, they will be applied, washed, weathered, evaluated and sent to a tannery to be stripped and tanned. This work will be coordinated out of Rankin Inlet in conjunction with the Foxe Basin study. The role of the National Research Council from this point on is unclear.

Detection and Deterrent Research

G. Stenhouse made a film at the tower at Cape Churchill in 1982 to illustrate the effect of rubber bullets and the smaller ferret rounds as deterrents for bears. Tests during the night were limited, despite the floodlights, because the bears soon learned to leave when the lights came on. Ferret rounds, which are small enough to be fired from a 12-gauge gun, were not heavy enough to deter the polar bears; a heavier model is being developed which may also be suitable for deterring black and brown bears. Recordings of barking dogs were poor because they sometimes caused large bears to charge. Other possible deterrents, such as dog repellents or inflatable balloons have not been tested. It was agreed that it is important, if bears are to be deterred, to give a negative stimulus immediately and not allow a positive response.

Most of the detection work in 1982 concentrated on the microwave motion detection units. However, a trip-wire fence which may be suitable for small camps has also been tested.

As a result of the 1982 work with rubber batons, the NWTWS purchased the rifles and batons for each station that received problem bear complaints. Officers went through a short training course on the use of this deterrent system and now have additional capacity to respond to bear problems. Officers also supplied filled out coded data sheets after each use of the rubber batons. The information was compiled to evaluate the effectiveness of rubber batons in deterring problem bears under actual field situations.

To date the results of this programme seem promising. Bears (black, grizzlies and polar) have been successfully deterred and no bear has charged an officer firing rubber batons, but the inaccuracy of the weapon has been a common complaint. With additional

practice with this weapon, officers will probably become more proficient in its use. A peep sight has been mounted on one riot gun, and this seems to assist in sighting at the target. Each officer can make sighting modifications as he sees fit.

At Cape Churchill in fall 1983, a new rubber baton (Fiestal - Germany) which was $4/shell cheaper than products used in the past (Schermuly - England) but had essentially the same ballistics as the Schermuly cartridge was tested.

One bear, a male yearling, was killed when it was struck with the new cartridge. A necropsy by Dr. J. Haigh showed that the baton had broken a rib, causing fatal internal injuries. To date, approximately 400 polar bears have been successfully deterred with rubber batons, with one fatality. It has always been recognized that this technique has the potential to kill a bear, but with proper use it is felt that this technique is still a useful tool and will reduce the number of problem bear kills significantly.

A total of 123 polar bears were successfully deterred from the bait site at Cape Churchill during the 1983 testing period. As in 1982, no bears which were struck charged or displayed aggression towards the person firing the rubber batons. One bear in 1983 could not be deterred from eating a beluga whale head at the bait site. This bear, a large thin male, was struck a total of five times without leaving. He was not struck again because of his poor condition After consuming most of the meat, the bear wandered off slowly and did not return for six days.

Modifications were made to rubber batons that allowed dye marking of individual bears when they were struck. This technique may be very useful for identifying problem bears. Food colors mixed with blonde hair dye were also tested. These marks, applied in late September, were still visible 12 December.

Tests in 1983 with the 12 gauge plastic slugs were on bears approaching a ground-based research crew, with no bait used. In general, the plastic slugs were successful in deterring most subadults and smaller adult bears, but not in deterring larger polar bears.

Peter Clarkson was hired as the new deterrent biologist in 1984. Tests using 12 gauge ferret shells (plastic slugs) were conducted at Cape Churchill, Manitoba between 19 October - 4 November 1984. A total of 119 tests were performed (77 experimental and 42 controls). The responses of bears to deterrents were measured by monitoring their movements through four circular zones. No significant differences were found in the time spent during entry or exit between experimental and control bears in the three outer zones. Control animals were not tested. Bears were hit an average of 2.14 times per trial. Experimental bears left the inner zone near the bait site significantly sooner than control animals. However, bears struck with a plastic slug returned in approximately 17 h while control animals returned significantly later at about 43 h. Of the identifiable animals, at least 87.5% returned to the bait site at least once; some bears returned at least 7 times. The ferret shells were fairly uniform in performance with less than 4% noticeably aberrant. Shots were fired at an average distance of 24 m from the bears and had an overall accuracy of 89%. Strong winds affected the accuracy.

A study by Compuheat Services of Canada Inc. (CSCI) on infra-red thermograph techniques for detecting polar bears at Cape Churchill found the system was highly effective in detecting polar bears in their natural habitat, and even showed size and shape. Adverse weather conditions (e.g. high winds and low temperatures) had no effect on the performance of the unit. This system is easily portable and simple to install and operate. A motion-detecting warning device was 100% effective in detecting moving bears. Once

installed, the system required little maintenance or tuning. With only slight modification, it could provide a totally automated detection-warning system. No conclusions regarding solar heat conduction efficiency by polar bears could be made from these tests, because the bears did not visit the test area during adverse weather.

Results of a study of acoustic stimuli as polar bear deterrents suggest that most of the polar bears were sensitive to a sonic bandwidth of 0.1-9 kHz. Most bears reacted to the 1-4 kHz frequencies. They did not appear to detect ultrasonic (21-30 kHz) radiation. The tests suggest that 1 or 2 kHz tones were optimal stimuli for eliciting avoidance behaviour in polar bears that would otherwise be strongly attracted to the positive stimulus of food. Pulsed tones appeared to be even more effective than continuous tones. On the basis of these findings, the sound deterrent technique might be an effective method of deterring some bears.

Detection and deterrent research in 1985 will be in several directions. Cart-a-balls (12 gauge rubber balls), cart-a-buck (12 gauge rubber pellets) and 12 gauge plastic ferret shells will be tested. Tests will include penetration tests on carcasses and deterrent tests on live bears. The tests on live bears will be completed only if there is no penetration of the carcasses. In addition, ballistics tests will be completed at the Arms Division of the RCMP at Regina. Acoustic and personal deterrents also will be addressed.

In addition to the deterrent tests, training and education to deal with problem bears is being emphasized. A 'Safety in Bear Country' manual will be available in August 1985. It has information on bear-people conflicts, bear biology, bear behaviour, avoiding bear problems, camp design and maintenance, bear detection systems, bear deterrent methods, and firearms safety.

Three types of 'Safety in Bear Country Workshops' will be used to implement the bear detection and deterrent programme, ranging from a one-day workshop for people in a position to provide others with information about bears or safety precautions while in bear country to a four-day instructors' workshop to facilitate the training of people who will be instructors for the one- and two-day workshops. The workshops include sessions on bear biology, bear/people conflicts, safety precautions to avoid bear problems, detection techniques, deterrent methods, camp design and maintenance, firearms safety, and instructional skills.

Site Operations Plans have been developed to provide information to workers in remote areas on the biology and behaviour of bears, and methods of reducing or eliminating bear/people conflicts. Each plan outlines techniques by describing the work place in relation to bears, provides guidelines to reduce the number of bears visiting the site, shows ways to deter bears, and outlines reporting relationships between workers, supervisors, and Wildlife Officers.

Bear Monitor Programme in the Beaufort Sea

At the Tarsuit seismic camp, monitors chased 15-18 bears off the site with snow machines or helicopters in 1983. The decision to chase the bears was usually so that work could continue out on the ice, and not because the bears acted aggressively.

Ontario

Annual fall aerial surveys started in 1963 were continued in 1983 and 1984. Also in 1984, spring productivity surveys (Kolenosky and Prevett 1983) were resumed after a hiatus of five years and a long-awaited live capture and tagging programme was finally initiated. The latter represented the culmination of a series of requests that had been ongoing for over two decades.

Fall Aerial Surveys

In 1983, aerial surveys were conducted 2-3 September and 15-17 October. The latter was carried out to test the hypothesis of an eastward movement of bears during late fall.

During the regular survey, the total of 204 for Ontario and Manitoba combined was the largest number observed since inception of the surveys. The total of 159 for Ontario ranked fourth among all years. During the late survey, the total of 185 for Ontario ranked first among the nine survey years. One rather unusual observation during the first survey was the occurrence of two sets of triplets. Although not unusual during spring productivity surveys, they have been sighted very infrequently during late summer censuses. From 1963 to 1980, only one of 115 family groups contained three young.

During the regular 1984 fall aerial survey, the total count was 134 bears for Ontario, 143 for Ontario and Manitoba, and five for Akimiski Island. For all three areas, numbers were the lowest for the past five years. The eastern third of the survey area (Hook Point to Winisk) had proportionately more bears and the western third (Fort Severn to Manitoba border) had proportionately fewer bears than average. The middle third (Winisk to Fort Severn) also had more than average. The greater dispersion of bears may have been partially due to the activities of a tagging crew that operated along the coast during summer - early fall.

Productivity and Maternity Denning

Three aerial surveys to assess productivity and maternity denning were conducted on 20-23 February, 5-7 March and 19-20 March, 1984. A total of 68 different groups, including singles were recorded. The number of different females with cubs (62) was approximately 17% greater than the previous high of 53 recorded in 1978. The estimated production of about 123 cubs was approximately 10% higher than the previous high value of about 105, estimated in 1978 (Kolenosky and Prevett 1983).

The average litter size of 1.8 ($n=40$) was 10% lower than the average of 2.0 recorded during the 1974-78 period. Most of that decline was due to a higher percentage of females with single cubs and a lack of females with three cubs. More hard snow than usual resulted in a greater frequency of litters whose size could not be determined and may have contributed to the apparent reduced litter size.

Live Capture and Tagging

The major objectives of a live-capture and tagging programme started in the summer of 1984 were to assess the size and discreteness of the polar bear population in Ontario. Because polar bears may move across jurisdictional boundaries, the field programme represented one component of a cooperative study involving Ontario, Manitoba, Northwest Territories, and the Canadian Wildlife Service.

Field studies were conducted from 20 July - 30 August and 21 September - 8 October. To ensure a sample large enough to determine population size with acceptable confidence limits, the capture target was 150 different bears. Bears were darted from a helicopter and immobilized with a 1:1 mixture of ketamine and Rompun. Processing followed standard procedures. Selected adult females were fitted with radio transmitter collars. Bears were revived by injecting a drug antagonist, yohimbine, directly into the lingual vein.

A total of 202 different bears were captured. Captured bears were grouped into five age classes based on dental characteristics. Adults comprised 47%, subadults 20%, cubs of the year 14%, yearlings 12%, and 2-year-olds 6% of the captured sample. Males outnumbered females in each of the three older age classes, whereas the reverse was true for the two youngest age groups. However, within individual age groups, none of the sex ratios differed significantly

Weights of adult males, which averaged 507 kg during the early tagging session, declined almost 13% to 442 kg during the later tagging period. Adult females averaged about 280 kg during both tagging periods.

An identifiable mark was painted on the back of each bear using Nyanza dye. Of the 200 different bears tagged and released, 107 were sighted at least once. That total was composed of 77 different singles or family groups, and 30 associated offspring. One subadult male moved at least 238 km between 4 August and 5 October and an adult female with a yearling moved at least 86 km between 5 August and 24 September. A subadult female tagged NW of Fort Severn on 21 July was sighted in Churchill, Manitoba about three weeks later, after travelling a distance of at least 480 km.

One rather striking natural behavioural pattern was the bonding exhibited by adult males. Groups of two to three males often stayed together and on one occasion, three males were darted together as a group. On another occasion, an attending second male had to be darted before the first male could be safely approached and processed.

Preliminary results support the idea of a limited interchange of bears between Ontario and Manitoba. At least five bears captured in Ontario had been tagged 1-2 years earlier in Manitoba and at least one bear marked during the current study was later sighted at Churchill, Manitoba. Also, a bear originally marked by the Canadian Wildlife Service at Cape Henrietta Maria in 1968 was subsequently recaptured near Cape Churchill in 1984. Although those recoveries indicate some interchange does occur, if the total number of bears marked in both regions is considered, the number of exchanges to date may be considered very small.

Summer - fall tagging and winter telemetry studies are expected to continue for at least two more years. continue.

Quebec

Michel Crête expressed an interest in two areas. The first concerned the distribution of bear populations or sub-populations, and particularly populations harvested by Inuit of northern Quebec. He proposed a genetic study of bears harvested in Quebec and elsewhere, in order to delineate sub-populations. Genetic studies recently have been successful on moose to recognize populations and he thought it would be worth trying this technique on polar bears. Dr. Ron Chesser of Texas Tech University would be interested in assisting with such a study. Samples of organs and muscles would need to be collected from other areas for comparison. An initial inquiry suggests that Inuit from Quebec would be willing to collaborate in this project.

Secondly, he proposed initiating an annual summer aerial count of polar bears present on the islands along the Quebec coast and maybe on the coast itself. This would be a survey similar to the one that has been carried out for years in Ontario and would help to detect any major change in bear numbers along the Quebec coast. The Quebec government may have an aircraft available for this or for telemetry surveys.

Yukon

Education and Awareness Programme Development

Both a brochure and slide show regarding appropriate behaviour of industrial personnel in the arctic to reduce conflicts with bears should be completed and distributed after 31 March 1985. In addition, a report is being prepared: "Identifying options and procedures for the management of existing and anticipated nuisance bear activities in Yukon's Arctic."

Barney Smith has completed a catalogue and review of materials available as teaching aids for polar bear awareness programmes. Most of the materials available are written pamphlets describing life histories, problem prevention, and management concerns. There are few broadcast-quality video or television programmes; few teaching aids for specific target audiences such as children, natives, or industrial personnel; and few aids on specific subjects, such as research and management studies, the effect of oil spills, or design of coastal camps.

Smith made the following recommendations for joint development of aids for specific audiences regarding specific subjects:

1. In terms of funds and energy, the most efficient means of producing useful educational aids that can be shared is to produce aids specific to audiences and subjects, and general with respect to area.
2. Agencies with specific management concerns should take the lead role in specific programmes and seek technical committee review to minimize duplication of effort.
3. Graduate students in education and computer graphics should be considered to develop programmes directed at high schools to give Inuit a better understanding of population sensitivity, particularly in response to harvest and industrial disturbance. This could be a joint PBTC/IUCN production.
4. More television documentaries and movies are needed over the long term to maintain public concern for management and research programmes. Smith recommended that CBC be contacted by the PBTC or PBAC to produce a television documentary on the management of human-caused stresses on polar bear

populations. Given how much movie footage is available (e.g. Manitoba, Thor Larsen, etc.), we should consider applying for IUCN or WWF funds and contracting an independent film maker to produce a film about polar bear *biology* and research, material that will not rapidly become dated.

5. All agencies should support the excellent instructional programmes being developed by the Government of NWT. They feel their basic show can benefit from specific scenario-type examples suited to bear problem prevention in specific settings.
6. All agencies should produce copies of aids that would be available for distribution to other agencies. It is hoped the catalogue of teaching aids will generate interest in such exchanges.

Research with NOGAP

Since the Yukon Government shares responsibility for the Beaufort Sea population, it strongly supports the cooperative research programme. Although it is difficult to separate research requirements for the management of the harvest from this population and those research requirements to manage industrial development, the Government of Yukon has to meet the terms of the NOGAP programme and the polar bear project. Therefore they need to determine maternity denning areas on Yukon's north slope and to evaluate the potential impacts to the population ecology arising from industrial activities in the vicinity of such denning areas. From the broader perspective of being prepared to manage industrial development, particularly given the offshore denning results, they require information on the proportion of females denning onshore vs offshore, on movements of females relative to potential harbour and staging sites, and to a lesser extent, the distribution of onshore denning areas. From the perspective of harvest management, determining female survivorship, movements relative to communities and total population size is important.

Although autumn field work in 1984 was restricted by weather, there were 32 drums cached at Komakuk and 16 at Stokes Point. Additional funds were received for monitoring in spring 1985. The Polar Continental Shelf Project of the Department of Energy, Mines and Resources, provided helicopter support of 35 hours grant and at least 35 hours charged.

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APPENDIX 5: ECOLOGICAL ENERGETICS OF THE POLAR BEAR

and Related Research
at the Institute of Arctic Ecophysiology

Status Report prepared for the
IUCN Polar Bear Specialist Group Proceedings
Edmonton, Alberta, August 1985

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The application of energetics in wildlife management (for example, Moen 1973) evolved from primary studies on domestic animals (Brody 1945, Kleiber 1961). Earlier work on arctic animals (Scholander et al. 1950a,b,c) led to the formation of a research programme in energetics, to evaluate the effects of human activity on the polar bear (*Ursus maritimus*) (Øritsland et al. 1973). The Churchill laboratory was established for this purpose in 1971. International support for the study of polar bear energetics (IUCN 1976) was central to its further development. Formal incorporation of the facility as the Institute of Arctic Ecophysiology (IAEP) occurred in 1980. The IAEP is a registered charity run by a local Board of Directors. The following is a status report on the IAEP's first fifteen years of ecological energetics research on the polar bear.

Through the development of a respiration chamber for exercising polar bears (Øritsland et al. 1976) it was concluded that the species had a curvilinear response of metabolic rate to walking speed (Hurst et al. 1982a) and a cost of locomotion that was as much as twice the expected values (Hurst et al. 1982b). Variables that were quantified included radiative heat loss both during exercise and at rest (Øritsland et al. 1974, Øritsland and Lavigne 1976). Methods of determining energetic output on free-ranging polar bears were developed in the laboratory (Best 1976, Øritsland et al. 1977, Best et al. 1981). Presently, there are enough laboratory data to commence studies on the energy costs of free-ranging bears. The extension of the lab studies to the sea ice and other natural habitats will require support for the integration of physiological transmitters with location radio collars. Further treadmill studies will concentrate on expanding the weight range of animals tested and determine the variation within given weight classes. This continued research should be done in conjunction with measurements of body composition such as those initiated for denning studies (Watts 1983). An examination of respiration quotient and the caloric equivalent of weight loss are required to determine how body components are mobilized to meet energy demands.

Whole animal energetics have also been applied to the study of maternity denning in the polar bear. The results provided preliminary quantification of the energetic cost of age class renewal (Watts 1983). In the laboratory, the adult female polar bear reduced basal metabolic rate and whole body thermal conductance during simulated denning (Watts 1983). The field section of the study led to the development of a concept of optimal den site selection. Conclusions were based upon an analysis of body temperature of the adult female polar bear in the natural maternity den. In the same study, a method was developed for determining body composition and energy content of live polar bears. Further work on the energetics of maternity denning should include an expansion of sample size and a delineation of the role of carbon dioxide levels in the natural dens. Results should be integrated with information on adult female body composition from both successful and unsuccessful cub producers.

Models of energy utilization and starvation both at the individual and the population level are being developed for use in management decisions (Øritsland 1974, 1977a,b, 1980, Hurst 1982, Watts 1983). Starvation may be the main natural cause of polar bear mortality (Stirling pers. comm.). Continued investigation of polar bear energy balance will enable wildlife managers to consider the effects of human activity on the starvation rate in this species. Although the IAEP research has been directed towards the quanitification of energy utilization, preliminary studies on energy intake have also been conducted (Best 1977, 1985).

Several other related topics in ursid biology and management have been investigated. Some initial research on bear deterrents and attractants was conducted at the IAEP (Wooldridge and Belton 1977, Cushing 1980, Miller 1980). Baseline information was obtained on blood chemistry (Lee et al. 1977) and vision (Sivak and Piggins 1975) in the

polar bear. The metabolic cost associated with denning in the black (*Ursus americanus*) and grizzly bear (*Ursus arctos*) was quantified (Watts et al. 1981, Watts 1982, 1983). Results will aid in the determination of the seasonal food requirements for overwinter survival and cub production in these species. Contributions were also made in the area of remote sensing of mammals (Lavigne and Øritsland 1974b, Lavigne et al. 1977).

In vitro, basic properties of polar bear fur were investigated (Frisch et al. 1974, Lavigne and Øritsland 1974a, Øritsland and Ronald 1978, Øritsland 1978) and subsequently used to interpret the effects of oil fouling (Hurst and Øritsland 1982). Based upon our accumulated data on the whole animal energetics of the polar bear, the effects of crude oil were also investigated *in vivo* (Øritsland et al. 1981). In this study, emphasis was placed upon the thermoregulatory and metabolic reactions of the polar bear in response to oil exposure (Hurst 1981, Hurst et al. 1981). An *ad hoc* examination of the toxicology and pathology of oil exposure in polar bears was included (Øritsland et al. 1981).

The present computer at the Churchill facility is inadequate for extensive ecological modelling. The Churchill chapter of Lions Club International has recently established a project to assist in raising $15 000 Canadian for an advanced computer for the IAEP. Other local support for the facility includes $10 000/year for the Arctic Trading Research Fellowships and the establishment of the Arctic Wildlife Heritage Trust Fund. The trust fund will provide ongoing funds for conservation research at the IAEP on large arctic mammals. Related studies in ecology and energetics are being conducted on the beluga whale (*Delphinapterus leucas*) and the arctic fox (*Alopex lagopus*). Cooperative projects have been established with researchers from Laurentian University and the University of Manitoba. Other activities include university credit courses and a community services programme.

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APPENDIX 6: RESEARCH ON POLAR BEARS IN NORWAY 1978-85

The polar bear research in Norway is mainly carried out at, or in cooperation with, the Norwegian Polar Institute and the University of Oslo.

In his Dr. Philos. thesis from 1985, Dr. Thor Larsen of the Norwegian Polar Institute covers most of his work during the last 10 years. The general introduction and the general results and discussion of this thesis are enclosed as Part A.

Dr. Nils A. Øritsland has worked partly at the University of Oslo, partly at the Norwegian Polar Institute and partly with institutions in Canada and Alaska. A summary of his work is in Part B.

Dr. Karl I. Ugland has developed a model for polar bear population dynamics, described in Part C.

The effects on Svalbard polar bears of lack of ice during summer were studied in 1984 and 1985. Some preliminary results are given in Part D.

