POLAR BEARS

Proceedings of the Technical Workshop
of the IUCN Polar Bear Specialists Group

Grand Canyon, Arizona 16-18 February 1983

International Union for Conservation of Nature and Natural Resources
1196 Gland, Switzerland
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Available from Publications Services, IUCN, Avenue du Mont-Blanc
CH-1196 Gland, Switzerland

ISBN 2-88032-904-3

IUCN POLAR BEAR SPECIALISTS GROUP

TECHNICAL WORKSHOP - GRAND CANYON, ARIZONA

16 - 18 FEBRUARY 1983

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INTRODUCTION

The IUCN Polar Bear Specialists Group Workshop was scheduled to begin on 16 February 1983 at the Canyon Squire Inn, Grand Canyon, Arizona. The USSR delegates advised the IUCN that they would be unable to attend. The delegates from Denmark were delayed one day in arriving because of problems with their air connections. The minutes of discussions which were limited to IUCN delegates on 17 February are given first. Second are workshop discussions held with members of the Polar Bear Specialists Group and invited specialists through the period 16-18 February.

PRELIMINARY DISCUSSIONS BETWEEN GROUP MEMBERS

1. Introductory Remarks and Organization of the Meeting

The meeting was opened by the present chairman of the IUCN Polar Bear Specialists Group (PBSG), I. Stirling. It was agreed that he would chair the meeting but still be able to speak freely. Those present were S. Amstrup, U.S.A.; E. Born, Denmark; T. Larsen, Norway; J. Lentfer, U.S.A.; S. Schliebe, U.S.A.; R. Schweinsburg, Canada; R. Scott, IUCN; I. Stirling, Canada; and C. Vibe, Denmark.

2. Functioning of the Polar Bear Group

R. Scott reported that IUCN felt the Polar Bear Group was one of the more successful groups in the Species Survival Commission (SSC) and as such was sometimes held up as an example of the benefits of international cooperation in conservation. R. Scott explained that the USSR wanted to have a plenary meeting, but in Switzerland, not in Arizona, where they were unable to attend. IUCN felt that delegates from all five signatories should be present before a plenary session was held. The Group had already agreed to this view and hence the meeting in Arizona was called a workshop.

The group noted there were already several examples of international polar bear meetings being held outside Switzerland (1965 - Fairbanks, Alaska; 1973 - Banff, Canada;

1979 - Copenhagen, Denmark; 1981 - Oslo, Norway). It was also felt that attending meetings is very expensive, so if two meetings could be planned for the same time and place, considerable savings resulted. It was unlikely the Europeans would have been able to attend the meetings of the International Bear Biology Association (IBA), which were held at Grand Canyon 18-22 February, any other way. The countries represented also felt that meetings should continue to be held in conjunction with other scientific meetings; they could be held before or after and still have the privacy required.

It was suggested that meetings should only be held when they were needed, which might not necessarily be every two years. It was agreed that meetings could occur every two to four years. R. Scott said IUCN would have no problem with this schedule but would want all countries represented. A principal objective is to keep all five arctic nations together in scientific cooperation.

Countries would continue to nominate their own delegates. Each country would have two members and the emphasis is to remain on research-oriented people as opposed to administrators. IUCN would continue to be represented.

3. Election of Chairman

The Group felt a new chairman could only be elected at a plenary meeting, not at a workshop. I. Stirling agreed to continue as chairman until the plenary session.

4. Location of the Next Meeting

It was noted that the next International Theriological Congress (ITC) was to be held in Edmonton, Canada in August 1985. Larsen suggested the next meeting of the IUCN Polar Bear Specialists Group could be held immediately prior to the ITC. It was hoped this association and venue would be acceptable to the Soviet delegates, since the ITC originated in the Soviet Union and there was already the precedent of an IUCN Polar Bear meeting in Canada in conjuntion with an IUCN congress. R. Scott agreed to contact the Soviet Union on this matter.