Part A: T. Larsen 1985: Abundance, Range and Population Biology of the Polar Bear in the Svalbard Area - Summary

General introduction:

The polar bear (Ursus maritimus) is a relatively young species in an evolutionary sense. It developed from brown bear like ancestors, probably in late Pleistocene (Kurten 1964, Vereshchagin 1969). Whilst brown bears (Ursus arctos) and black bears (Ursus americanus) are omnivorous species, polar bears are typical carnivores, and well adapted to a life under extreme conditions in the High Arctic. The polar bear's main diet consists of seals, but it occasionally eat other mammals, birds, and plants (Nathorst 1900, Lønø 1970, Russell 1975). Polar bears occur in the northern hemisphere only. They are common in drift-ice areas and adjacent shores all around the Arctic, but are less frequent in the Central Arctic Ocean. They also live in the Hudson Bay and James Bay area in Canada where they occur along shorelines and partly in the coniferous forest (Stirling et al. 1977). Some polar bears are found as far south as Labrador (Stirling and Kiliaan 1980). Fig 1. Previously bears were also common along the west coast of Spitsbergen in summer (Lønø 1970). Occasionally, bears occur along shores far away from their normal range as on the Norwegian mainland, and in Japan (Johnsen 1947, Larsen 1969,1979, Davids 1982).

Polar bears have been hunted for centuries mainly for their pelts which were considered rare and valuable. Polar bear hides were exported to Asia, the Middle East and Europe during the Middle ages, and live bears were regarded as particularly valuable (Ingstad 1948, Perry 1966, Larsen 1979, Davids 1982). Eskimos and other natives also hunted polar bears, and used the meat and hides for their subsistence. Early explorers to the Arctic often met polar bears which were then shot (De Veer 1876, Nansen 1897, Nathorst 1900, Lønø 1970, Davids 1982). There are no reliable hunting statistics of polar bears until this century, although estimates of annual takes are available from some regions (Hoel 1949, Vibe 1967, Lønø 1970). Until a few years ago, biological knowledge about polar bears was fragmentary, although some accounts contained valuable information (Nansen 1924, Ingstad 1948,

Freuchen 1959). Reliable data on population sizes, migrations, mortalities and recruitments were lacking. There was no satisfactory data on polar bear population biology which could govern annual takes on sustainable yield basis. Scientists disagreed about population discreteness and migration. Knotterus-Meyer (1908) and Birula (1932) stated that there were several races and even subspecies of polar bears. Later, however, Pedersen (1945) stated that all bears undertook long migrations around the polar basin, and that all polar bears consequently more or less belonged to the same stock. Chernyavksii (1969) concluded that polar bears were monotypical throughout their range. Estimates of world population size varied between ca 17000 to 19000 (Scott et al. 1959), and 5000 to 8000 (Uspensky 1965). The great differences in the population estimates illustrated the lack of adequate surveys, and the consequent great uncertainties with regard to polar bear numbers in different areas.

In 1965, representatives from the five arctic nations Denmark, Canada, U.S.A., U.S.S.R. and Norway met at The First International Scientific Meeting on the Polar Bear in Fairbanks, Alaska. The delegates reviewed existing information and statistics. They agreed that scientific data which could be used as a platform for sound management was still fragmentary or lacking. Simultaneously, an estimated 1300 polar bears were killed in different Arctic regions each year, and this number was expected to increase. The Conference called upon each arctic nation to initiate studies of polar bears which could be used in management and conservation of the species. After the Fairbanks Conference, the International Union for the Conservation of Nature (IUCN) established the Polar Bear Specialist Group in 1968, with representatives from the five arctic nations. The group has presented polar bear data and research, discussed results and presented recommendations through eight Working Meetings and one Technical Meeting between 1968 and 1983. I have been a member of that group since 1968. The close cooperation with polar bear specialists from other countries through the IUCN Polar Bear Specialist Group has

greatly facilitated my work in the Svalbard area.

The Norwegian delegation to the Fairbanks meeting in 1965 presented plans for a Norwegian research program on polar bears. The objective was to study polar bears in the Svalbard area and adjacent ice-covered areas, in order to obtain data on polar bear population discreteness, migration and population biology. (Norsk Polarinstitutt 1965). Harvest statistics were also presented at the meeting. They showed that Norwegians mainly hunted polar bears from weather stations, winter trappers' stations and from vessels. The average annual Norwegian take was 183 bears per year between 1945 and 1965 (Øritsland and Norderhaug 1965). There was a general concern that polar bear hunting in the Norwegian Arctic was exceeding the sustainable yield levels.

The Norwegian polar bear research program mentioned above was launched as a joint venture between the University of Oslo and Norsk Polarinstitutt. Since 1972, Norsk Polarinstitutt has had the responsibility for polar bear ecological research in Norway. My own field studies started in Svalbard in 1966, as a part of this project, with a pilot program which aimed at developing methods for live capture of bears for subsequent marking and sampling. Bears were chased from an icegoing vessel and shot from the ships deck with a syringe gun containing immobilizing drugs (Larsen 1967). Polar bear data and samples were collected during 19 expeditions to Svalbard and the Barents Sea, between 1966 and 1983, one to Canada in 1967 and one to East Greenland in 1973. Appendix 1. Other data, samples and information were collected from trappers, weather stations and expeditions to the Svalbard area. Co-workers in other countries assisted in obtaining biological specimens from other arctic areas. Data and preliminary results were published in progress reports to the IUCN Polar Bear Specialist Group, and in other publications. Appendix 2.

In 1970, O. Lønø presented the first, accurate account of the polar bear in the Svalbard area (Lønø 1970). Lønø had collected harvest data from the Norwegian polar bear hunts

in Svalbard, from East Greenland, the western Soviet Arctic and from ice-covered seas in the European Arctic. He presented results from his studies of polar bear food habits, male and female reproductivity, breeding biology, polar bear denning habits, age and population structure, mortality, and more. Lønø,s work has been an important platform and reference for my study.

The major objectives of my polar bear studies in Svalbard and adjacent areas between between 1966 and 1983 were to:

1: Determine the range and discreteness of the Svalbard polar bear population.
2: Estimate the immigration and emigration of bears between Svalbard and adjacent areas.
3: Describe seasonal movements of bears in the Svalbard area.
4: Estimate population size in the late 1960's when the population was harvested, and in 1980-1983 when it had recovered after the prhibition of all hunting in 1973.
5: Study polar bear denning biology and estimate cub production in Svalbard.
6: Estimate population parameters which govern decline and growth in the Svalbard polar bear population.

This dissertation is a combined discussion and evaluation of data and results obtained through this program. They are presented in the following six publications:

Paper no. 1: Larsen, T., Tegelstrøm, H. Juneja, R.K., and Taylor, M.K. 1983. Low protein variability and genetic similarity between populations of the polar bear. Polar Research 1 n.s.: 97-105

Paper no. 2: Larsen, T., and Kjos-Hanssen, B. 1983. Trichinella sp. in polar bears from Svalbard, in relation to hide length and age. Polar Research 1 n.s.: 89-96.

Paper no. 3: Larsen, T. 1983. Polar bear denning and cub production in Svalbard. Manuscript. Accepted for publication in J. Wildl. Manage.

Paper no. 4: Larsen, T., Jonkel, C. and Vibe, C. 1983. Satellite radio-tracking of polar bears between Svalbard and Greenland. Int. Conf. Bear Res. and Manage. 5: 230-237.

Paper no. 5: Taylor, M.K., Larsen, T., and Schweinsburg R.E. 1984. Observations of intraspecific murder and cannibalism in polar bears. Manuscript. Submitted to Arctic.

Paper no. 6: Larsen, T. 1984. Population biology of the polar bear in the Svalbard area. Manuscript. Submitted to Norsk Polarinstitutt Skrifter.

GENERAL RESULTS AND DISCUSSION

Unlike most other large carnivores, polar bears occur in relatively large populations. Their abundance is often sufficiently large to obtain adequate samples for studies of their population biology. Surveys can yield sufficient numbers for the calculations of relative and absolute abundances. Samples can be obtained through hunters and from specific scientific programs. On the other hand, the species occupy remote areas which often are inaccesible, or where field studies require support from icegoing vessels and aircraft. Systematic studies are therefore often expensive and sometimes prohibitive. One research method alone will normally not yield enough data for conclusive results. I have therefore used different approaches and methods, and drawn my final conclusions by weighing the combined results of various studies.

During the 1965 Fairbanks meeting, it became clear to the delegates that scientists disagreed on whether polar bears occured in discrete populations or not. This problem needed to be addressed, because it was crucial in studies of other aspects of polar bear biology. Methods used to determine the growth or decline in populations require knowledge about the populations' discreteness and size and the extent of immigration and emigration. An evaluation of the harvest impact have to be weighed against best available data on population size and characteristics. Population size and growth are affected by population discreteness and migrations between Svalbard and adjacent areas. Population discreteness can be studied by several methods. One is to map polar bear abundance and densities through air and ship surveys, and to relate observations to physical and biological parameters. Differences in water mass properties and marine productivity can determine the availability of seals and other food sources, and hence polar bear occurrence. Ice drift patterns must be studied, because heavy ice drift can prevent bears from migrating between areas,and because seasonal fluctuations in ice distribution and coverage determine polar bear

migratory patterns and abundance (Vibe 1967).

The study of polymorphism in polar bear blood protein was used in order to distinguish between populations. Samples from Svalbard, Greenland, Canada and Alaska were compared. The study did reveal differences, but they were not significant and could hence not be used as a tool to discriminate between populations. This is discussed in Paper 1. Another approach is to study the Trichinella infection rates in polar bears from Svalbard, and to compare that with similar studies from other Arctic regions. The Trichinella study showed that arctic strains of Trichinella probably are different from those found on other latitudes. The infection rates in Svalbard and East Greenland bears were comparable, but different from the infection rates in bears from the North American arctic. Since the Trichinella parasite in polar bears probably is transferred mainly through cannibalism and scavenging, it is also possible that geographical isolation between bear populations may favor the evolution of different Trichinella strains in some populations, or cause differences in infection rates due to differences in food habits, or other ecological factors. The Trichinella study, (Paper 2), showed that bears from Svalbard and East Greenland may belong to the same population, but are different from North American polar bears.

Papers 4 and 6 discuss the distribution range and movements of polar bears in the Svalbard area, based on observations, mark/recaptures and telemetry studies. Observations between 1966 and 1983 showed that Svalbard polar bears probably have their distribution limit between 82o north and the ice edge in the south, and between ca. 5o west and ca. 70o east. Outside this area, the marine productivities and seal abundances are low, and consequently polar bears are also rare. But the findings are not conclusive, due to relatively few surveys and observations, and because adequate data is lacking particularly from the western Soviet arctic. But mark/recovery and telemetry studies confirmed that the Svalbard bears roam more or less within the borders described above, and that their seasonal movements follow regular patterns. Some bears migrate from Svalbard across the Greenland Sea to Southeast

Greenland and even around Cape Farewell to Southwest Greenland. They do not drift passively with the ice, but are able to migrate extensively against the ice drift in the Greenland Sea. Bears are also able to remain in or migrate back to the Svalbard area in spite of strong ice drifts in the Barents Sea. Most bears congregate in the ice-covered parts of the Barents Sea, between Svalbard and Frans Josef Land in summer, where they feed on seals. Summer movements in the Barents Sea are local and restricted. Observations from many sources and analysis of harvest statistics show that there are regular, seasonal migrations of polar bears with the changing ice conditions in Svalbard.

Craniometric variation can sometimes reveal population differences in mammals, and have been tried on polar bears from various Arctic regions. Manning (1971) was able to demonstrate differences between polar bears from the North American Arctic and Europe, but he could not determine if the differences were genotypic. I compared polar bear skulls from Svalbard and the western Soviet Arctic, but my craniometric studies could not reveal significant differences between these areas. I concluded therefore that there was nothing in cranial variation which suggested population differences, and that polar bears from Svalbard and the western Soviet arctic could belong to the same population. (Larsen 1978). This fact, plus observations in the Barents Sea, the results of mark/recaptures, telemetry studies and harvest analyses show that polar bears in Svalbard and the western Soviet arctic belong to the same population. (Papers 4 and 6).

The common conclusion of the seven different approaches (blood protein polymorphism (Paper 1), Trichinella infection rates (Paper 2), telemetry (Paper 4 and 6), observations, mark/recaptures, harvest data analyses (Paper 6), and craniometric studies), is that polar bears in Svalbard belong to a common population which also embraces East Greenland and the western Soviet arctic. Migrations between this common region and other areas are considered to be negligible, at least with reference to short time spans such as one or two decades. Bears which belong to this common population

undertake seasonal and often extensive movements with the fluctuating ice. The Barents Sea is a major summer retreat, where most bears congregate in summer to hunt seals. Summer movements are restricted, probably between the ice edge in the south and ca. 82o north, and between the Svalbard archipelago in the west and the Frans Josef Land/Novaja Zemlja area in the east. In winters, pregnant females seek ashore, mainly to Kong Karls Land, Nordaustlandet, Edgeøya and Barentsøya in Svalbard, and to Frans Josef Land and Novaja Zemlja in the Soviet Arctic, in order to den (Paper 3). Other bears follow the expanding ice south and westwards in late fall, and move back to the summer retreat in the Barents Sea in spring. Their occurence and abundance is mainly determined by the ice situation. The quantitative extent of exchange between Svalbard and East Greenland, and between Svalbard and the western Soviet Arctic is still poorly known, and more studies are required in order to quantify such migrations.

The concept of discreteness must be related to a time perspective. Marking and recoveries and telemetry studies are normally done over a period of only a few years, and may conclude in population discreteness. In my work, the results from the study of blood protein polymorphism contradict the results from the other research. It is possible that polar bear blood proteins are homogenous throughout the Arctic, in spite of barriers between populations. But polar bears are also long-living animals. My own work, and other studies have shown that some individuals may undertake occasional long migrations, and stray far away from their normal range, to the central Arctic Basin, or to areas occupied by other populations. Such exchanges of only a few animals may be sufficient to create uniformities in genetic material. From a management standpoint. the Svalbard/East Greenland/ Western Soviet arctic polar bear population can be regarded as discrete. because the exchange of individuals over short time spans probably is small. But other scientists may argue that the exchange of bears and hence genetic material over many years is sufficient to dilute differences, and to justify Pedersen's (1945) statement that all polar bears are members of one, common population.

On the basis of the conclusions concerning Svalbard polar bear's population discreteness and distribution, my objectives were to study and describe population biology characteristics, and the impact of a changing harvest pressure upon the Svalbard polar bear population. Polar bears were hunted extensively in Svalbard over many years. Good harvest statistics are available from after 1945 (Lønø 1970, Norderhaug 1972). In the 1960's, a general concern was often expressed, that the polar bear population size and recruitment rates were not sufficient to sustain the heavy harvest. But reliable data and estimates were lacking. Population estimates and mark/recapture data which were obtained through this study between 1966 and 1969 (Larsen 1971, 1972) were a major reason for the introduction of new polar bear hunting regulations in Svalbard. Polar bear hunting was curtailed through quota systems and prohibition of the set gun in 1970, and all hunting was prohibited in 1973 through an international agreement (Anon. 1974). This means that population characteristics changed between the late 1960's and today, from a situation where the population was seriously overharvested, to a recovery phase obtained through total protection of the population.

Papers 3, 5 and 6 present status and trends in the Svalbard polar bear population. Data were mainly collected in two different periods. The first data set is from between 1966 and 1970, which was a period with a declining polar bear population caused by many years overharvest. The second data set, from between 1976 and 1983 is from a recovery phase, caused by a total protection of polar bears in Svalbard, and by an effective protection of their habitat through the establishment of national parks and nature reserves in the archipelago in 1973. Estimates of population densities and total population size within the borders described in Papers 1,2 and 4, prior to 1970, have been derived from mark/recaptures, air and ship surveys, and analyses of harvest data. The common conclusion from these different approaches is that there probably were around 1000 polar bears in the Svalbard area alone, and that the common East

Greenland/Svalbard/western Soviet arctic population size was around 1500 to 2500 bears in the late 1960's. (Paper 6). An average harvest of 320 bears per year between 1945 and 1970 meant that more than 10% of the population was harvested annually. The overharvest was particularly alarming because females and cubs could be harvested without major restrictions. This resulted in an accelerating decline of the population. If we accept a maximum population growth rate of 5% annually, then population size in 1945 was between 4800 and 5600 bears. A lower average population growth rate may be more realistic, particularly because of the high cub mortalitiy rates observed in the Svalbard area (Paper 6). However, if population growth rates were lower, then the heavy harvest could only have been sustained if there was a steady immigration of bears from outside areas. Mark/recapture and telemetry studies (Papers 4 and 6) do not suggest such immigration.

After the prohibition of polar bear hunting in 1973, other methods had to be used to estimate population size. Recoveries of marked bears from hunters could not be obtained. Less effort was therefore put into marking programs, although some bears were still captured, marked and studied in order to obtain blood samples, teeth for age determinations, and because markings could yield additional information about the exchange of bears between Svalbard and Greenland, where hunting still is permitted. Ship surveys became more efficient through the introduction of satellite navigational aids and laser rangefinders onboard ships and aircraft. (Paper 6). Much field effort was put into regular den surveys and counts. Polar bear denning is concentrated in Svalbard, and can be used to calculate population size and trends, when knowledge about family group representation is obtained from surveys and observations. (Paper 3). The common conclusion of the ship surveys and the den surveys is that the polar bear population had increased to around 1500 to 2000 animals in the Svalbard area alone after 1980, and that the common East Greenland/ Svalbard/ western Soviet arctic population probably counted between 3000 and 5000 bears. This population growth require a growth rate of 5% annually. If growth rate is lower, the

observed increase must partly have been caused by immigration from other areas (Paper 6).

There are three different parameters which are important in population projections, but which are difficult to estimate in any polar bear population. They are natural adult survival rates, cub survival rates, and fertility rates (or effective breeding success). Observed adult survival rate is a function of natural survival rate and population growth rate, of which the latter can be difficult to estimate. Natural survival rates can also differ between ages and sexes, and require large unbiased samples in order to be determined. In this study, age samples were small, and population growth rates were difficult to estimate due to great variation in population estimates. Average adult survival rate was found to be 0.95 after 1970. Cub survival rate is much lower than the adult survival rate, both for coys, yearlings, and probably also for two year olds. It was estimated to be 0.41 for Svalbard polar bear cubs between age 4 and 24 months, independent of their mothers survival. This is considerably lower than in other Arctic areas (Paper 6). Cannibalism in polar bears can be a major reason for cub mortalities. Coys are particularly vulnerable to predation by large males, but the absolute importance of such predation is difficult to quantify. (Paper 5). Trichinella studies show that the polar bear itself probably is the major vector for distribution of the parasite in polar bear populations, through cannibalism and scavenging. (Papers 2 and 5). It is possible that cub mortalities in Svalbard are affected by total population size and densities of single adults. (Paper 6). Cub mortalities are partly caused by loss of whole litters. An estimate of litters lost can be obtained through observations of population composition at different times of the year, provided observations are non-biased. But stratification in polar bear populations has been observed in many areas, and it is consequently difficult to obtain reliable information on the loss of whole litters (Papers 3 and 6).

Good estimates of reproductive rates and consequent effective breeding success can be obtained through different

approaches. One is to estimate fertility rates and consequent reproduction potential through histological examination of ovaries and embryo developments after breeding. But since polar bears have delayed implantation, samples are difficult to obtain, because they have to be collected immediately before or after females are entering dens in the fall. Furthermore, with no hunting in Svalbard, samples cannot be obtained from polar bear females there. Another method is to estimate the effective breeding success by marking a large number of fertile and available females during the breeding season, follow them to their denning areas, and then keep an account of which of them give birth and emerge from dens with offspring the following spring. This method is impractible, but also prohibitive because of the efforts and costs involved. It has not been possible to obtain good data on fertility rates and breeding success in Svalbard. But estimates of fertility rates and consequent breeding success can be obtained indirectly through population modelling, where breeding parameters are determined by other calculated parameters and by the observed population growth in Svalbard in order to obtain a match. To obtain a population growth as observed in Svalbard between 1970 and 1983, fertility rates must be around 0.94. The reproductive rate, i.e. the number of cubs produced per female per year, was calculated to be between 0.51 and 0.59. It is reasonable that polar bears which normally do not attain sexual maturity before they are five years old, and which have litters with ca. three years interval, must invest in high fertility rates, and extensive parental care. This is particularly important if cub survival rates are as low as found in this study. (Paper 6).

The polar bear population in the Svalbard area can grow with a theoretical maximum of ca. 5% annually, if conditions are optimal. True growth is probably lower (Paper 6). After hunting was stopped in Svalbard in 1973, the population probably continued to decline for a few years, because there were relatively few adult females available for reproduction, and because the number of adult bears were reduced through natural deaths. It must have taken some years before cubs and subadults could enter the breeding pool and compensate for the

losses. This means that average population growth between 1970 and 1980-83 probably was less than 5% annually. Consequently, the population estimates prior to 1970 are too low. or the estimates around 1980-83 too high, or both. Annual harvest levels can probably not exceed 2% provided females and cubs are protected from hunters, and provided other ecological factors, or environmental, detrimental conditions do not affect the population.

Monitoring of the Svalbard polar bear population, estimates of population parameters and modelling of population trends must be given the highest priorities in ecological polar bear research in Svalbard. Better estimates are needed for natural survival rates of adults, subadults and cubs, for fertility rates, reproductive rates and for breeding sucess of females of different ages. As the polar bear population is increasing in Svalbard and adjacent areas, density dependence and intraspecific relationships need to be studied.

Part B: N.A. Øritsland : Polar Bear Research 1978-85

A status report to the Polar Bear Specialist Group

Introduction

The 19 papers and reports listed here encompass most of the 1978-85 bear research in which I have played a central role. A few of the papers discuss seals and Svalbard reindeer, and are thus not directly concerned with polar bears. Nevertheless the ideas and concepts presented in those papers are also an integral part of my "polar bear thinking". Under a more favourable economic climate the focus should have stayed on polar bears. However, a coherent new model (SEAERG) for arctic mammal energetics at the population level has been developed, and is presently being applied to harp, harbour and ringed seals. The experimental basis for a reconstruction and application of SEAERG to polar bears is ready.

The listed papers may be classified as experimental or mainly theoretical work. Below follow a few comments regarding the scope of the papers, i.e. results of some polar bear research 1978-85.

Experimental results

Papers 4, 7, 11 and 13 emerge more or less directly from the ill famed experiments regarding the effects of crude oil on polar bears. Besides providing clear insight into oil toxicity on polar bears - which may be severe, the oil project also produced some basic research data. Paper 6 is the main report on the project. The energy cost of walking is described (10 and 13), and we have some information on the insulative properties of polar bear fur (13) as well as characteristics concerning solar heating of this species (2 and 13). Indications on skin reactions to oil in polar bears were substantiated by work on rats (15).

The "translation" of heart rates and body temperatures to energy consumption is described in paper 9 and an earlier paper not listed here. Thus when, in the future, radio telemetry of heart rates and body temperatures of free-ranging polar bears is carried out, the data will be meaningful in quantitative terms of energy requirements.

The energetics of the denning situation must be considered separately. An account of this theme should be given by Dr. Paul Watts. Paper 8 elucidates some of the principles of denning energetics. An important aspect of denning in bears is that because they are big sized (i.e. have a small surface to volume ratio), they do not need to depress deep body temperatures in order to save energy. Hence because deep body temperature remains high during denning, muscular response and alertness is considerably nearer normal than what may be observed for small sized hibernators.

Theoretical computer models

The most recent status report on models of energy requirements at the population level is given in paper 16. We are now talking about a series of "ERG" (energetics) models in which SEAERG is operational for seals within the family Phocidae. The model is constructed from modules for temperature regulation, growth processes and population dynamics. It is dynamic and driven by body growth requirements. The programme listings are given (not properly documented) in paper 18 II. Details on construction and the application to harp seals are presently written only in Norwegian (18 I and 19). The basic development of the energy modules are elucidated in papers 1, 3, 5 and 12. (There is no obvious reason why paper 12 is not yet properly printed). The module for population dynamics is described in papers 14 and 17, where paper 17 is a fairly detailed documentation of the programme listing. Population dynamics are calculated according to a Leslie model, and the model has been applied to field data from Canada (paper 14) as well as Alaska and Norway (reference to this work is not listed here).

Plans for future work

Hopefully we, i.e. a small group of scientists at the at the Division of General Physiology at the University of Oslo, will be granted the means for producing a POLERG model for polar bears. Approximately one man-year is needed. There is a realistic possibility that we may also produce a coupling of SEAERG to POLERG.

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Part C: Dr. Karl I. Ugland: FENRIS - a computer model for polar bear population dynamics

The basic principle of FENRIS is that all thinkable parameters are included, or may easily be so. For example, each age class has its own natural mortality, fertility, etc. The user plays in the parameters she wants, or she may use standard values.

The most important parameters are:

1. Subadult/adult survival rate is defined for each sex and age as the annual fraction of natural deaths among bears aged two years and older.
2. Cub annual mortality rate is specified as the fraction of COYS in each litter that survives specified time intervals during the first two years. The mortality rate is therefore not assumed to be independent among the COYS. A natural way to divide the two years is in months after birth, for example (0,3), (3,9), (9,18), (18,24).
3. Fertility rate is defined as the fraction of mature and available females which get pregnant during the breeding season, defined for example as April and May. Females loosing their COYS prior to these months may thus enter the breeding pool the same year if this option is wanted.

All these parameters are density dependent

FENRIS is a self sufficient model, it may give you any projection you want. However, if the parameter values are chosen with proper judgement, the projections give the most probable picture of what has occurred with the studied stock.

The final assessment is consequently dependent on extra information from other sources, for example mark-recapture, transect etc. For the Svalbard-Novaya Zemlya area we have some confidence in the following projections: For the years 1900, 1970, and 1985, we estimate 15 000, 2000, and 3500 animals respectively. This assumes parameter values giving a maximum growth rate of 4%.

Future work plans

1. Implement FENRIS on more computers (with simplified versions on personal computers);
2. Improve FENRIS to be very user-friendly;
3. Use FENRIS to identify the weakest parts in our chain of knowledge of polar bear population dynamics; and
4. Construct field programmes to find answers to problems addressed by computer analysis.

Part D: Effects on polar bears of unusual ice conditions in Svalbard 1984/85 - Summary (in prep)

In 1984 the drifting ice belt, normally extending south to Kong Karls Land (78°N) in eastern Svalbard in the summer, and south of South Cape and Hopen (76°30'N) in winter, stayed north of Nordaustlandet (81°N) most of the year. Similar situations were not recorded before. The question was thus raised whether Svalbard bears, unable to catch seals from land or in the sea, would now starve.

Summer 1984

Bears were counted in eastern Svalbard and the Barents Sea (normally main summer retreats) in the summer of 1984. Results indicated that only a minor part of the Svalbard population stayed in this area (estimated 275-360 bears out of 1500-2000). The polar bears still present were stranded on the eastern-most islands, but observations also confirmed their ability to swim long distances.

Autumn 1984

In September and October 1984 bears were studied on Kongsøya, Kong Karls Land. Summer count on the island was 64 adults and 19 COYS. The autumn estimate was 70 adults. Five COYS were found. One disappeared, probably killed by an adult. Another COY, relatively fat, was found dead. Sixteen percent of the adults were considered fat, 63% in medium shape and 21% were lean. Preliminary conclusions: The drop from 19 to 4 COYS indicate a higher COY mortality in Svalbard in 1984 than in normal years. The low number of fat adults could result in lower cub production next spring than normal.

Spring 1985

Den surveys were carried out on Kongsøya in the spring of 1985. Five maternity dens were found on the eastern side of the island, seven on the western side. If "possible maternity dens" are included the total rises to 16.

In 1972, 5 dens were found, in 1973 24 and in 1977 31 (only the western part of the island was covered these years). In 1978 and 1979 dens were only counted in the Bogen valley on the western side, giving 5 and 20 dens, respectively. A subjective estimate for the whole western part is 15 in 1978 and 30 in 1979. In 1980 56 maternity dens were found, 14 on the eastern side, and 42 on the western side.

From the 1980 relation 14:42 = 0.33, a rough estimate for the total number of dens on Kongsøya in 1972, 1973 and 1977 can be made, giving 20, 30 and 41 dens, respectively. Although very inaccurate, these figures emphasize that the 1985 number of dens is low. If the steady increase in numbers of dens found up to 1980 is due to population increase, the 12 (or 16) dens in 1985 should be compared with the 56 dens in 1980. If representative for all of Svalbard, this would indicate a cub production lowered by 79% (71%) in 1985 as compared to 1980.

The low number of bears found on Svalbard during the summer may indicate that substantial part of the population could have been somewhere else, for instance near east Greenland, where there was more ice at that time. If pregnant females in this area denned up on Greenland instead of on Svalbard as they normally would have done, the "production loss" in 1985 might in fact be less dramatic than the Kongsøya results indicate. Unfortunately no data from Greenland have been available.

The unusual ice condition may also have altered the denning pattern of the females that stayed on Svalbard, making Kongsøya less representative than it is normally supposed to be.

APPENDIX 7: POLAR BEAR MANAGEMENT IN NORWAY 1981-1985

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The management of the Svalbard polar bear population is regulated by "Regulations Concerning the Management of Game and Freshwater Fishes on Svalbard and Jan Mayen" of 11 August 1978. The regulations' Section 4 protects, among other species, the polar bear. Furthermore, most of the eastern areas of Svalbard, where bears mainly occur, are nature reserves where aircraft landing, use of motorized vehicles etc., as well as all kinds of hunting, is prohibited. This reduces man-bear conflicts on Svalbard to a low level. The regulations' Section 6, which allows for killing bears in self defence, is enforced in a relatively liberal way. Between two and five bears have been killed in self defence yearly since they were protected. So far none were killed this year.

Since the summer of 1985, landing by boat as well as by aircraft on the Kong Karls Islands is prohibited, although permission may be achieved for scientific purposes. The islands are by far the most important denning area in Svalbard, and they are also an important summer retreat.

Except for this, there have been no changes in the management of the polar bears in Norway in the last five years, and no such changes are planned.

There has been some pressure from trappers on Svalbard for permission to hunt a limited number of bears. The trappers, a total of 5 men of whom one or two are active in this matter, claim that Article VII parts 1 d) and e) of the Agreement on the Conservation of Polar Bears allows for such a hunt. The Ministry of Environment has repudiated this claim. The matter has also been discussed on a governmental level, and for the time being there is no wish to change the current management strategies.

Oil exploration and possible exploitation may create problems for polar bear management in the near future. A number of oil companies are now applying for permission to carry out seismic investigations and test drilling. Some 60% of Svalbard land area is protected, but the Svalbard Treaty grants companies from signatory states certain rights to carry out economic activity on the archipelago. This applies for minor parts of the protected areas as well. Offshore oil exploration is also rapidly expanding northwards from Norway. Eastern Svalbard and the Barents Sea are the most promising areas for finding petroleum resources. If oil or gas is found in sufficiently great amounts, it is most likely that it will be exploited.

The consequences for the management of the polar bears and the natural environment on Svalbard in general are at present unpredictable.

APPENDIX 8

POLAR BEAR SPECIALISTS GROUP
TENTH MEETING
EDMONTON, ALBERTA, CANADA

RESEARCH ON POLAR BEARS IN ALASKA, 1983-1985

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INTRODUCTION

Research on the ecology and status of polar bear populations in Alaska has continued since 1967. Research was a joint U.S. Fish and Wildlife Service/Alaska Department of Fish and Game effort until passage of the Marine Mammal Protection Act in 1972, and has been largely a Federal effort since then. In 1985, Alaskan polar bear research continues to be carried out by the Research Division of the U. S. Fish and Wildlife Service (DOI). A recent reorganization removed authority for ecological research in Alaska from the Denver Wildlife Research Center, and vested it with the newly created Alaska Office of Fish and Wildlife Research. This new research office is the center for Federal fish and wildlife related research throughout the state of Alaska and in its coastal waters.

Although the responsibility for polar bear research lies with the U.S. Fish and Wildlife Service, numerous other organizations and agencies deserve mention for their cooperation and support of the ongoing research. These include: the U.S. National Oceanic and Atmospheric Administration (DOC), The U.S. Minerals Management Service (DOI), The Canadian Wildlife Service, The Northwest Territories Wildlife Service, the Yukon Wildlife Service,

Dome Petroleum Ltd., Gulf Canada, and the Alaska Department of Fish and game.

STUDY AREA AND OBJECTIVES

Recent industrialization of the Beaufort Sea in Alaska and Canada has raised concerns for wildlife of this northern region. These concerns are prominininent in the Arctic National Wildlife Refuge (managed by the U. S. Fish and Wildlife Service) which is proposed for extensive development of hydrocarbon resources and which is also presumed to be some of the best terrestrial denning habitat for polar bears in Alaska. Concerns are heightened since existing information suggests the polar bear population in the Beaufort Sea is small and relatively isolated. Therefore, polar bear research conducted in Alaska since 1983 has been concentrated in the Beaufort Sea. Cooperation and assistance from various Canadian jurisdictions has allowed studies to be continuous across northern Alaska and the mainland Beaufort Sea coast of Canada as far east as Cape Bathurst, Northwest Territories.

Three major objectives have accounted for the bulk of the research effort on polar bears in Alaska since 1983:

A. Determine the size and trends of polar bear populations in Alaska--a continuing effort since the beginnings of the program.

B. Determine movement and distribution patterns of polar bears in the Beaufort Sea.

C. Determine the distribution, timing, and importance of polar bear maternity denning in Alaska.

METHODS

Polar bears were located by flying over the sea ice at speeds of 125-150 kph and altitudes of 100-200 m. Usually, location of a bear was preceded by intersection with tracks which were subsequently followed to the animal. When located, bears were shot from the helicopter with a projectile syringe containing immobilizing and tranquilizing drugs. Once immobile, bears were fitted with teflon, number coded, button type ear tags. Both upper lips of captured bears were tattooed with numbers corresponding to those on the ear tags. Pertinent anatomical measurements were recorded along with observations of general condition. We painted numbers on the hind quarters of all captured bears to allow identification if subsequently observed during the study. Blood was drawn from the femoral vein of adults, and selected adult females were fitted with radio transmitting collars. Lentfer (1968), Larsen (1971), Stirling et al. (1980), and Schweinsburg et al. (1982) described techniques for capturing and handling free-ranging polar bears.

The location of each capture site was recorded along with pertinent

information about habitat or other circumstances surrounding the capture event. Each year, new captures and recaptures were tallied for studies of population dynamics and estimates of population size.

Radio-collared bears were relocated approximately every six weeks by searching for their transmitted signals from a fast flying, high altitude aircraft.

In 1985, a concerted attempt was made to test the efficacy of using marker darts to quickly mark many bears without taking the time to capture them. These darts simply made a splotch of color on the bear when shot from the helicopter.

RESULTS

Since spring of 1983, we have captured and marked 210 polar bears in waters adjacent to Alaska. This includes 55 recaptures of bears captured during earlier years of the study or in adjacent jurisdictions. Mark and recapture data accumulated recently and those collected in the past continue to provide considerable information on population characteristics and have provided the basis for a manuscript, recently submitted for publication, describing size and trend of the polar bear population in the Beaufort Sea (Appendix I).

In the spring tagging season of 1985, we experimented with "marker darting" bears rather than catching all bears seen. The idea was to save

time spent on the ground, thus increasing hunting time and hopefully numbers of single female bears observed. Also, we were attempting to obtain a large sample of visually marked bears to test population size estimation from large scale single season tag and resighting efforts. The preliminary conclusions from these efforts were not what was expected.

We had to fly approximately 1.6 hours to find each bear observed, and despite the large number of hours flown, relatively few breeding females were observed. By not capturing and marking other bears we failed to collect recapture information on growth, reproductive interval, and survival for this and subsequent years. Also, non-breeding females that may have been previously collared but had subsequently shed their collars were not recaptured. Information on the fates of some of those bears would have been important. It might have worked out otherwise, but most females we did catch and instrument would also have been captured if normal mark and recapture procedures had been used. Thus, sacrifices in terms of total knowledge of polar bears may have been made for what appears at this point to be relatively little gain. In years when larger numbers of bears were available (such as 1984) this technique might work better. However, with the encounter rate we had in 1984, which was pretty typical of most years, marker darting seemed a marginal technique at best.

Further, we learned, just by chance, that at least some polar bears undergo significant molt by the middle of April. This is earlier than previously thought and may be early enough to prohibit large scale use of mark and

recapture efforts based upon marker darting alone. The mark/resighting data have not yet been analyzed for a population estimate, but the preliminary assessment is that similar efforts of major proportions may not be practical for population size estimation.

Movements Studies

In Alaska sixty-two adult female polar bears have been fitted with radio transmitter collars since 1983. An additional 19 radios were attached to polar bears in the Canadian portion of the Beaufort Sea in 1983, and 32 more were deployed in the spring of 1985.

Unfortunately, we have continued to have trouble with transmitter reliability. Earlier problems with packaging and antenna configuration were largely solved, but premature failure of transmitters apparently due to improper battery formulation has prevented collection of much important data. In addition, due to the large scale movements of polar bears, we have maximized power output (and thus current drain) of the transmitters to assist in regular relocation. This, of course, has resulted in relatively short battery life even without malfunction.

Despite these problems and the fact that many radios have only been on the air a short time, we have collected over 500 relocations of instrumented bears since March of 1983. These relocations have told us much about movements of polar bears in the Beaufort Sea and have helped define the area occupied by the Beaufort Sea population. Polar bears in the Beaufort

Sea move great distances east and west both seasonally and annually , but most bears moved smaller distances north and south (Figs. 1-5). Activity areas occupied by instrumented polar bears ranged up to 750 km in length and extended over 375 km from the north coast. Areas occupied by polar bears relocated at least ten times were large but quite variable. The mean area size was 96,924 km^2, the maximum was 269,622 km^2 and the minimum was 9739 km^2 The standard deviation of the mean was 78,453 km^2. It is not clear whether these activity areas correspond to home ranges as one normally thinks of them in terrestrial mammals. However, instrumented bears did seem to be at least somewhat faithful to them. As additional data have accumulated, activity areas of most bears have increased in size suggesting that several years of information might be necessary to accurately describe the total area occupied by individual polar bears.

One conclusion from these radio-tracking data has become inescapable. Alaska and Canada extensively share the population of polar bears occupying the area from approximately Pt. Barrow, Alaska to Cape Bathurst, Northwest Territories, Canada. This finding has special ramifications for both nations, since the International Agreement for the Conservation of Polar Bears mandates that shared populations be managed by consultation.

Maternity Denning Studies

One of the big unknowns for Alaska polar bears has always been where

they den. The period of winter dormancy may be the period during which polar bears are most vulnerable to various human disturbances. Industrial activities and related human population growth are and will undoubtedly continue to increase the likelihood of human disturbances in Alaska's arctic regions in the future. Therefore the denning question has taken on special significance in recent years.

Since 1983, radio-telemetry has provided new insights into questions about maternity denning of polar bears in the Beaufort Sea. Sixteen known or suspected maternity dens were located by radio-tracking in the winter of 1983-84, and another ten were located in the winter of 1984-85. This was big news in itself since fewer than 50 dens of Alaskan bears had been found in all of previous recorded history (Lentfer and Hensel 1980). The important find, however, was the distribution of those dens (Fig. 7). Twenty-one of the dens located during the last two years for which we have data were located on the drifting pack-ice. Some of those were considerable distances from shore, and in most cases, the dens were at latitudes farther north than any previous relocations of the bears in question. One den was known to be on the fast ice along the Yukon coast and another was suspected of being on Yukon coastal fast ice but could not be accurately pinpointed due to erratic radio transmission. That den could actually have been on land. The three other dens were on land in Alaska and the Yukon.

Two dens, one of which was visually located without aid of telemetry, were located in 1981 on the Alaskan side of the Yukon border. The bear

suspected of denning along the fast ice of the Yukon coast in the winter of 1983-84 denned on Herschel Island the previous year but did not leave the denning area with cubs. Another collared bear was visually observed looking for a den in the Canning River region of Alaska in 1983, but due to failure of her radio, could not be relocated later.

Of 27 known or suspected dens located by radiotelemetry (radio-telemetry locations are not biased as are the locations of dens found in aerial or ground searches) 21 or 78% were on the pack ice. Hunting by Yankee whalers and coastal residents may explain why denning along the Beaufort Sea coast may be less common now than at times past. Clearly, significant changes could have taken place with the introduction of modern weaponry around the turn of the century (Stirling et al. 1975). Speculation aside, however, the evidence now available from radio-telemetry seems quite clear in the fact that the majority of maternity dens in the Beaufort Sea now is on sea-ice.

The bear that denned along the Yukon border in fall of 1981 was observed with twin cubs in the spring of 1982, and the bear that denned on Herschel island in fall of 1982 left the denning area without cubs. This second bear may have been disturbed. A Tuktoyaktuk resident indicated afterwards that a relative of his had been hunting in early March, 1983 on Herschel and spooked a single polar bear from the draw where the den was located. Perhaps she fled, leaving offspring behind. Three bears tracked to dens in the fall of 1983 were also observed without cubs in the spring of 1984. One of these was recaptured and available evidence suggested she had

given birth and begun lactation but subsequently lost her cubs. Unexpectedly, this bear did not den in the winter of 1984-85 despite the fact that she was in her best body condition in over three years. The other two bears were not captured, and we do not know why they were without cubs in spring of 1984.

Premature radio failure, mentioned earlier, has unfortunately hampered efforts to locate other dens, and especially to verify the outcome of denning events. Due to radio failure, four females that denned in 1983-1984 were not located after den emergence, and their productivity cannot be verified. Of the nine remaining bears tracked to dens that winter, six were later observed with single cubs and three with twins.

Radio failure interfered with determining the outcome of denning to an even greater extent with bears that denned in 1984-85. Six of the ten females that denned that year were not relocated after emergence from the den. One female was confirmed to have twin cubs, but three others were observed without cubs. One of the three females that did not produce cubs may have been disturbed from her den by vehicle traffic that approached to within 200m of her den during early January (see Appendix II). None of these females was recaptured to allow an assessment of what might have been involved in their failure to produce cubs. Unfortunately, all of these bears are now off the air, so the likelihood of recapture is very slim. Very early radio failure may have also reduced the number of dens we found in 1984-85. Behavior of at least another five bears in summer and early fall of 1984 suggested they might den, but their radios

failed prior to the time of den entry.

Automated Processing of Polar Bear Data

Since 1983, great strides have been made in the development of computer programs to assist in the analysis of data from polar bear research. Data are now entered directly from field forms into six computer files. For example, all information related to marks on bears is in one file, all information related to measurements of bears is entered into another file, and all information related to drugging of bears is entered into another file. These files can be mixed and matched as needed for particular tabulations or analyses. We also have a program (Bearlist) that creates a printout of all files in the order in which they appear on our field data sheets. This printout provides a quick check of information against the data sheet as well as a sequential reference of all capture records for all bears (For an example of output from Bearlist see Appendix III). Another computer program selects data from the files of information related to location and activity and allows plots of bear locations to be created in almost any order and with various labels and legends.

There is still much to be learned about applications and limitations of these new tools, and their analytical capabilities have so far only been sampled; but they have already proven valuable in illustrating some of our recent findings. All of the illustrations in this report were created by the computer from our data storage files.

Satellite Monitoring of Polar Bears

In May 1985, we deployed two experimental radio transmitter collars designed to communicate with overflying satellites. These collars are very similar in appearance to conventional VHF collars we have been using for years, except that they are a little larger. Completed collars, hermetically sealed and fitted to a female polar bear, weigh approximately 1,700 gm. The collars transmit a one watt signal approximately once each minute. Position of the polar bear wearing the collar is determined by the satellite from Doppler Shift. In addition to position, these collars transmit temperature and activity data. Our experimental transmitters broadcast for six hours each day, and at that rate are expected to have a transmission life of over one year. For ground truthing and conventional tracking from aircraft, each collar is also equipped with a VHF beacon.

Only time can tell what the long term performance of these satellite collars will be like. However, to date, they are exceeding our expectations. Position fixes appear to be within a few hundred meters of the true location, and the activity counters appear to depict activity levels of the bears. Since they were deployed, our transmitters have provided approximately one location per day plus several transmissions of the other information. Plots of the movements of satellite collared bears appear in Figs. 8 and 9. For a comparison of the amount of position information available from satellite systems, compare the movements of bear 6204 from aircraft tracking (Fig. 1) and from satellite tracking (Fig. 9). Although we may not need daily relocations for long term data

collection, tests so far demonstrate that with this system we will have the ability to obtain whatever relocation resolution we require. It is also apparent that relocations can be frequent enough to attempt to relate ice conditons and movements to polar bear locations, a feat not really possible with infrequent aircraft relocations. Based upon the results of the test so far, we plan to expand the experiment this fall and next spring.