5. Observers at the Polar Bear Group Workshop

A writer had asked for permisson to observe the meetings. It was noted that such permission had been denied on an earlier occasion. The Group agreed that writers and media persons should not be present at the discussions but that members were free to discuss anything they wished to outside the meetings.

Several delegates asked that persons from their countries who were not delegates but who were directly involved in polar bear research, be allowed to attend. This was agreed to on the grounds that the workshop would benefit from their additional knowledge and that participation would be beneficial to the individuals in their continued work with polar bears. The following persons were admitted: D. Andriashek, Canada; W. Calvert, Canada; R. Hansson, Norway; G. Kolenosky, Canada; N. Lunn, Canada; M. Ramsay, Canada; B. Smith, Canada; G. Stenhouse, Canada; M. Taylor, Canada; and J. Thomassen, Norway.

WORKSHOP TOPICS: GROUP MEMBERS AND INVITED SPECIALISTS

1. Production of Minutes

R. Scott felt that minutes should be kept from this workshop. There is value in maintaining continuity in the minutes of meetings and workshops of this group. IUCN would be prepared to produce 250 copies. CWS agreed to prepare the minutes. Once they have been corrected, a camera-ready version will be sent, with reports from countries, to IUCN for printing.

2. Summaries of Research and Management by Country

Because this meeting was a workshop and not a plenary session, not all countries prepared national reports. The following oral and written reports were received.

Canada

I. Stirling summarized polar bear management and research in Canada 1980-82 (See Appendices 1 and 2).

Denmark

No work on polar bears has been done in Greenland since 1979. Greenland now has home rule, and possible funding for future studies has not been discussed. Some studies have been conducted with Norway in Svalbard. A collection of biological specimens (teeth, hair, diaphragm, fat, kidney, liver) from hunters in Scoresby Sound was started in the spring of 1983 for analyses of baseline levels of heavy metals and a study of genetic polymorphism.

The harvest of polar bears in central west Greenland has increased in recent years. About 10 bears were shot in this area in 1980 and about 16 bears in 1981. Some long-distance movements of tagged polar bears have been recorded - one from NW Franz Josef Land to SE Greenland, and another from Baffin Island to W. Greenland.

Norway

There has been no polar bear hunting in Norway since 1973, but about six bears are killed in self-defence each year at weather stations and mining towns in Svalbard.

Linear transect surveys to estimate the density of polar bears in the pack ice were conducted from a research vessel in the summers of 1980, 1981, and 1982. The analysis should be completed in May, and a first draft of the report is expected by December, 1983.

A paper on low protein variability and genetic similarity between polar bear populations will be published as part of the IBA proceedings. The abstract is in Appendix 3.

Work is continuing on *Trichinella* species differences and infection rates. In connection with this work, T. Larsen requested samples of polar bear diaphragms from Alaska and Canada, to compare to the Norwegian specimens.

J. Thomassen and R. Hansson have finished their graduate theses and some of their work at the denning area at Kongsoya, Svalbard will be published in the proceedings of the IBA conference. Abstracts of their presentations are in Appendix 3.

U.S.A.

J. Lentfer reported that since the Marine Mammal Protection Act (MMPA) of 1972, the State of Alaska has had no active management programme. Jurisdiction over polar bear management may be returned to the State, but subsistence priority use would have to be agreed upon first. If the Federal Government retains management, it cannot set quotas, seasons, or protection for certain sex and age groups without changes to the MMPA declaring the species depleted. At present, they would only be able to continue to monitor the kill.

S. Schliebe summarized the harvest data (Appendix 4). Most interesting are the differences in sex ratio and average age between the kill sample and the capture sample. S. Amstrup summarized the report on the U.S. Fish and Wildlife Service polar bear research in Alaska since 1980 (Appendix 5). R. Schweinsburg requested blood-plasma samples from bears captured in Alaska, and it was agreed these samples would be collected whenever possible.