FUTURE RESEARCH

Research during the next few years will adhere, for the most part, to the recommendations presented by Amstrup (1984). Movements and denning information available from VHF transmitters will be collected through spring of 1986, at which time those studies will be at a natural termination point. Additional movements studies supported by satellite telemetry systems will be implemented by then, with the principal objectives of confirming the boundaries of the Beaufort Sea polar bear population and then outlining the boundaries and movements of Chukchi Sea bears. Depending upon funding, studies of recruitment and mortality of polar bears will be initiated, with the new found ability to relocate bears (from satellites) providing the starting point.

Subject to budget restrictions, techniques for assessing population size and trend will be tested in cooperation with the management division the U.S. Fish and Wildlife Service.

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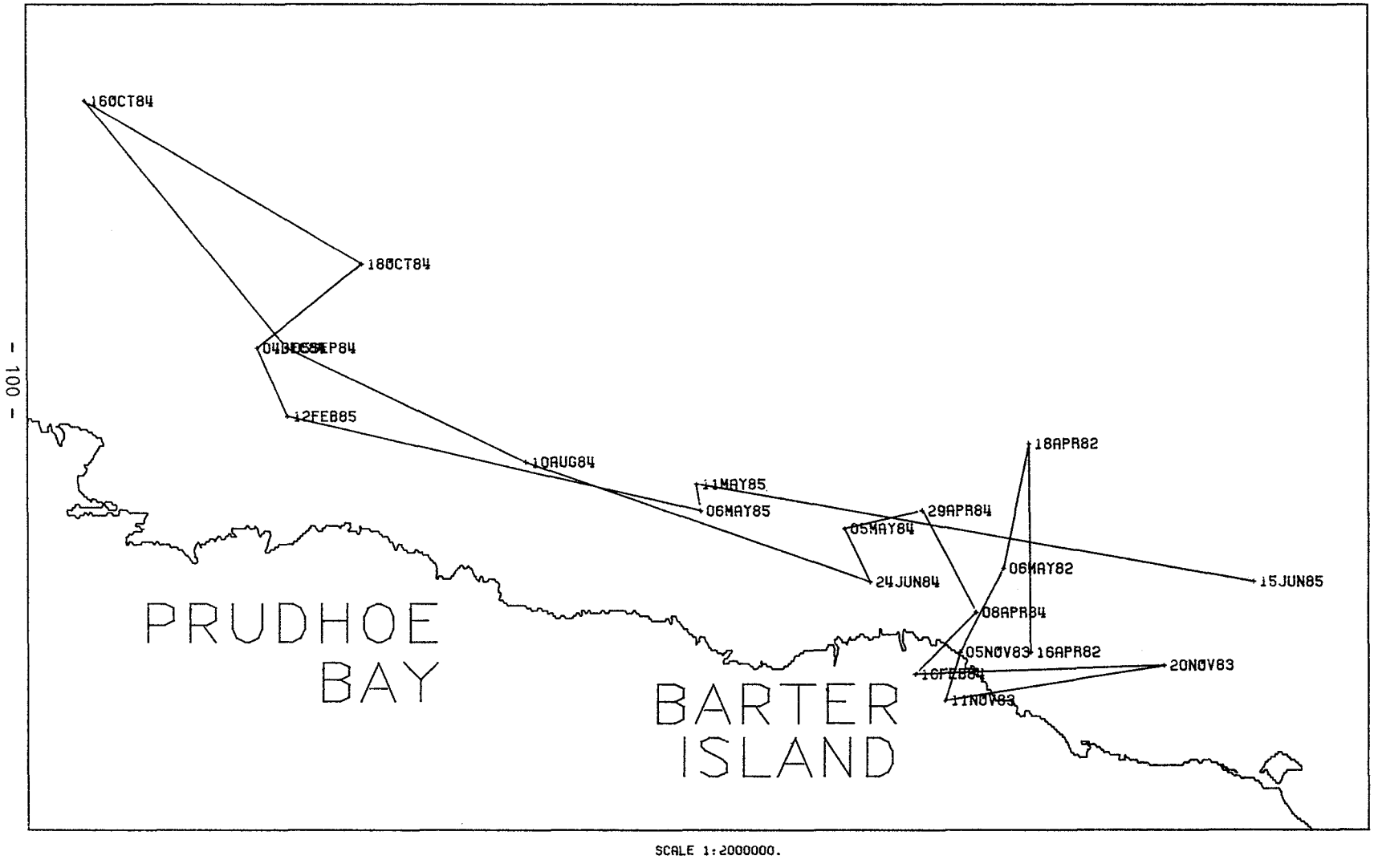
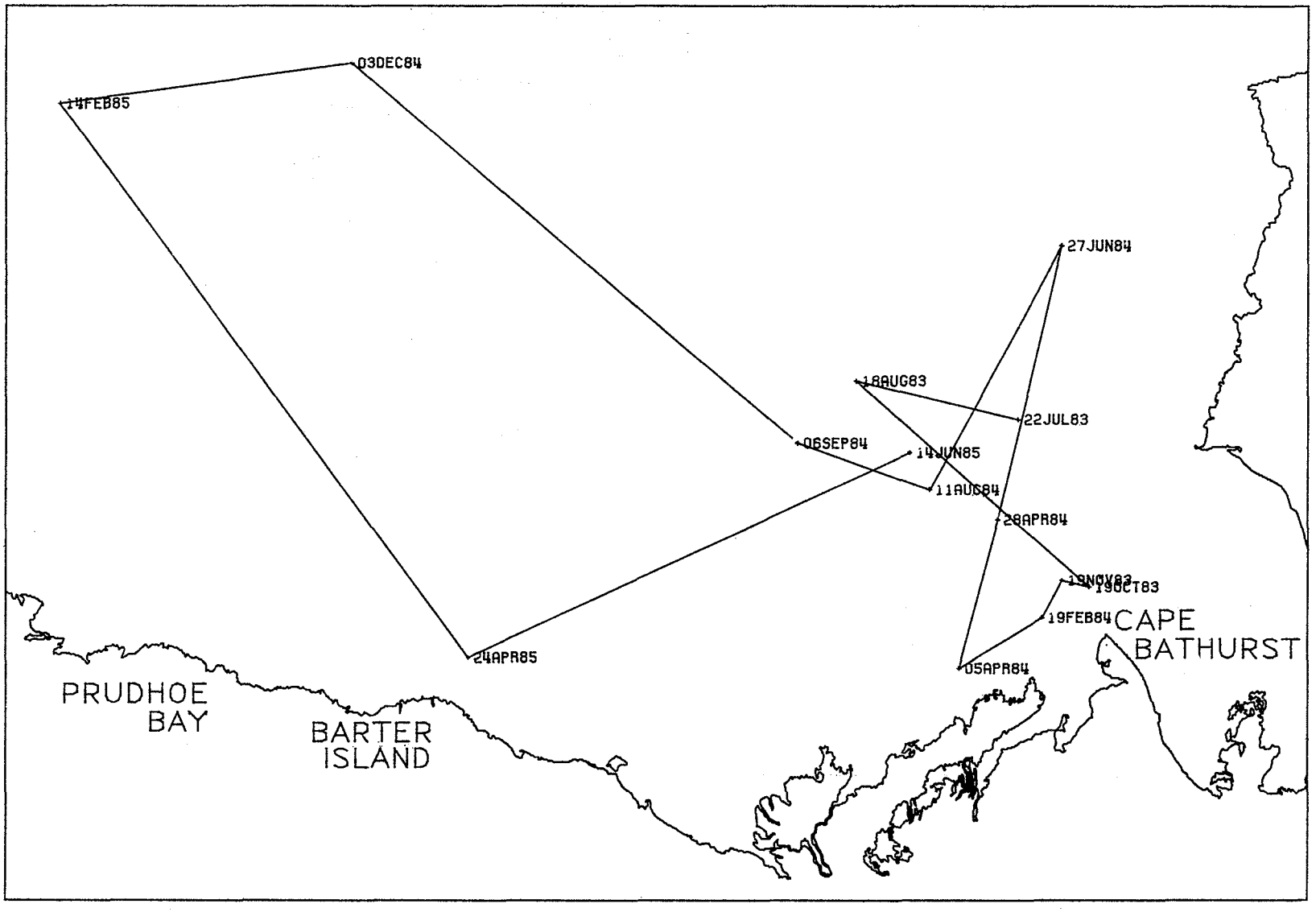
MOVEMENTS OF POLAR BEAR 6204: 16APR82–15JUN85

FIGURE 1



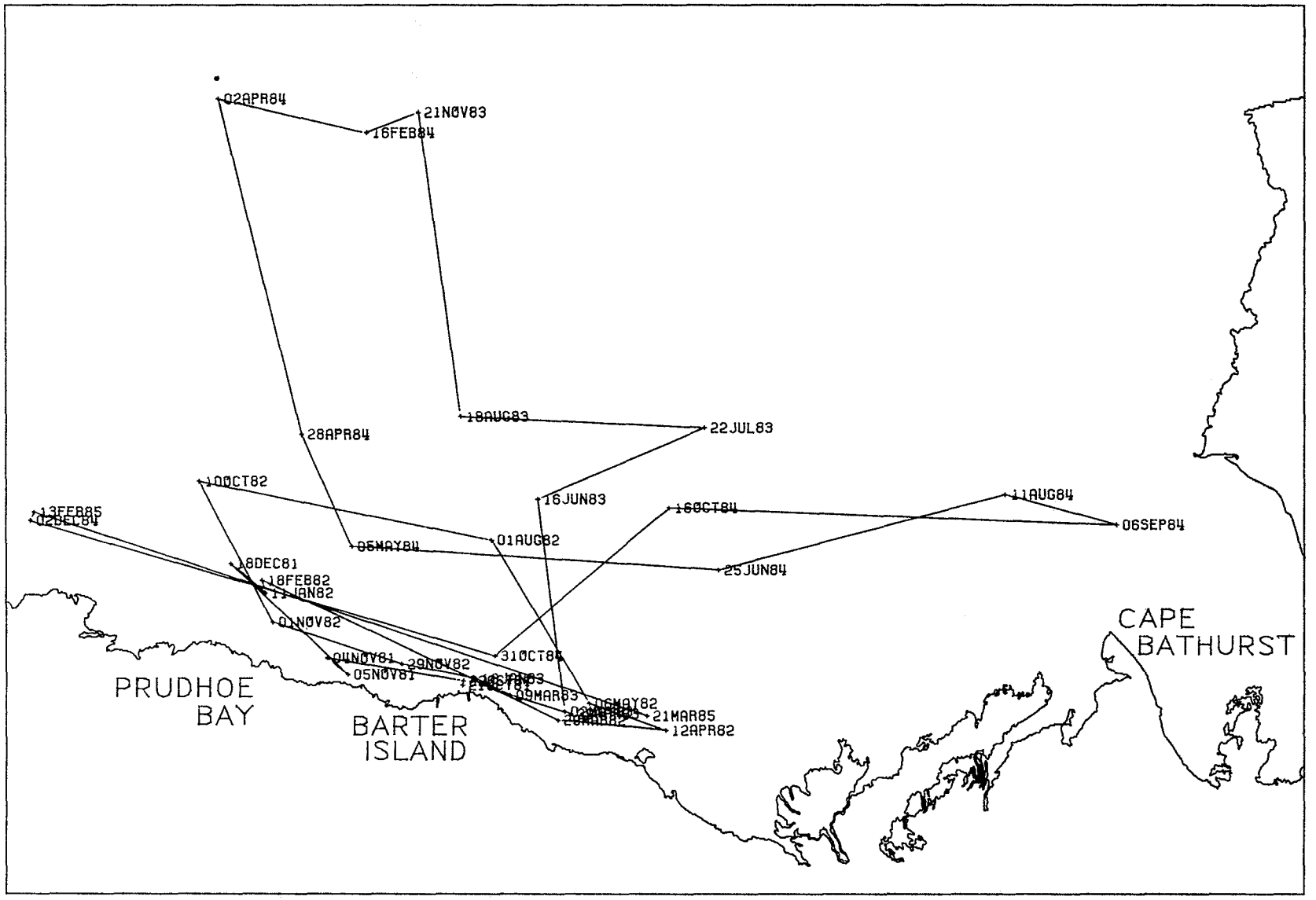
MOVEMENTS OF POLAR BEAR 9433: 22JUL83–14JUN85

FIGURE 2



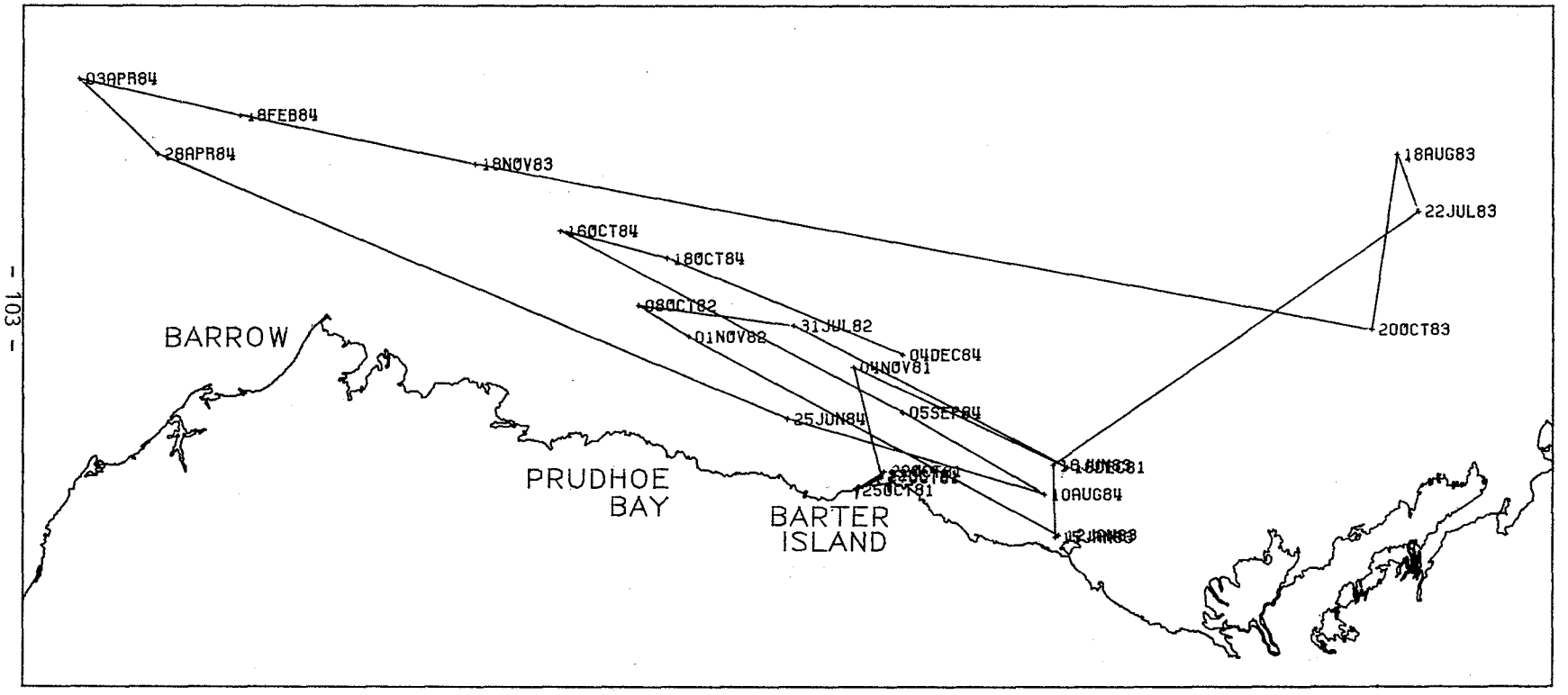
MOVEMENTS OF POLAR BEAR 6157: 11JAN82-21MAR85

FIGURE 3



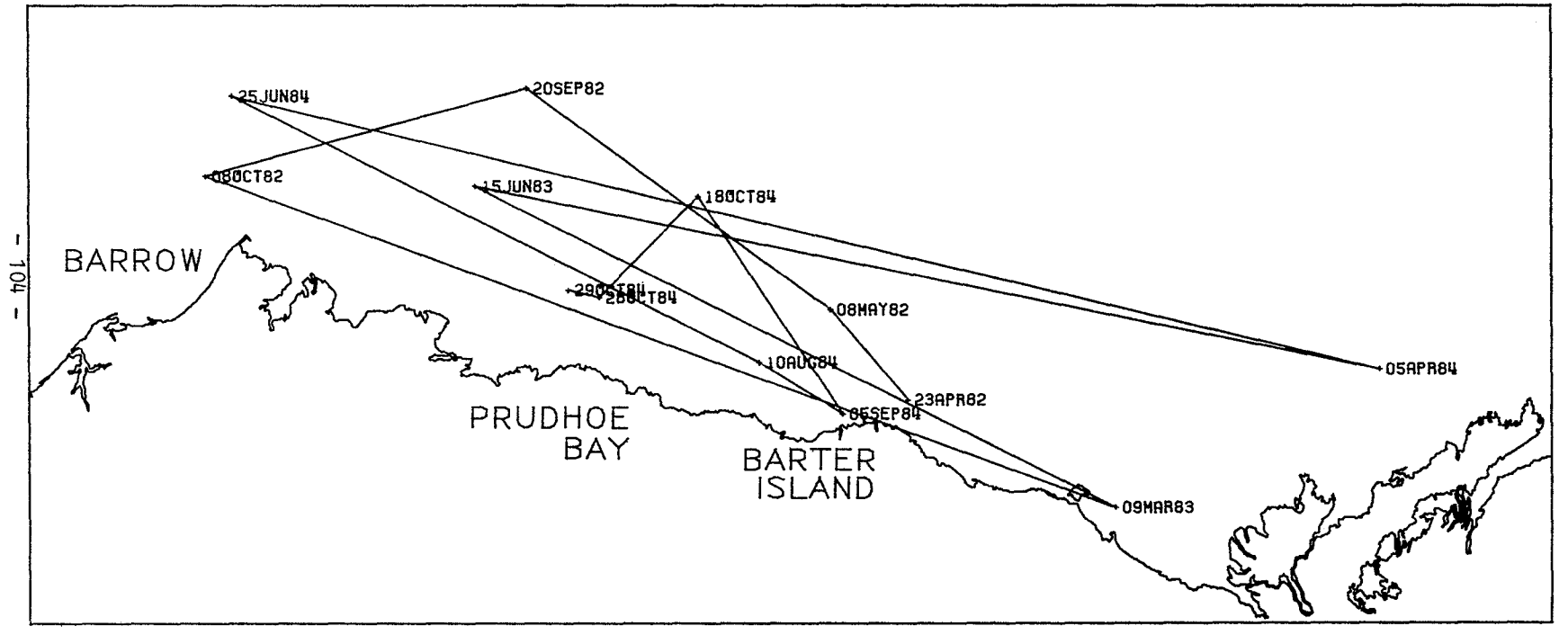
MOVEMENTS OF POLAR BEAR 6160: 22OCT81-04DEC84

FIGURE 4



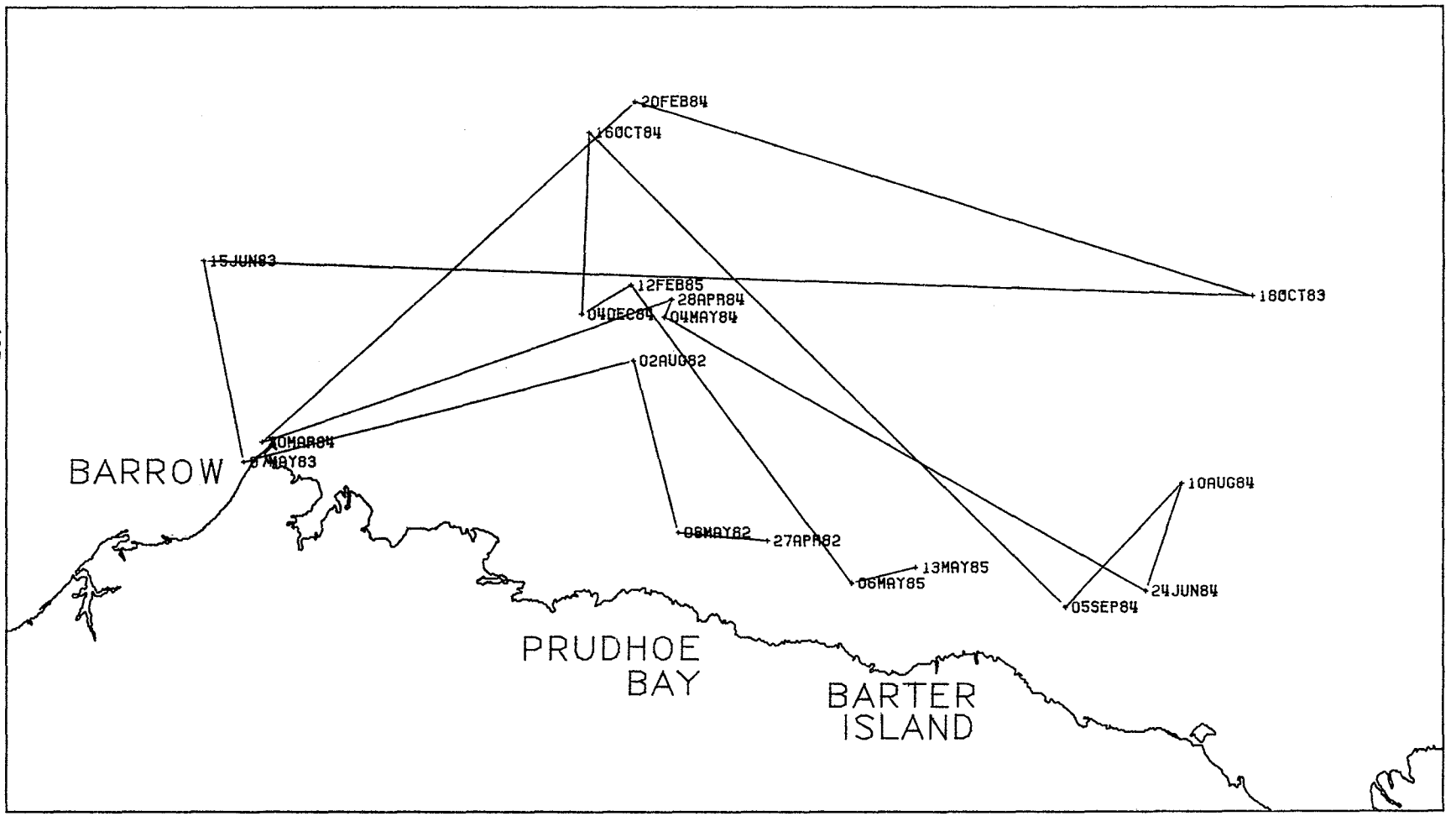
MOVEMENTS OF POLAR BEAR 6218: 23APR82-290CT84

FIGURE 5



MOVEMENTS OF POLAR BEAR 6244: 27APR82-13MAY85

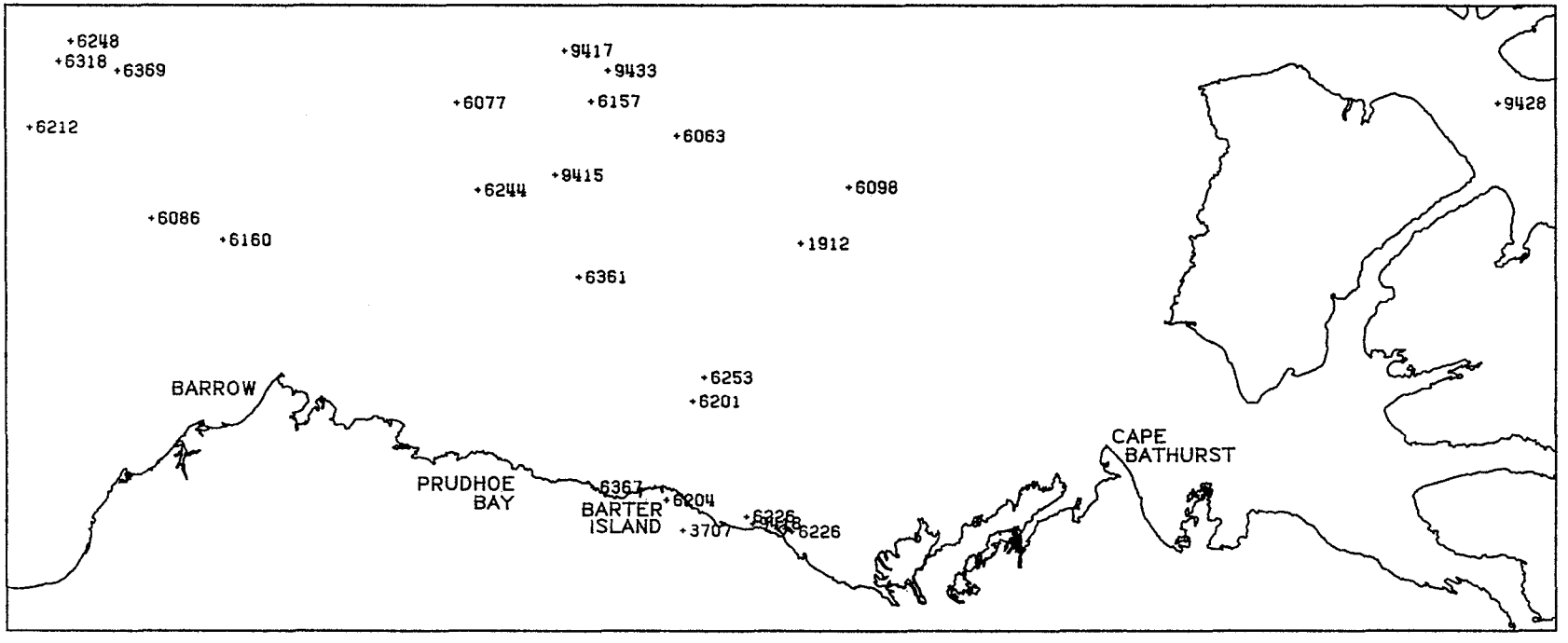
FIGURE 6



SCALE 1:3500000.

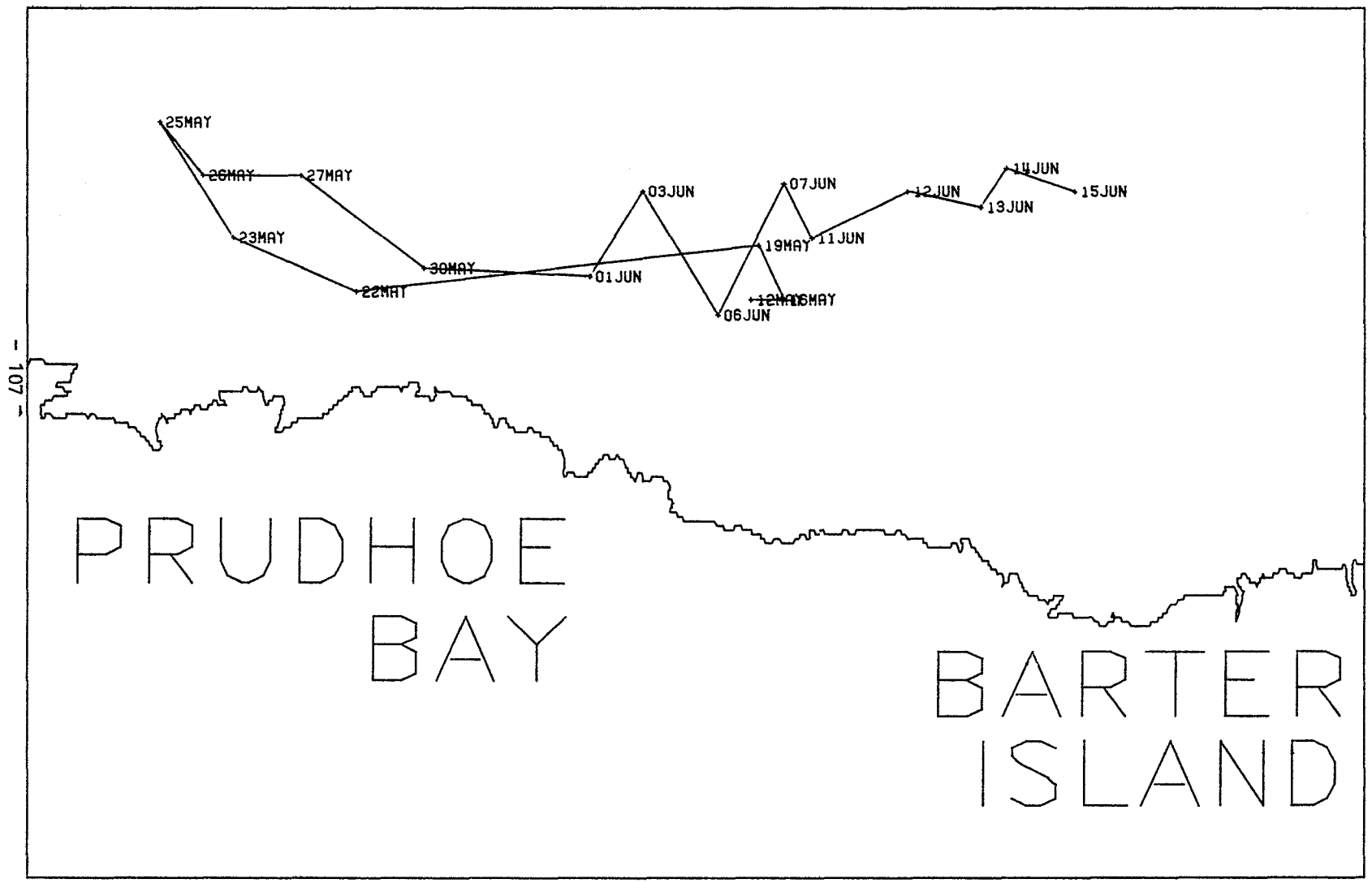
POLAR BEAR DEN LOCATIONS 1983–1984

FIGURE 7



SATELLITE LOCATIONS OF POLAR BEAR 1600 – 1985

FIGURE 8



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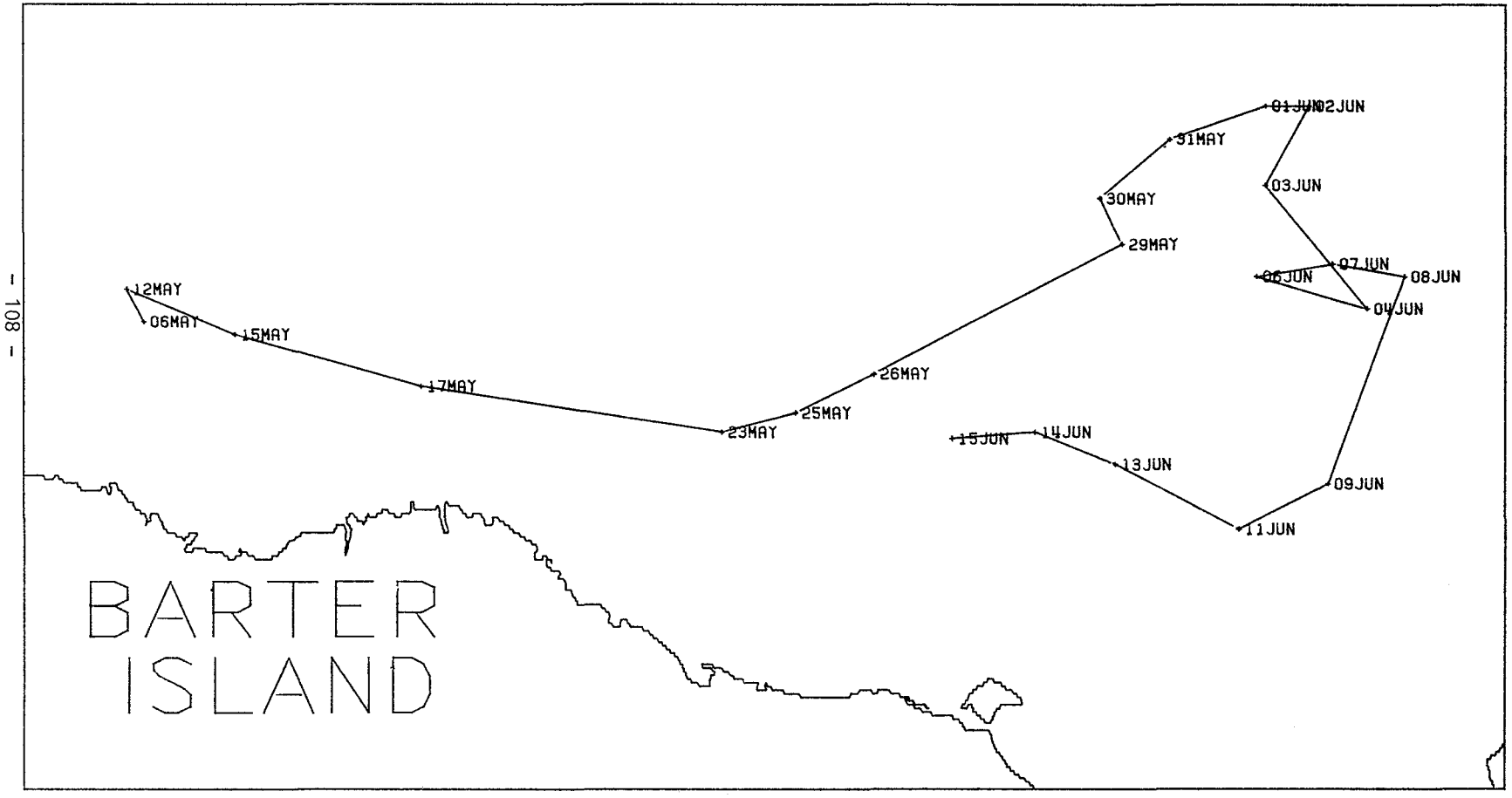
SATELLITE LOCATIONS OF POLAR BEAR 6204 – 1985

FIGURE 9



APPENDIX I

Steven C. Amstrup

Alaska Office of Fish and Wildlife Research

U. S. Fish and Wildlife Service

1011 E. Tudor Rd. Rm 220

Anchorage, Alaska 99503

SIZE AND TREND OF ALASKAN POLAR BEAR POPULATIONS

RH: ALASKAN POLAR BEAR POPULATIONS

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Wildl. Soc. Bull. 00(0): 000-000.

SUMMARY AND CONCLUSIONS

Four independent procedures for estimating population size suggest the number of polar bears in Alaska in 1984 was not detectably different from what it was in 1956, and that polar bears have probably never been more numerous in most Alaskan waters than one for every 137 to 240 km^2. Independently, each of these estimators is weak because of sample size limitations, questionable assumptions, or large variances. However, we believe the degree of agreement between them is significant.

Numbers of polar bears in Alaska apparently declined by the end of the trophy hunting period in 1972. Some recovery occurred during the mid- and late 1970's, and numbers appear to have been relatively stable since then.

Radio-tracking data suggest that polar bears occupying the area between Point Barrow, Alaska, and Cape Bathurst, Northwest Territories, Canada, are members of the same population. Mark and recapture data suggest the size of this population is 1,300 to 2,500 bears (Table 1). Limited information from the Chukchi Sea suggests winter-spring densities similar to those in the Beaufort Sea. Densities of bears in the Bering Strait region may be higher in late winter and early spring, but are highly variable seasonally and dependent entirely on the conditions and motion of the ice. Without knowing more about their movements, we cannot discuss total numbers or vulnerabilities of polar bears along the western coast of Alaska.

We are concerned about the future of polar bears in the Beaufort Sea for several reasons. First, our estimates suggest stability in recent years, but the population is not large. A small, isolated population with low reproductive potential is vulnerable to natural and human caused perturbations. Second, despite many years of study, our knowledge of polar bear population dynamics is still rudimentary. We cannot rule out the possibility that our present assessment of stability may be in error, and with a small population there is little latitude for error. In addition, hydrocarbon exploration and development have allowed unprecedented increases in human numbers in coastal areas of the Beaufort Sea, and habitat is changing at an accelerating rate. As a result, opportunities for encounters between polar bears and humans are increasing. There is great potential for a change in philosophy among increasingly numerous and mobile local people, a change in value of polar bear parts (e.g., hides, gall bladders), or development related phenomenon (such as an oil spill) to increase the human-caused mortalities of polar bears in the Beaufort Sea. The Beaufort Sea population can sustain little if any increase in female mortalities. Since we currently have no regulatory ability to protect females and young in Alaska, this potential for adverse change cannot be overlooked.

Not withstanding the above conclusions, the harvest of polar bears in Alaska has a long history, and polar bears must be recognized as a valuable renewable resource. During the period of trophy hunting in Alaska, males comprised 75% of the polar bear harvest, demonstrating that a managed hunt can afford substantial protection for females and concentrate on the less valuable male segment of the population. Reducing the losses of females to hunting would

decrease the vulnerability of the population to both natural and human-caused perturbations. Also, since large numbers of adult males may suppress ursid population growth rates (Kemp 1976, McCullough 1981, Young and Ruff 1982), a harvest managed to concentrate on male Polar Bears may even have some compensatory benefits to the polar bear population, including the possibility of an increased take.

Acknowledgements: Principal funding for this research was provided by the U.S. Fish and Wildlife Service, Canadian Wildlife Service, and the Alaska Dep. of Fish and Game (funding provided according to provisions of the Federal Aid in Wildlife Restoration Act). Additional support was provided by the Minerals Management Service (U.S. Dep. of Interior), the National Oceanic and Atmospheric Administration (U.S. Dep. of Commerce), Dome Petroleum Ltd., the Polar Continental Shelf Project (Dep. Energy Mines and Resources, Canada), the Northwest Territories Wildlife Service, the Beaufort Sea Project, and the Naval Arctic Research Laboratory. We thank D. Andriashek, W. Calvert, J. Gravning, R.J. Hensel, P. Latour, L.H. Miller, T.G. Smith, and F. Sorensen for their assistance in the field, office, and laboratory. V.G. Barnes, C.M. Handel and J.R. Gilbert critically reviewed this manuscript.

APPENDIX II

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. TUDOR RD.
ANCHORAGE, ALASKA 99503

IN REPLY REFER TO:
AOFWR

MEMORANDUM

TO: Glen Elison, Refuge Manager Arctic NWR

FROM: Steve Amstrup, Polar Bear Project Leader

SUBJECT: Vacated Polar Bear Den on 1002 Area.

Per your request, the information from bear #6367 follows:

I first captured this bear May 8, 1984 approximately 50 miles NW of Barter Island. She was accompanied by an adult male at the time of capture, and was in peak of estrus at that time. Expecting, therefore, that she would be bred, I put a radio transmitter on her. She was relocated throughout the summer and recaptured at the mouth of the Okpilak River on October 30, 1984. At that capture site, she had dug several test dens. It appeared that she was searching for a den site but found insufficient snow at this location. Just prior to capture her tracks were heading seaward again.

This bear weighed only 330 lbs. in the spring, but weighed 570 lbs. in fall. At the time of her fall capture, she was rolling fat and gave every indication of pregnancy. Her physical appearance coupled with the den search behavior convinced me she was pregnant.

After her recapture, she moved to a den site near the mouth of the Canning River. This den was on a bluff of a ravine right on the coast (Lat=70 06' Long=145 41'). She was located there on December 2, 1984 and again on December 27, 1984. Presummably, she occupied this den at least during the intervening period. However, by the week of February 11, 1985, she had abandoned the den and was observed alone on the sea ice near Barrow.

All the evidence indicates that this bear was pregnant and preparing to have cubs. She should have remained in her den until late March, since cubs cannot survive on the ice until that time. My suspicion is that some disturbance caused her to leave her den between the end of December and mid-February. An aerial survey of the area near her den site on February 28, 1985 revealed vehicular traffic had occurred between 1/8 and 1/2 mile from the den site. A single set of caterpillar tractor tracks was evident within 200-250 m of the den site; a very well traveled (cat train) route paralleled the coastline within 450-500 m of the den; and a lesser used route was 800 m away on a spit paralleling the coast. These distances, which were paced off, were comparable to measurements taken from the 1:63360 USGS topographic map Flaxman Island A-3.

To be completely objective, I must recognize that other factors might have been involved. This was a young bear, and it would have been her first litter. Perhaps she was just not adequately prepared to give birth and nurse young, although I tend to doubt that. When captured in the fall of 1984 this had to be darted twice. Probably because of her extremely fat condition and also due to her pre-hibernation lethargy, she recovered from her drug dosage very slowly and remained at the site of capture for 2 full days. I monitored her recovery and verified that she maintained her core temperature. She seemed to be merely taking a long time to "sleep it off". This reaction to the drug may have affected her ability to bring her pregnancy to term. However, we have no evidence that drugging has any effect on pregnancy, especially in such early stages. Furthermore, bear #6204 reacted in the same fashion to being captured at a den in November of 1983, and she produced 2 healthy cubs in a den 15 miles east of Barter Island in the spring of 1984.

I think timing of the human activity is also an important consideration. The activities near the den of bear #6367 occurred during and after the first week of January 1985 (we think). Thus, the activities would have started either just before or just after parturition. At that time the female's investment in her cubs would have been minimal. Since the natural history of polar bears revolves around the longevity of the female and low investment in each reproductive event, it is not at all unreasonable to suspect she might have abandoned the den and cubs at that time.

Reactions of denned bears to machinery have not been previously documented. However, Norwegian studies have shown that the mere sight of humans on foot at distances of 300-400 m causes an instant flight back to the den by bears that have recently emerged. Also, the Soviets have reported that several female polar bears abandoned maternal dens from 1-8 days after scientists walked nearby, despite the fact that the dens were still sealed and there was no direct contact between the bears and humans. Thus it does not seem too far fetched to conclude that the movement of several tons of mechanical equipment past a den at distances of 200-800 m might cause abandonment. In my opinion, this bear was exposed too closely to significant human disturbances. Whereas, I can not be certain why she left her den as early as she did and many factors cannot be ruled out, I must suspect disturbances associated with the movement of equipment near the den site were involved.

I hope this information is of some assistance.

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6204 F  0 16APR82 1525 1 OB ARE LATT LONGI H FMST PO PD S TEM WS D W AC YOUNG# YOUNG# YOUNG# A MFU OTHER BEARS
                       1 07 BTI 7002 14153 W 0304 00 50 3 -12 06 3 1 11                          11  1567
                       2 LEFTE# T RIGHT# T TATTOO PREVIOUS NUM TRANS FREQ PUL DIA PT
                       2 006204 B 006204 B 006204              09462  569 120 673  20
                       3 TLEN  SLEN  GIRT  NESH  NEAX  SKL  SKW  TAL  FFL  FFW  HFL  HFW  TEMP WEIG H
                       3 194.3    .0 110.5  72.4  62.2   .0   .0 16.5  5.1 13.1 13.1 14.0      0360 S
                       4 H VUL VUW T TSL TSW CON  T B H PV HBB
                       4 N                  0020 Y N N
                       5 DRDOSE DRDOSE DRDOSE INJLOC INJLOC INJLOC IND REC RS PUL CV
                       5 M907.5 M515.0        LTHIP  SUBLIN        007 003
                       1 OB ARE LATT LONGI H FMST PO PD S TEM WS D W AC YOUNG# YOUNG# YOUNG# A MFU OTHER BEARS
                18APR82 1832 1 02 BTI 7049 14154 W 0306 10 60 3 -08 00 0 0 01
                 6MAY82 1615 1 02 BTI 7021 14211 W 0304 25 40 3  05 12 6 2 01
                 5NOV83 1044 1 09 BTI 7002 14240 W 06                    12                          1
                       2 LEFTE# T RIGHT# T TATTOO PREVIOUS NUM TRANS FREQ PUL DIA PT
                       2 006204 B 006204 B 006204              16365 5449  96      32
                       3 TLEN  SLEN  GIRT  NESH  NEAX  SKL  SKW  TAL  FFL  FFW  HFL  HFW  TEMP WEIG H
                       3 227.0 188.0 145.0  84.5  61.4 36.2 20.5 12.0  3.2 14.0 12.8  4.8 0339 0580 S
                       4 H VUL VUW T TSL TSW CON  T B H PV HBB
                       4 P 054 032          50   Y Y Y 48 190
                       5 DRDOSE DRDOSE DRDOSE INJLOC INJLOC INJLOC IND REC RS PUL CV
                       5 PC1700 SP0950        RUMP   SHOULD SHOULD 086           03
                       1 OB ARE LATT LONGI H FMST PO PD S TEM WS D W AC YOUNG# YOUNG# YOUNG# A MFU OTHER BEARS
                11NOV83 1022 1 13 BTI 6951 14250 W 06                    04                          1
                20NOV83 1630 1 02 CAN 6959 14024 W
                16FEB84 1630 1 04 BTI 6957 14310 W 06                    12
                 8APR84 1026 1 10 BTI 7011 14229 W 0504 00 60 3          0 06 006341 006342        0 12
                       2 LEFTE# T RIGHT# T TATTOO PREVIOUS NUM TRANS FREQ PUL DIA PT
                       2 006204 B 006204 B 006204              18114 5643 M60 680  26
                       3 TLEN  SLEN  GIRT  NESH  NEAX  SKL  SKW  TAL  FFL  FFW  HFL  HFW  TEMP WEIG H
                       3 224.5 179.0 115.5  69.0  59.0 36.9 19.9 17.2  4.0 14.5 14.2 13.6 0389 0390 S
                       4 H VUL VUW T TSL TSW CON  T B H PV HBB
                       4   048 033          20   Y Y Y 45 167
                       5 DRDOSE DRDOSE DRDOSE INJLOC INJLOC INJLOC IND REC RS PUL CV
                       5 PC0500 SP0200        BACK                 007           02
                       1 OB ARE LATT LONGI H FMST PO PD S TEM WS D W AC YOUNG# YOUNG# YOUNG# A MFU OTHER BEARS
                29APR84 1645 1 02 DEH 7034 14305 W                      0
```

APPENDIX 9

ALASKA POLAR BEAR NATIVE SUBSISTENCE HARVEST
1980 - 1985

S. Schliebe, U.S. Fish and Wildlife Service, 1011 E. Tudor, Anchorage, Ak. 99503

The Marine Mammal Protection Act (MMPA) of 1972 prohibits the hunting of all marine mammals except by Alaska coastal dwelling Natives for subsistence purposes or for creation of authentic native handicrafts, providing that the taking is in a non-wasteful manner and the population(s) is not found to be depleted. Since 1980 the U.S. Fish and Wildlife Service (FWS) has collected harvest data to document the sex, age, chronology and locations of the harvest.

Location

Hunters from 20 villages located over 1800 miles of coastline were found to have harvested polar bears during the last 5 harvest years (Figure 1).The summary report refers to "northern" and "western" villages. For ease of reference northern villages are located from Wainwright east to Kaktovik Western villages comprise the remainder. St. Lawrence Island villages of Gambell and Savoonga are noted if treated separately.

Harvest Numbers

The documented minimum polar bear harvest for the 5 years is 676 animals or an average of 135 polar bears per year (Figure 2, Table 1). The average annual harvest was increased due to the take of 292 bears during the 1983/84 harvest year when ice conditions probably contributed to the greater availability of bears along nearshore areas. Individual village polar bear harvest totals ranged from 1 to 155 (Table 1).

Sex and Age

Sex and age information is reported from 432 (64%) of the 676 bears. Additional sex and age information for bears taken during 1983-85 seasons is being processed for inclusion in a final report. Annually, information has been collected from 52% (1982/83) to 76% (1983/84) of the harvest. Sex or age information was not collected from 190 bears. Of this total, 131 (69%) were from the northern area. Efforts to improve data collection in this area are necessary.

The male to female sex ratio of the harvest was 64:36. Slight annual variation in sex ratios occurrred. All females and cubs, less than 3 years old, constituted 52% of the harvest (Table 15). This figure is high due to inclusion of third year of life cubs some of which may have been functioning as independent bears. Known family groups comprised 16% of the harvest.

Average age of males was 6.4 + 4.2 years and average age of females was 8.1 years + 4.8 (Table 2). In 1980/81 and 1984/85 females were older than during other harvest seasons. Annual average age of males was less than for females for all areas except for St. Lawrence Island during the 1983/84 season when an unusually high number of old age males were taken (Tables 4&5). A high number of males (44) with skull length and width measurements totaling greater than 24 inches (62.0cm) where taken. One individual had a skull length and width measurement totaling 29 11/16 inches (75.4cm). The average age of bears of unknown sex was appreciably less than that of known sex bears, thus indicating a hunter tendency to not report or forget the sex of younger individuals (Table 6).

Chi-square comparison between the sex and age structure of bears captured by Lentfer 1967-76 and hunter killed bears reported here reveals that neither the overal sex composition nor the age structure are similar (Table 7). The chi-square test was most influenced by 3 year old males and males 10 years or greater.

Chronology

Polar bears were harvested during each month of the year (Table 8-12,Figure 2) although only 1 bear was killed during September. The harvest season begins in October along north slope areas as the advancing ice pack comes into proximity of shore. Ice edge advancement continues to bring bears into contact with land at more southerly latitudes until December when pack ice generally surround St. Lawrence Island. Generally, the preponderance of the statewide harvest occurs during November - January. During 1983/84 the harvest extended into the spring resulting in an inflation of the average monthly harvests between February and May.

Northern Area

Recent evidence indicates the population of bears inhabiting the Beaufort Sea from Barrow to Banks Island, Canada exhibits a high degree of interchange. One hundred eighty-eight polar bear(28% of total) or an average of 38 per year were removed from the Beaufort population. The male to female sex ratio of the harvest in the area is 60:40 (Table 13). Annual average age of the harvest ranged from 10.6 + 3.6 (1980/81) to 7.1 + 4.0 (1983/84) for females and 6.8 + 4.5 to 3.4 + 1.8 for males (Tables 4,5). Sex or age information for 50% of bears taken in this area is unavailable. Of those for which sex and age information is available cubs (22%), females 4 years of age and greater (34%) and males 4 years of age and greater (44%) comprise the harvest (Table 16). Some third year of life cubs are included as dependent cubs when they are actually independent animals. Harvests in this area peaks during October and November (49%), and March-May (29%). This area accounted for 57%(93) of the statewide harvest during October and November.

Western Area

The western area accounted for 488 bears (72%) of the statewide harvest. Undoubtedly this population is shared with the USSR. The male to female sex ratio is 63:37 with average age of harvested males ranging between 4.6+ 1.4 (1982/83) and 6.3+ 3.6 (1980/81) (Table 17). Female average ages ranged between 5.3+ 3.6 (1982/83) and 10.0+6.8 (1980/81) (Table 4 & 5). Bears taken by St. Lawrence hunters are not included in the above sex ratio or average age calculations and are shown separately (Table 18). The villages of Shishmaref and Wales accounted for 31% of the Alaska harvest. Chronology of the start of hunting is delayed until November and the more southerly villages may initiate hunting in December and continue to harvest bears during June or July. Data on bears taken is much more complete for this area than for the northern area.

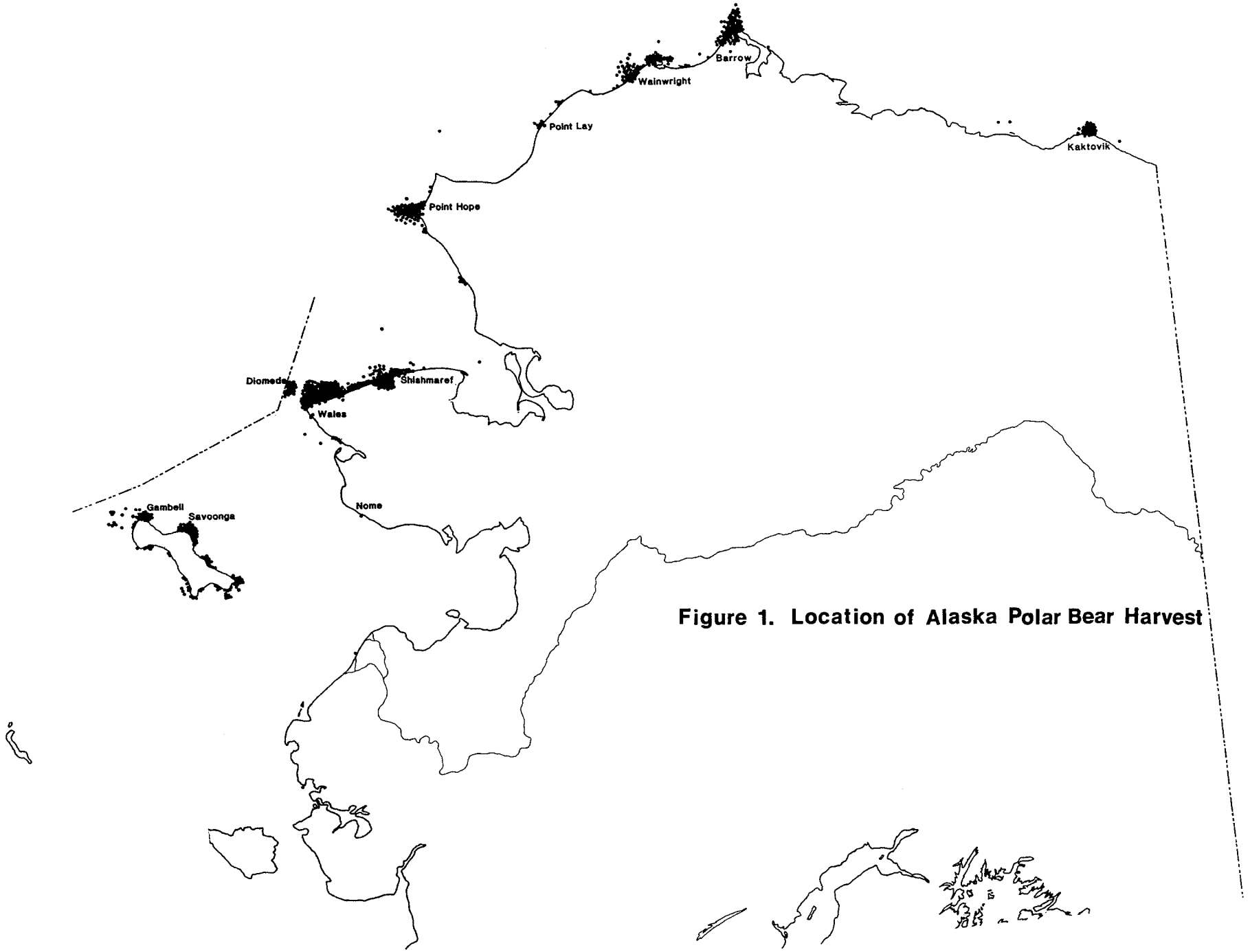

Figure 1. Location of Alaska Polar Bear Harvest

Figure 2

Chronology of Alaska Polar Bear Harvest

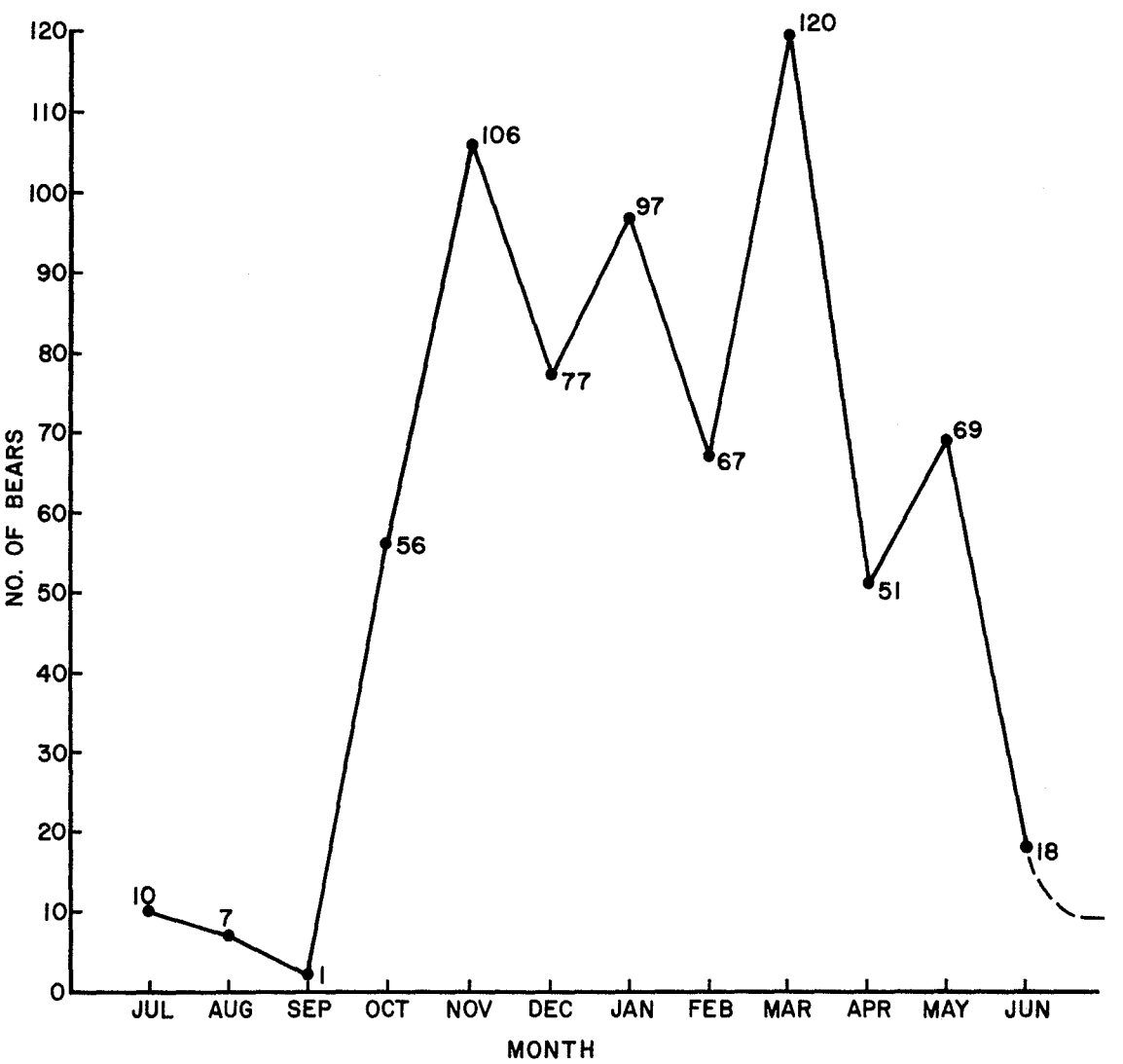

Table 1. ALASKA POLAR BEAR BY HARVEST SEASON

Village	1980/81	1981/82	1982/83	1983/84	1984/85	Total
Kaktovik	23	1	1	1		26
Nuiqset	1					1
Prudhoe Bay			2		2	4
Barrow	6	5	12	26	28	77
Wainwright	3	16	16	32	13	80
Pt. Lay	1	4	1	9		15
Lisburne			1			1
Pt. Hope	9	7	21	29	15	81
Kivalina		1		3	1	5
Kotzebue				2		2
Kiana					1	1
Shishmaref	29	22	13	80	11	155
Wales	6	11	7	20	13	57
Little Diomede	1	3		10	5	19
Brevig Mission				5	1	6
Nome				1		1
Savoonga	16	21	9	48	7	101
Gambell	6	1	6	25	4	42
Emmonak		1				1
Hooper Bay				1		1
Total	101	93	89	292	101	676

*Harvest season extends from July 1 to June 30.

Table 2. AGE STRUCTURE OF ALASKA HARVEST

	Males		Females	
	No.	%	No.	%
1	4	1.5	2	1.2
2	27	9.9	10	6.3
3	37	13.6	20	12.5
4	55	20.2	17	10.6
5	34	12.2	11	6.9
6	27	9.9	11	6.9
7	13	4.8	11	6.9
8	9	3.3	11	6.9
9	10	3.7	10	6.3
10	4	1.5	7	4.4
11	11	4.0	5	3.1
12	9	3.3	12	7.5
13	4	1.5	11	6.9
14	9	3.3	7	4.4
15	9	3.3	3	1.9
16	4	1.5	5	3.1
17	1	.4	2	1.2
18	1	.4	2	1.2
19	1	.4	1	.6
20	2	.7	1	.6
22	1	.4		
29			1	.6
Total	272	100	160	100

Male $\bar{X}$ = 6.4, S.D. = 4.2
Female $\bar{X}$ = 8.1, S.D. = 4.8

Table 3. POLAR BEAR AVERAGE AGE BY SEX, ALASKA

	1980/81	1981/82	1982/83	1983/84	1984/85
Male $\bar{X}$	6.0	6.1	4.7	7.0	4.6
S.D.	3.6	4.4	2.1	4.5	4.1
Female $\bar{X}$	10.4	8.2	6.2	7.4	9.2
S.D.	5.7	4.7	3.5	4.5	5.2
Unknown $\bar{X}$	3.0	2.0	5.0	3.3	
S.D.	.9	0.0	0.0	.5	

Table 4. FEMALE AVERAGE AGE BY GEOGRAPHIC AREA

	1980/81	1981/82	1982/83	1983/84	1984/85
North $\bar{X}$	10.6	8.0	8.5	7.1	9.2
S.D.	3.6	5.6	2.1	4.0	5.4
West $\bar{X}$	10.0	9.4	5.3	7.0	9.3
S.D.	6.8	4.2	3.6	4.1	6.4
St. Lawr. $\bar{X}$	9.4	6.4	7.3	8.4	9.0
S.D.	5.6	5.3	4.0	5.9	0.0

Table 5. MALE AVERAGE AGE BY GEOGRAPHIC AREA.

	1980/81	1981/82	1982/83	1983/84	1984/85
North $\bar{X}$	6.0	6.7	4.7	6.8	3.4
S.D.	0.0	3.8	2.5	4.5	1.8
West $\bar{X}$	6.3	6.1	4.6	5.7	4.4
S.D.	3.6	4.8	1.4	3.8	3.0
St. Lawr. $\bar{X}$	5.5	5.9	5.0	9.4	11.0
S.D.	3.8	4.5	3.3	4.7	11.3

Table 6. UNKNOWN SEX AVERAGE AGE BY GEOGRAPHIC AREA.

	1980/81	1981/82	1982/83	1983/84	1984/85
North $\bar{X}$	2.8				
S.D.	.8				
West $\bar{X}$	4.0	2.0	5.0	3.3	
S.D.	0.0	0.0	0.0	0.5	

Table 7. CHI-SQUARED COMPARISON BETWEEN BEARS KILLED 1980-85 AND BEARS CAPTURED BY LENTFER 1967-76

	FEMALES		MALES	
Age	Observed	Expected	Observed	Expected
0	2	13.0	4	10.2
1	10	30.1	27	30.1
2	20	30.1	37	22.7
3	17	23.6	55	11.6
4	11	23.6	34	24.5
5	11	23.6	27	25.5
6	11	15.7	13	18.1
7	11	16.7	9	11.6
8	10	24.5	10	5.1
9	7	14.8	4	4.1
10	5	11.1	11	5.1
11	12	8.3		
12	11	5.6	41	6.5
13	7	6.0		
14+	15	10.2		
Total	160	256.9	272	175.1

$\bar{X}$ (27 d.f.)=447.4

Expected values based on composite sex-age structure of polar bears marked or recovered after marking, 1967-76, after Lentfer et.al. (1980)

Table 8. CHRONOLOGY OF POLAR BEAR HARVEST 1980/81 N=97

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Kaktovik				12	11							
Nuiqset				1								
Barrow						1	1					
Wainwright				3								
Pt. Lay							1					
Pt. Hope						4			2	1	2	
Wales						5			1			
Shishmaref						19	9	1				
Little Diomede							1					
Gambell									3	3		
Savoonga							3	1	11	1		

Table 9. CHRONOLOGY OF POLAR BEAR HARVEST 1981/82 N=84

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Kaktovik										1		
Barrow	1	2			1						1	
Wainwright					8	2				1	2	2
Pt. Hope				1			3		1			1
Shishmaref						15	6					
Wales					6		3		2			
Little Diomede					2							
Gambell						1						
Savoonga						8	11	1	1			
Emmonak						1						

Table 10. CHRONOLOGY OF POLAR BEAR HARVEST 1982/83 N=82

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Kaktovik										1		
Barrow	1			1	3	1			2	1	3	
Wainwright					3	9					2	2
Pt. Hope							4	5	7			
Lisburne										1		
Prudhoe Bay											1	
Shishmaref							7	3	3			
Wales							7					
Little Diomede												
Gambell							1		3	2		
Savoonga							5	1	2	1		

Table 11. CHRONOLOGY OF POLAR BEAR HARVEST 1983/84 N=289

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Kaktovik		1										
Barrow		2		1	2		2	4	6	3	6	
Wainwright	1	1	1	16				3	1		9	
Pt. Lay					5	2		1	1			
Pt. Hope					1	1	1	12	6	7	1	
Kivalina											2	
Kotzebue									1			
Shishmaref					37	3	25	11	2		1	1
Wales	1				14	1			1		1	2
Little Diomede				3			3	1		2	1	
Brevig Mission										3	2	
Nome											1	
Gambell									10	3	12	
Savoonga								11	29	1	6	1

Table 12. CHRONOLOGY OF POLAR BEAR HARVEST 1984/85 N=101

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Barrow	1			18	3				3		3	
Wainwright	2	1			9	1						
Prudhoe Bay										1	1	
Pt. Hope							1	5	2	3	3	
Kivalina							1			1		
Kiana							1					
Shishmaref							1		8	2		
Wales									2	5		6
Little Diomede									4	1		
Brevig Mission												1
Gambell	2								1		1	
Savoonga									2	5		

Tables 8-12 include only polar bears of known harvest date

Table 13. VILLAGE SEX COMPOSITION OF POLAR BEAR HARVEST

Village	Male	Female	Unknown	Total
Kaktovik	7	6	13	26
Nuiqset	1			1
Prudhoe Bay	1	3		4
Barrow	36	25	16	77
Wainwright	39	21	20	80
Pt. Lay	6	4	5	15
Lisburne	1			1
Pt. Hope	39	23	19	81
Kivalina			5	5
Kotzebue	1		1	2
Kiana			1	1
Shishmaref	91	46	18	155
Wales	32	18	7	57
Little Diomede	13	5	1	19
Brevig Mission	3	3		6
Nome	1			1
Savoonga	65	36		101
Gambell	27	12	3	42
Emmonak	1			1
Hooper Bay			1	1
Total	364	202	110	676

Table 14. ANNUAL SEX COMPOSITION OF HARVEST BY VILLAGE

	1980/81			1981/82			1982/83			1983/84			1984/85		
	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U
Kaktovik	4	6	13	1			1			1					
Nuiqset	1														
Prudhoe Bay							2							2	
Barrow		2	4	4	1		5	3	4	17	6	3	10	13	5
Wainwright	1		2	11	2	3	5	7	4	14	7	11	8	5	
Pt. Lay		1		1		3	1			4	3	2			
Lisburne							1								
Pt. Hope	4	3	2	4	1	2	9	6	6	13	10	6	9	3	3
Kivalina						1						3			1
Kotzebue											1	1			
Kiana															1
Shishmaref	15	11	3	13	6	3	7	5	1	47	22	11	9	2	
Wales	5	1		5	6		6	1		10	10		6		7
Little Diomede	1			1	1	1				6	4		5		
Brevig Mission										2	3		1		
Nome										1					
Savoonga	11	5		12	9		6	3		31	17		5	2	
Gambell	2	4		1			3	2	1	20	5		1	1	2
Emmonak				1											
Hooper Bay												1			
Total		101			93			89			292			101	

Table 15. ANNUAL HARVEST BY AGE CLASS

	1980/81		1981/82		1982/83		1983/84		1984/85	
	No	%	No	%	No	%	No	%	No	%
Cubs										
Males	13		8		7		27		9	
Females	5	(31)	5	(24)	4	(30)	15	(20)	2	(31)
Unknown	4		1				3			
Subadult										
Males	8		11		9		53		7	
Females		(14)	1	(20)	4	(38)	19	(32)	3	(28)
Unknown	2				1		1			
Adult										
Males	16		16		7		68		3	
Females	24	(55)	17	(56)	5	(32)	40	(48)	11	(48)
Unknown										
TOTAL	72		59		37		226		35	

N = 429

Cubs 103 (24%)
Subadults 119 (28%)
Adults 207 (48%)

Cubs <3 yrs.
Females >3 yrs.
Males >3 yrs.

Table 16. POLAR BEAR SEX AND AGE STRUCTURE, NORTHERN ALASKA.

	1980/81			1981/82			1982/83			1983/84			1984/85		
Age	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U
1													2	1	
2			2				1			1			1		
3			2	1	1					2	1		2		
4			1	2						2	3		3	1	
5							1			7	1		1	2	
6	1									6				1	
7		1		1			1	1					1		
8	2		2								1				
9		1								1				2	
10								1						1	
11											1				
12		1								1	1				
13		1	1							1	1			2	
14				1						1					
15														1	
16															
17		1													
18															
19															
20														1	
21										1					

N = 81

Cubs 17 (20.9%)
Subadults 24 (29.6%)
Adults 40 (49.3%)

Known Age/Sex Ratio 60:40

Cubs <3 (22%)
Females >3 yrs. (34%)
Males >3 yrs. (44%)

Table 17. POLAR BEAR SEX AND AGE STRUCTURE, WESTERN ALASKA.

	1980/81			1981/82			1982/83			1983/84			1984/85		
Age	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U
1				1						1	1				
2	1	1		4	1	1				8	2		1	1	
3	7	1					4	4		10	4	3	2	1	
4	4		1	4			3	1		25	10	1	3		
5	1						3	1	1	9	4				
6	1	1		2	2		2			8	6				
7				3	2		2			3	2				
8	3	1		2	1			1			4				
9	3	2			1					2	1				
10	1	1								2	2				
11		2								4	1		1		
12	2	1			2					1	1			1	
13									1		4				
14					2					1	2			1	
15	1			1						3	1				
16		2			1					1					
17															
18											1				
19															
20				1						1					
29		1													
Total	24	13	1	18	12	1	14	7	2	79	46	4	7	4	

N = 232

Know Age/Sex ratio 63:37

Cubs 59 (25%)
Subadults 71 (31%)
Adults 102 (44%)

Cubs <3 yrs. (26%)
Females >3 yrs. (29%)
Males >3 yrs. (45%)

Table 18. POLAR BEAR SEX AND AGE STRUCTURE, ST. LAWRENCE ALASKA.

	1980/81			1981/82			1982/83			1983/84			1984/85		
	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U
Age															
1															
2	1			2	2		2			3	3				
3	4	3			1					2	4		1		
4				3	1		1			5	1				
5	3			2			1	2		5					
6	1			2	1		1			2					
7	1	1			1					2	1				
8	1									1					
9				1	1					1	1			1	
10		1								1	1				
11							1			5					
12		1						1		5	3				
13										1	2				
14										6	1				
15		1								4					
16	1	2								2					
17										1	1				
18				1	1										
19											1		1		

N = 117

Know age/sex ratio 63:37

Cubs 28 (24%)
Subadults 24 (21%)
Adults 65 (55%)

Cubs <3 yrs. (24%)
Females >3 yrs. (27%)
Males >3 yrs. (53%)

APPENDIX 10: RESEARCH AND MANAGEMENT OF POLAR BEAR POPULATIONS IN THE USSR 1981-85

Update for the Ninth Conference of the Polar Bear Working Group
International Union for the Conservation of Nature and Natural Resources, 1985

by

Professor S.M. Uspenskii
All-Union Scientific Research Institute
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(translation by Secretary of State, Canada)

In accordance with the Agreement on the International Conservation of the Polar Bear concluded between the USSR, the USA, Canada, Denmark, and Norway in 1975 - -(blank half line).
During the period under review, the Soviet Union complied strictly with the main provision of the Agreement, a hunting ban. A maximum of only 20 live cubs was caught annually for restocking zoological gardens; the adult females were in all cases immobilized, kept alive, and tagged. Individual polar bears were also shot by special authorization in cases where they represented a real threat to human life.

As in previous years, during the period under review the leading institution studying the polar bear in the USSR, and coordinating this research, was the All-Union Scientific Research Institute of Nature Conservation and Wildlife Preserves of the Ministry of Agriculture USSR.

Investigations by the All-Union Scientific Research Institute of Nature Conservation and Wildlife Preserves, Ministry of Agriculture USSR

1. Analysis of polar bear population structure using geochemical techniques (Director of studies: S.M. Uspenskii, Doctor of Biological Sciences; participants: S.M. Uspenskii; A.N. Golovkin and N.G. Chelintsev, Candidates of Biological Sciences).

   Elemental analysis of polar bear bone tissue enabled us to establish three USSR geographic and ecological groupings:
   a. western (the region of the Barents and Kara Seas);
   b. central (the Laptev and East Siberian Seas);
   c. eastern (the Chukchi and Bering Seas).
   The central grouping differs significantly from the other two in its potassium, titanium, nickel and aluminum content. The eastern and western groupings differ in their potassium content. These differences do not depend on either the age or sex of the animals or the times at which they were taken. They do indicate that polar bears live for a long time in distinct geochemical settings, i.e., they occur in specific geographic regions. (Detailed results of this study appear in " S.M. Uspenskii, A.N. Golovkin, V.I. Gurevich and N.G. Chelintsev. 1985. Geographic groupings of polar bears in the Soviet Arctic based on geochemical data. Zoologicheskii zhurnal, Vol LXIV, No. 4, pp. 600-605.") Scientists got similar results when they analysed polar bear bone tissue samples from the Northwest Territories, Canada.

2. S.E. Belikov, Candidate of Biological Sciences, did field research on the polar bear in the Franz Josef Land (1981 and 1985) and Severnaya Zemlya (1982 and 1983) archipelagos.

   Franz Josef Land

   In aerial counts of polar bears and their dens in 1981, we used an IL-14 fixed-wing aircraft with a cruising speed of about 250 km/h (at which speed we could not record all dens). We examined the coasts of most of the islands, as well as some land areas away from the shore and potentially suitable for denning. In addition, we inspected the sounds between the islands, and areas of the Barents and Kara Seas and the Arctic basin adjoining the archipelago. During flights from

12 - 15 April 1981, we noted 9 dens (5 of them assumed), 5 solitary bears, 7 family groups (3 females had 2 cubs each, and 4 had one each) and 13 bear trails, including those of 2 family groups (each containing one cub). When we flew towards Victoria Island, we did not find either polar bears or their dens. When we investigated on the ground at Graham Bell Island (16-27 April 1981) we found three temporary dens.

We caught cubs on Franz Josef Land in 1985 and attached ear tags (tag numbers 813, 876, 877 and 878) to the lactating females whose cubs we removed. On the basis of information gained from questioning inhabitants, dens were noted on Victoria Island in the spring of 1985, while several dozen bears, including family groups, were observed near the island.

Severnaya Zemlya

We did aerial counts on 1, 2, 10 and 11 April 1982 using an AN-2 fixed wing aircraft (flight altitude 100-200 m, and speed about 180 km/h). Despite our low flight speed, we found only seven dens. The small number of dens encountered here may be due, apart from adverse weather conditions (in two out of four cases we did our counts a day or two after a blizzard that had lasted several days, and at an atmospheric temperature of about -30°C; when the cold is this severe, the females usually do not open their dens), to the generally small number of polar bears living in this region. In winter, polar bears are more numerous within the Severnaya Zemlya archipelago along the edge of the polynya extending on the eastern side of the archipelago and southwest of it, and in areas with a large number of stretches of open water and channels through the ice. In summer and autumn the bears occur more often here in the sounds between the islands and along the edge of the ice in bays and inlets.

A tentative estimate of the total numbers of female polar bears denning annually is 100 - 150 on Franz Josef Land and 30 - 50 on Severnaya Zemlya.

Research by other organizations

On Wrangel and Herald Islands, the main USSR reproduction centre for polar bears in the Wrangel Island State Wildlife Preserve, the Preserve (L.F. Stashkevich, Director) has counted denning pregnant bears (habitable dens) annually in March and April, recorded all encounters with polar bears, and collected other information on the ecology of the species.

As in previous years, research officers at polar stations of the State Committee of the Council of Ministers USSR for Hydrometeorology and Environmental Monitoring recorded occurrences of polar bears, their movements and other events in the animal's lives. Members of the Arctic and Antarctic Scientific Research Institute of the USSR State Committee for Hydrometeorology and Environmental Monitoring, when performing aerial ice reconnaissance in the seas of the Arctic Ocean, continued to record encounters with movements of polar bears.

Results of counts of habitable dens on Wrangel and Herald islands.

Years	Number of habitable dens counted in key areas	Total number of habitable dens (extrapolation)	Remarks
1982	145	230	Using aerial counts, covering 6000 km
1983	140	300	Counts on the ground
1984	184	350	Counts on the ground

Some general conclusions

USSR polar bear research has continued mainly in traditional areas: the analysis of the present-day distribution and numbers of the species, and its dynamics and population structure. Our data indicate continuing growth of the animals' population, noticeable especially in the northeastern USSR (the Chukchi and East Siberian Seas). At the same time, it is becoming increasingly obvious that polar bears are losing their fear of humans, as can be seen in their more frequent visits to populated localities (although this may also have resulted from the bears' difficulties in catching seals, particularly due to the severe ice conditions in these seas in recent years).

As the situation now stands, it has become necessary to change USSR practice in managing polar bear populations: the authorities have begun restricted selective shooting of individual animals gravitating towards built-up areas and especially those behaving aggressively to humans. This selective slaughter of polar bears is to be authorized primarily in the Chukchi Autonomous Region, and will not exceed more than a few dozen animals a year.

Planned future research

We foresee a continuation of research work already begun by the All-Union Scientific Research Institute of Nature Conservation and Wildlife Preserves, Ministry of Agriculture USSR, at the Wrangel Island State Wildlife Preserve, and the collection and analysis of information from polar stations and the Arctic and Antarctic Scientific Research Institute of the USSR State Committee for Hydrometeorology and Environmental Monitoring. We are also planning to improve the techniques of counting polar bears from the air over large areas in order to organize periodic absolute counts of the population of these animals in the Soviet Arctic.

APPENDIX 11: PRELIMINARY REPORT ON POPULATION DIFFERENTIATION OF THE POLAR BEAR BASED ON NON-METRICAL CRANIAL TRAITS

by

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The occurrence of 18 non-metrical traits (Fig. 1) was examined in polar bears from collections in Europe and North America. Not used in the study were 9 traits that were age- or sex-dependent, were inconsistently diagnosed, or which did not differ between at least two of the areas examined. C.A.B. Smith's Mean Measure of Divergence was used as described by T. Sjøvold (1977. Ossa 4, sup. 1:1-133) to obtain a measurement of population separation. The material, 2588 specimens, was divided into 12 areas (Fig. 2). In the Bering Strait area, material collected before and after 1950 differed significantly. Table 1 shows how the traits occurred in the 12 areas, and in the Bering Strait area before and after 1950. The results of comparisons, which are based on the total number of sides, are shown in Table 2.

On the North American part of the range, local populations are found in Northeast Greenland, South Greenland, and Hudson Bay. No conclusion based on the results shown here can be reached concerning the areas of Baffin Bay and Western Canada. Here one or more discrete populations may exist. Labrador is believed to connect to both Hudson Bay and Baffin Bay. The above six areas are all different from the remaining areas, with the exception of Northeast Greenland, Labrador, and Hudson Bay, which do not differ from Eastern Siberia. It is argued that this lack of difference can be disregarded based on distance between the areas, and the presence of intervening areas, which differ from both Eastern Siberia and the three North American areas.

It has been suggested that the majority of polar bears shot in Northeast and South Greenland come from a Svalbard-Western Soviet population (T. Larsen. Norsk Polarinstitutt Skrifter. In press.). This is rejected based on the findings of this study.

Material from Bering Strait differ from the adjacent area Northern Alaska, and from the other North American areas. Craniometric studies by T.H. Manning (1971. Can. Wildl. Serv. Rep. Ser. 13:1-21) and D.E. Wilson (1976. IUCN Publ. 40:447-453) show similar results. Material collected in the Bering Strait area before and after 1950 differed. It is suggested that heavy hunting, which occurred in the U.S. part of the area from the mid 1950s to 1972, and which to some extent was selective for trophy males (J.W. Lentfer and J.W. Brooks. 1970. IUCN Publ. 16:143-149), caused immigration to the area, especially from nearby Northern Alaska.

On the Eurasian part of the polar bear range, no difference is observed between Franz Josef Land and Svalbard, which agrees with Larsen (op. cit.), who finds that the bears in the two areas belong to the same population. Craniometric measurements show a gradual increase in size from the western to the eastern part of the U.S.S.R (S.M. Uspenskii. 1979. Der Eisbär. Wittenberg). Such clinal variation can explain the differences and similarities between the areas Eastern and Western Siberia, and Svalbard Franz Josef Land. Animals from each end of the cline differ from each other, but not when compared to the group in the middle.

Acknowledgements

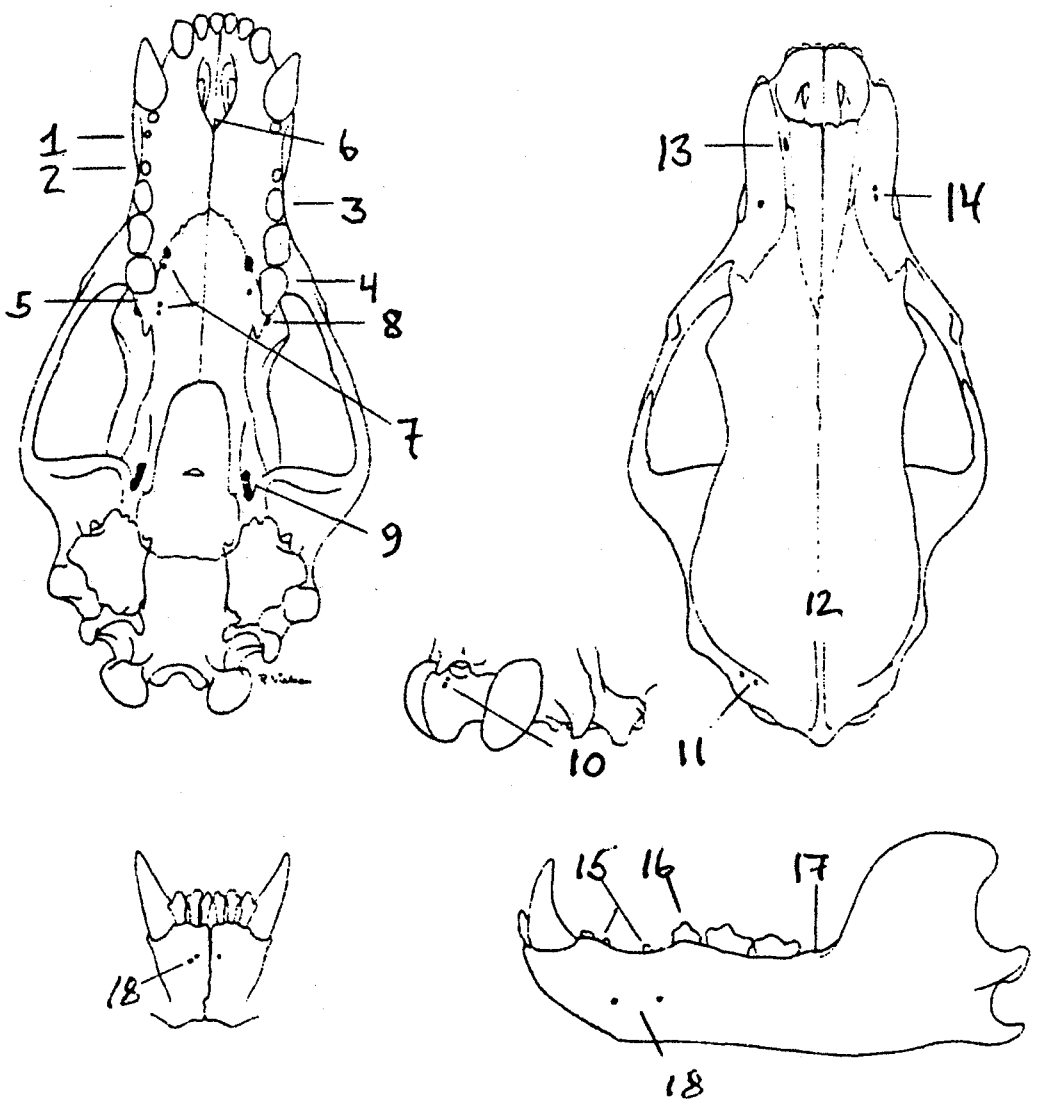
This study was supported by the Danish Natural Science Research Council, the USSR Academy of Sciences, and the Greenland Scientific Committee.

Figure 1. Non-metrical traits in the polar bear. Only traits marked + were used in the study.
1: + p2/ present 2: + p3/ missing 3: + p4/ missing 4: + m2/ missing 5: Hypoconolid on m2/ missing 6: Intermaxillary foramen missing 7: Accessory minor or major palatine foramen present 8: + Supraethmoid foramen bridged 9: Oval-alar foramen border sharp 10: + Condylar canal double 11: Parietal foramen present 12: Crista sagitallis missing 13: + Premaxillary foramen present 14: Maxillary foramen double 15: p/2 and/or p/3 present 16: p/4 missing 17: + m/3 missing 18: + Accessory anterior and/or accessory mental foramina present

Figure 2. Areas where material used in the study was collected. 1: Northeast Greenland 2: South Greenland 3: Baffin Bay 4: Labrador 5: Hudson Bay 6: Western Canada 7: Northern Alaska 8: Bering Strait 9: Eastern Siberia 10: Western Siberia 11: Franz Josef Land 12: Svalbard

Table 1. Geographical occurrence of the traits used in the study. For each area, the lower four rows give the number of individuals where presence or absence of the traits could be determined in both sides of the skull. The upper two rows show the number of sides with the trait and the total number of sides; added to them are the results from specimens (not shown), where presence or absence of the traits could be determined in only one side.

Table 2. Above the main diagonal: Mean Measure of Divergence based on 9 cranial traits calculated from the total number of sides. For each comparison, the standard deviation is given below. Below the main diagonal: Mean Measure of Divergence is considered significant at the 2.5% level when twice as large as the standard deviation. Significant (S) and non-significant (NS) results are indicated.



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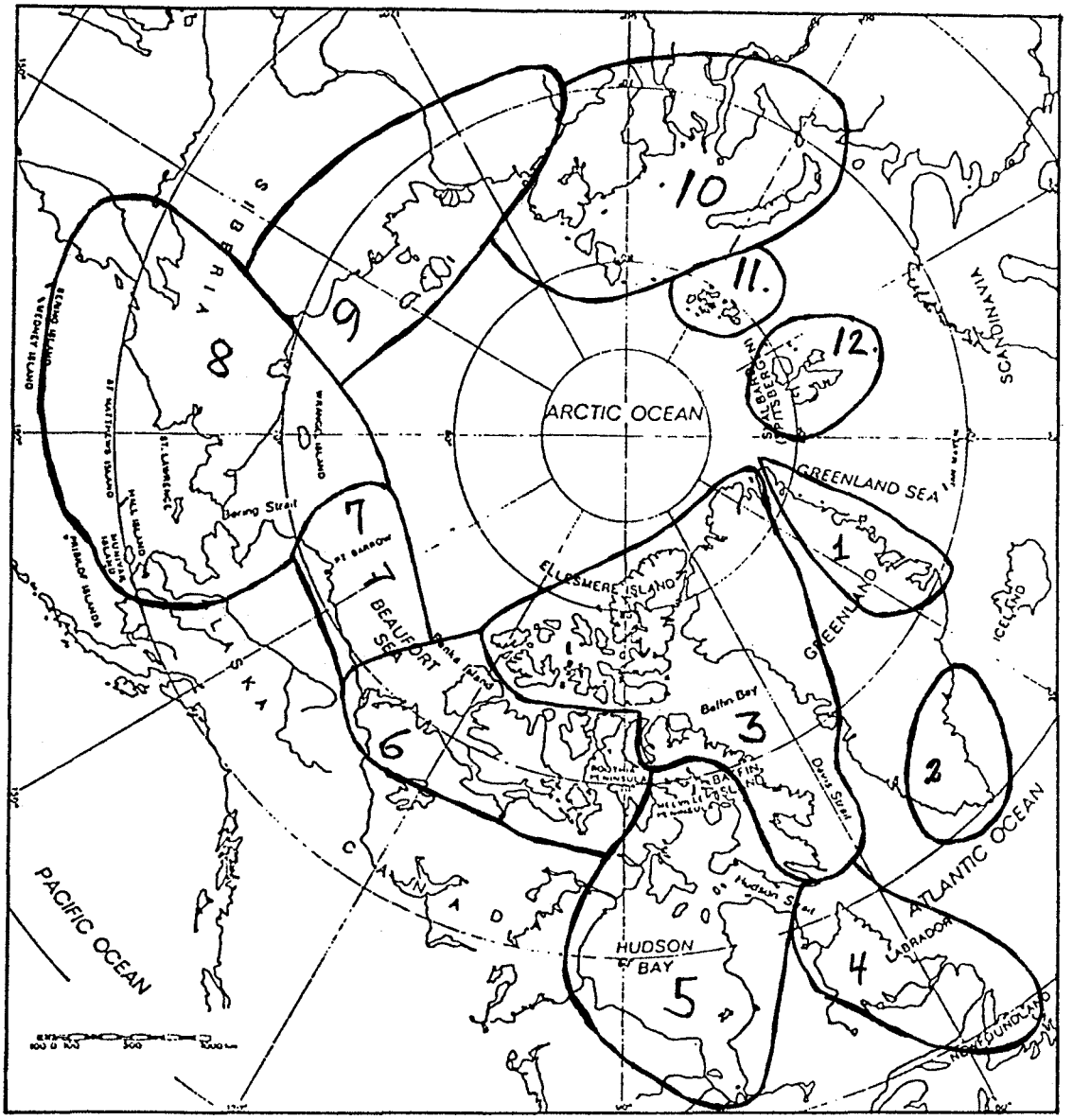

Figure 2. Areas where material used in the study was collected. 1: Northeast Greenland 2: South Greenland 3: Baffin Bay 4: Labrador 5: Hudson Bay 6: Western Canada 7: Northern Alaska 8: Bering Strait 9: Eastern Siberia 10: Western Siberia 11: Franz Josef Land 12: Svalbard

Table 1. Geographical occurrence of the traits used in the study

Trait number:	1	2	3	4	8	10	12	17	18
NORTHEAST GREENLAND									
Sides with trait	27	11	0	0	12	13	201	13	243
No. of sides	302	302	304	301	288	261	303	263	282
With trait in both sides	5	3	0	0	2	1	74	3	104
With trait in left side	9	1	0	0	2	6	31	4	20
With trait in right side	8	4	0	0	6	4	21	3	11
Without trait	128	142	152	150	128	117	25	129	4
SOUTH GREENLAND									
Sides with trait	15	1	0	0	3	11	114	1	113
No. of sides	146	144	146	144	136	132	140	142	133
With trait in both sides	5	0	0	0	0	4	49	0	47
With trait in left side	5	1	0	0	1	1	5	0	4
With trait in right side	0	0	0	0	2	2	9	1	12
Without trait	63	71	71	72	64	59	6	70	2
BAFFIN BAY									
Sides with trait	103	6	11	1	21	52	679	14	783
No. of sides	943	946	945	947	912	918	923	976	906
With trait in both sides	29	0	2	0	1	1	282	3	326
With trait in left side	18	4	3	0	11	20	45	6	54
With trait in right side	26	2	4	1	8	30	68	2	45
Without trait	397	466	463	472	431	404	65	473	10
LABRADOR									
Sides with trait	2	0	2	0	1	3	33	0	50
No. of sides	60	67	67	68	63	61	64	64	58
With trait in both sides	0	0	1	0	0	0	11	0	20
With trait in left side	0	0	0	0	0	1	5	0	5
With trait in right side	2	0	0	0	1	2	6	0	3
Without trait	28	33	32	34	30	27	10	32	0
HUDSON BAY									
Sides with trait	82	6	1	0	8	36	326	12	473
No. of sides	589	592	594	591	526	511	553	595	556
With trait in both sides	23	1	0	0	2	1	115	3	199
With trait in left side	15	2	0	0	3	11	46	2	37
With trait in right side	20	2	1	0	1	22	46	4	25
Without trait	243	283	295	294	247	205	67	283	10
WESTERN CANADA									
Sides with trait	32	2	0	0	1	15	191	2	251
No. of sides	265	269	269	271	242	213	249	337	313
With trait in both sides	10	0	0	0	0	1	81	0	106
With trait in left side	10	1	0	0	0	5	11	0	15
With trait in right side	2	1	0	0	1	8	15	2	17
Without trait	108	131	133	135	116	88	16	165	15
NORTHERN ALASKA									
Sides with trait	86	5	4	0	13	20	244	3	270
No. of sides	351	354	354	354	342	312	338	340	326
With trait in both sides	30	0	1	0	3	3	103	0	113
With trait in left side	20	5	0	0	2	6	24	1	21
With trait in right side	6	0	2	0	5	7	13	2	20
Without trait	119	172	174	177	159	138	28	166	7

	1	2	3	4	8	10	13	17	18
BERING STRAIT, before 1950									
Sides with trait	67	1	3	2	3	7	64	1	35
No. of sides	229	244	256	262	103	233	135	77	45
With trait in both sides	25	0	0	0	0	0	25	0	12
With trait in left side	10	1	1	1	3	2	4	1	2
With trait in right side	5	0	2	1	0	5	10	0	3
Without trait	73	119	124	129	47	106	28	37	5
BERING STRAIT, after 1950									
Sides with trait	47	2	4	3	7	9	127	11	146
No. of sides	184	186	186	186	180	170	184	185	174
With traits in both sides	18	1	2	1	0	1	48	5	64
With trait in left side	7	0	0	0	4	3	19	1	6
With trait in right side	4	0	0	1	3	3	12	0	8
Without trait	63	92	91	91	81	76	13	86	6
BERING STRAIT									
Sides with trait	115	3	7	5	10	15	195	12	187
No. of sides	423	440	452	458	285	409	327	270	232
With trait in both sides	43	1	2	1	0	1	75	5	81
With trait in left side	17	1	1	1	7	5	23	1	8
With trait in right side	10	0	2	2	3	8	22	1	11
Without trait	140	216	220	225	130	187	43	127	12
EASTERN SIBERIA									
Sides with trait	9	3	0	0	2	5	45	0	66
No. of sides	98	98	98	98	90	74	91	87	87
With trait in both sides	1	1	0	0	0	1	18	0	24
With trait in left side	5	0	0	0	1	2	6	0	6
With trait in right side	2	1	0	0	1	1	3	0	7
Without trait	41	47	49	49	43	33	18	40	3
WESTERN SIBERIA									
Sides with trait	61	6	2	2	4	5	147	4	168
No. of sides	243	244	244	244	219	174	234	227	220
With trait in both sides	20	2	1	1	1	1	61	0	65
With trait in left side	9	0	0	0	1	2	11	0	16
With trait in right side	12	2	0	0	1	1	12	4	21
Without trait	80	118	121	121	103	78	32	108	7
FRANS JOSEF LAND									
Sides with trait	100	5	2	4	12	23	304	15	336
No. of sides	454	457	458	458	417	329	444	441	431
With trait in both sides	34	1	1	2	1	3	117	5	136
With trait in left side	19	3	0	0	6	9	37	3	27
With trait in right side	13	0	0	0	3	7	29	2	32
Without trait	160	224	228	227	190	142	36	209	18
SVALBARD									
Sides with trait	147	11	4	5	7	29	448	8	447
No. of sides	640	640	640	640	521	346	639	585	541
With trait in both sides	47	2	0	2	0	1	177	3	182
With trait in left side	25	5	4	1	0	12	49	1	40
With trait in right side	28	2	0	0	6	14	40	1	55
Without trait	220	311	316	317	237	136	51	283	9

Table 2.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
NORTHEAST GREENLAND	1:	-	1.49 0.61	1.15 0.26	2.18 1.04	0.90 0.30	2.07 0.41	2.66 0.38	7.40 0.78	2.48 0.61	3.44 0.40	1.35 0.84	2.85 0.52	2.00 0.36	2.61 0.31
SOUTH GREENLAND	2:	S	-	-0.24 0.47	3.87 1.24	1.99 0.52	-0.59 0.62	1.26 0.59	9.73 0.97	3.09 0.81	5.13 0.61	3.84 1.05	3.76 0.73	1.78 0.58	1.28 0.25
BAFFIN BAY	3:	S	NS	-	1.76 0.91	1.13 0.17	0.44 0.27	1.28 0.24	7.52 0.67	2.25 0.47	3.49 0.27	2.70 0.70	2.80 0.38	1.74 0.23	1.47 0.17
LABRADOR	4:	S	S	NS	-	1.09 0.95	3.69 1.05	5.14 1.02	6.51 1.35	5.53 1.25	5.04 1.04	-0.67 1.47	4.63 1.16	4.76 1.01	4.71 0.95
HUDSON BAY	5:	S	S	S	NS	-	1.48 0.31	1.66 0.28	4.10 0.71	2.24 0.51	2.01 0.31	0.15 0.75	1.54 0.42	1.18 0.27	1.16 0.21
WESTERN CANADA	6:	S	NS	NS	S	S	-	1.51 0.39	7.32 0.79	3.55 0.61	4.52 0.41	2.77 0.85	2.56 0.53	1.54 0.37	1.00 0.31
NORTHERN ALASKA	7:	S	S	S	S	S	S	-	3.88 0.76	0.42 0.58	1.17 0.38	3.22 0.82	0.47 0.50	0.20 0.34	-0.01 0.29
BERING STRAIT BEFORE 1950	8:	S	S	S	S	S	S	S	-	3.20 0.96	-	2.74 1.18	0.45 0.87	2.38 0.75	3.96 0.71
BERING STRAIT AFTER 1950	9:	S	S	S	S	S	S	NS	S	-	-	4.44 1.04	0.24 0.72	-0.25 0.58	0.53 0.52
BERING STRAIT	10:	S	S	S	S	S	S	S	-	-	-	3.25 0.84	-0.22 0.51	0.28 0.37	1.31 0.31
EASTERN SIBERIA	11:	NS	S	S	NS	NS	S	S	S	S	S	-	1.64 0.96	2.37 0.80	2.57 0.75
WESTERN SIBERIA	12:	S	S	S	S	S	S	NS	NS	NS	NS	NS	-	-0.09 0.49	0.39 0.43
FRANS JOSEF LAND	13:	S	S	S	S	S	S	NS	S	NS	NS	S	NS	-	-0.01 0.28
SVALBARD	14:	S	S	S	S	S	S	NS	S	NS	S	S	NS	NS	-

APPENDIX 12: STATUS OF POLAR BEAR POPULATION MODELLING

by Mitchell Taylor, Michigan State University, East Lansing, Michigan, U.S.A.

The ANURSUS analysis and projection routines were frozen and are now known as ANURSUS 1.0. The consensus of biologists attending the December 1984 population workshop in Yellowknife and the January 1985 Polar Bear Technical Committee meetings in Edmonton was that ANURSUS was ready for preliminary testing as a research and management tool. Current efforts on ANURSUS are being directed towards review of the algorithms via the publication process, review of the coding, expanding the approach to include the Churchill population (where 40% of the adult females breed in alternate years), and development of a micro-computer version.

The initial results from the ANURSUS were troublesome. Inconsistencies between the data collected and the algorithms suggest non-representative sampling with apparent bias against family groups in some management areas. Other results appear to be non-representative due to disproportionate sampling during severe environmental conditions. Although ANURSUS has not been used extensively to analyse data from any zones, preliminary work indicates the results should be interpreted with caution.

The population projection component of ANURSUS has been useful in estimating maximum and minimum rates of sustainable harvest. For example, if adult females are killed, it appears that no more than 1 to 1.5% of the total (males, females, and cubs) population can be harvested. The model was also useful in exploring management options for declining or depleted populations. The modeling exercise underscored the importance of an accurate population estimate and accurate harvest records.

Three other models have been developed. Manitoba's POLARPOP, developed by Brian Knudsen and Brad Johnson, provides a useful approximation to the projection part of ANURSUS. POLARPOP provides graphical summaries and can be run on portable APPLE micro-computers. Nils Øritsland's APL model (see Appendix 6) appears to be useful in "gaming" to reach management decisions although it also summarizes rather than mimics polar bear life history. Karl Ugland and Thor Larsen have developed a model particularly designed to accept the data collected by Thor on the Svalbard population (Appendix 6). Although I am not familiar with the structure of their model, I assume it mimics polar bear life history, as does the ANURSUS model.

The four projection models have not been rigorously compared, but it appears that all of them indicate that few adult females can be harvested on a sustainable basis. A useful next step for the modeling effort might be to incorporate the best features of all the projection models into a single model that would be accurate (i.e. mimic the life history), be able to run on a personal computer, have graphics capability, and be sufficiently general that it could be used on any of the polar bear populations.

The population parameter estimation procedure of ANURSUS suggests some sort of sampling bias may be occurring. This could result from geographic segregation of family group categories and non-random capture, or from different probabilities of capture of family group categories. Telemetry is needed to discriminate between these possibilities and to better understand the capture data.

The Fisher and Ford (1947) method was used to estimate annual survival and population size for the various management zones. Best results were achieved in Zone H (the eastern Beaufort Sea and Amundsen Gulf) where long-term tagging has been systematically spread over the entire study area. It appears that measurement of high annual survival rates is enhanced by spreading the tagging out over time. If the determination of annual survival rates is deemed important, tagging in alternate years could be considered. Mark-recapture estimates in many management zones were suspect because of geographical bias in the capture and recapture samples. The possibility of capture bias can be minimized by capture programmes that are as geographically random as possible. Evaluation of capture bias is a research priority.

APPENDIX 13: RESOLUTIONS

A. Protection of Females with Young and Bears in Dens

The IUCN Polar Bear Specialist Group,

recognizing that Article II of the Agreement on the Conservation of Polar Bears states that Contracting Parties "... shall take appropriate action to protect ... denning ... sites ... and ... manage polar bear populations in accordance with sound conservation practices based on the best available scientific data."; and,

recognizing that recent research on mathematical modelling of polar bear population dynamics clearly shows that the survival of adult females is more important to the maintenance of viable populations than is the survival of any other age or sex class; and,

recognizing that in the State of Alaska and in Canada, those deriving the benefits from hunting polar bears shall desire to perpetuate the populations upon which they depend; and,

noting that in the State of Alaska in the United States and in the Province of Quebec in Canada female polar bears with cubs and bears in dens have no protection in legislation;

therefore urges the United States and Canada to take immediate steps to negotiate informal agreements with the user groups to achieve full protection in practice for females with young and bears in dens and to follow such agreements with full protection in legislation as soon as possible.

B. Management of Internationally-shared Populations

The IUCN Polar Bear Specialist Group,

recognizing that Article II of the Agreement on the Conservation of Polar Bears states that Contracting Parties shall "...take appropriate action to protect the ecosystems of which polar bears are a part..."; and,

recognizing that Article VII of the Agreement on the Conservation of Polar Bears states that Contracting Parties shall "...consult with other parties on the management of migrating polar bear populations and exchange information on research and management programmes, research results and data on bears taken."; and,

recognizing that industrialization of northern nearshore and all offshore areas and its concomitant growth in human numbers represent potential threats to polar bear habitat, and thus to polar bears; and,

recognizing that many northern indigenous people depend on polar bears for at least part of the maintenance of their culture and economy;

therefore urges the countries affected to immediately take more active steps to coordinate research and management of migrating polar bear populations in the Beaufort Sea, Chukchi Sea, Baffin Bay-Davis Strait, Greenland Sea, and the Barents Sea.

C. Collection and Analysis of Harvest Data

The IUCN Polar Bear Specialist Group,

recognizing that it is very expensive to continue to conduct multiple-year mark and recapture studies of polar bears for the purpose of monitoring the status of harvested populations on a continuing basis; and,

recognizing that it is relatively straightforward and inexpensive to collect information and specimens from which the age and sex composition of the polar bears harvested from each population can be monitored; and,

recognizing that, to date, analytical techniques for interpreting harvest data on polar bears have not been adequately developed;

therefore recommends that a high priority be placed on the collection and analysis of harvest data with a view to the development of techniques for monitoring the status of populations and the effects of different management practices.

D. Trend Indicators

The IUCN Polar Bear Specialist Group,

recognizing that it is very expensive to continue to conduct multiple-year mark and recapture studies of polar bears for the purpose of monitoring the status of harvested populations; and,

recognizing that alternative, less expensive, and repeatable methods of population monitoring by indices such as line or strip transect counts, infra-red scanning, or track counts etc. may be possible;

therefore recommends that such techniques be investigated, developed if practical, and tested under controlled circumstances in the field; and,

further recommends that the internationally-shared population of polar bears in the Beaufort Sea be considered for this research because there is already a large body of data available for this area, because internationally coordinated research is continuing there at present, and because there is a unique body of movement data gained from telemetry studies available for that area now.

E. Improvement of Design of Mark-recapture Studies

The IUCN Polar Bear Specialist Group,

recognizing that the modelling of polar bear populations has indicated that it is essential to have an estimate of population size (N) for calculation of sustainable harvest; and,

recognizing that although it is both extremely expensive and labor-intensive to conduct multiple-year mark and recapture studies of polar bears to estimate population size, this remains the only successful method developed to date; and,

recognizing that significant additional benefits of conducting mark and recapture studies are many extremely valuable data obtained on age composition, reproductive rates, sex ratio, survival, and movements;

recommends that research be directed at improving the cost-effectiveness and statistical reliability of the mark and recapture studies by developing and testing new research designs, and by using movement data gathered from telemetry to understand and develop corrections for capture biases in the mark and recapture data; and

further recommends that the internationally-shared population of polar bears in the Beaufort Sea be considered for this research because there is already a large body of data available for this area, internationally coordinated research is continuing there at present, and there is a unique body of movement data gained from telemetry studies available for that area now.

F. Study of the Unhunted Population of Polar Bears at Svalbard

The IUCN Polar Bear Specialist Group,

recognizing that many northern indigenous people depend on polar bears for at least part of the maintenance of their culture and economy; and,

recognizing almost all our information on the population dynamics of polar bears has been collected from populations which have been perturbed by hunting; and,

recognizing that to date there are no comparative data on the population dynamics, reproductive parameters, or movement patterns of an unharvested population of polar bears so that possible biases in the results of studies on hunted populations can be evaluated; and,

recognizing that data from studies of other species of mammals indicate that social interactions in stable populations may result in lower numbers of polar bears than the availability of habitat alone might dictate; and,

recognizing that only two of the jurisdictions responsible for polar bears, Norway and the USSR, may have populations which have been unperturbed for several generations and therefore could be studied for the purposes of comparing harvested and unharvested populations;
and,

recognizing that the polar bear population in the Svalbard area has the advantage of being more politically and logistically accessible to the international scientific community and, that baseline data are available both from the periods of harvesting and recovery in Svalbard;

recommends that Norway coordinate an international research project on the population dynamics, reproductive parameters, and movements of the unhunted population of polar bears in Svalbard for the purpose of developing a baseline for comparison with existing data from hunted populations.

G. Participation of Norway and Denmark in Polar Bear Research

The IUCN Polar Bear Specialist Group,

recognizing that the governments of Canada, Denmark, Norway, the USA, and the USSR concluded that the States of the Arctic Region had special responsibilities for the protection of the flora and fauna of the region and signed the Agreement on the Conservation of Polar Bears because they decided that protection of the species would best be effected through international cooperation; and,

recognizing that Article II of the Agreement on the Conservation of Polar Bears states that Contracting Parties shall "...take appropriate action to protect the ecosystems of which polar bears are a part ..." and that the increasing industrial interest in offshore exploration and production of hydrocarbons represents a potential threat to polar bear habitat; and,

recognizing that Article VII of the International Polar Bear Agreement states "The Contracting Parties shall conduct national research programmes on polar bears, particularly research relating to the conservation and management of the species...."; and,

noting that although both Denmark and Norway have made many significant contributions to polar bear research in the past, the continuation of these important studies in the future appears uncertain;

recommends that Denmark and Norway both be encouraged to maintain their productive and important research programmes on the conservation of polar bears within their jurisdictions and continue to participate actively in the IUCN Polar Bear Specialist Group.

H. Participation of Scientists from the USSR in the IUCN Polar Bear Specialist Group

The IUCN Polar Bear Specialist Group,

recognizing that the governments of Canada, Denmark, Norway, the USA, and the USSR concluded that the States of the Arctic Region had special responsibilities for the protection of the flora and fauna of the region and signed the Agreement on the Conservation of Polar Bears because they agreed that protection of the species would best be effected through international cooperation; and,

recognizing that Article VII of the Agreement on Polar Bear Conservation states "The contracting Parties shall conduct national research programmes on polar bears,... and ... exchange information on research and management programmes, research results and data on bears taken."; and,

recognizing that many northern indigenous people, including those in the Soviet Union, depend on polar bears for at least part of the maintenance of their culture and economy; and,

noting that polar bear scientists from the Soviet Union were not present at either the February 1983 workshop of the IUCN Polar Bear Specialist Group, held at the Grand Canyon, USA or the 9th Plenary meeting held in Edmonton in August 1985, and that this had a serious detrimental effect on the value of the discussions and on the international exchange of information which the Agreement so clearly noted was vital;

recommends that the Soviet Union ensure that their polar bear scientists are able to participate fully in future meetings of the IUCN Polar Bear Specialist Group so as to ensure the maximum international exchange of research and management information on polar bears, as was intended when the Agreement on the Conservation of Polar Bears was signed.

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