3. Polar Bear Studies in the Beaufort Sea

R. Schweinsburg explained that NOGAP (Northern Oil and Gas Program) was a Canadian Federal Government initiative to fund environmental research in the Beaufort Sea and Northwest Passage (Parry Channel) areas of the Canadian Arctic. It was to take place over three to four years and the polar bears of those regions were one concern. This programme is a response to an increased interest in exploration for and production of hydrocarbons from the Beaufort Sea. A sum of $ 100,000 (Can.) has been provided, but it

has to be spent by 31 March 1983, because of the way the government's fiscal planning operates. This makes it difficult to expend the money responsibly in terms of the return of meaningful data.

This problem was discussed at a workshop on polar bear population modelling at the University of British Columbia, Vancouver (UBC) in January 1983. It was decided to use the funds to support the following:

a. population modelling at UBC

b. additional aircraft charters to track female polar bears which are already carrying conventional radios put on by S. Amstrup and the U.S. Fish and Wildlife Service in the Alaskan Beaufort Sea. Several of these bears went into Canada during the winter and continuing tracking them would increase the data base on their distribution and movements.

c. attach an additional 20 radio collars to adult females in the area north of the Tuktoyaktuk Peninsula to increase the sample of bears being relocated by S. Amstrup each month. This would increase the understanding of polar bear movements between the Canadian and Alaskan portions of the Beaufort Sea.

These options were discussed and supported by the group because each would provide a return of data on its own and not require continuation of new funds in subsequent years. It was agreed that new radios should only be put on adult females in male-female pairs and those accompanied by 2-year-old cubs because they would be most likely to be pregnant and denning by fall. If they could be located after denning, it would provide new and important data on the distribution of maternity dens in the Beaufort Sea area. However, because of the short period of time available in which the radios could be put on, it was agreed that adult females located with cubs of the year and yearlings could be captured as well if it became necessary in order to use the radios in the time available.

4. Re-introduction of Polar Bears into Former Habitat

S. Amstrup explained that polar bears used to inhabit St. Matthew Island in the Bering Sea but were eliminated by the Yankee whalers. The island is presently a National

Wildlife Refuge containing sea lions and walruses. The U.S. Fish and Wildlife Service is interested in the possibility of re-introducing polar bears there, and possibly on Hall Island as well, because they used to be part of the indiginous fauna. There is also an interest in exploring for petrochemicals in the area. S. Schliebe has written a re-introduction proposal which has received signature but no action to date. Several possible problems were raised by the group. One was the possibility of causing man-bear interactions. Second, the genetic reservoir would need to be large. A third problem forseen was that bears introduced to the island might simply leave on the ice and return to their area of origin. If the idea was to be tried, it would probably be best to use young bears. The idea was mainly put out for information and no conclusions were reached.

5. NWT Oilspill Action Plan

R. Schweinsburg explained that this plan had been developed specifically to deal with problems that might arise with polar bears in the event of a major oilspill or well blowout. It outlines five possible options:

a. monitor the effects of a spill, but take no direct action
b. attempt to scare bears away from the oil
c. transport bears away from the oil
d. capture bears that have been in contact with oil, clean their fur and treat them for injested oil using knowledge gained from the treatment of the bear at Churchill
e. euthanize oiled bears

The plan is meant to be comprehensive and consider all aspects of an oil spill in Canadian waters, including Davis Strait and Baffin Bay. The section on polar bears is just one part. It gives all options considered possible to date, without deciding on the preferred action. Option d. would necessitate transporting a mobile hospital to the site of the spill, probably at huge expense. However, the government may have to be prepared to do this since it is likely to be favoured by public opinion.

This plan has been out for review and is now being updated. More comments were requested. The report will be widely distributed when finished.

S. Amstrup reported that the Outer Continental Shelf (OCS) Office in Juneau, Alaska, is preparing a report on how the oil industry will deal with oilspills in Alaska. He will circulate a reference as soon as it is available.

6. Satellite Tracking

M. Taylor summarized the work to date. The programme began in August 1981, using the Argos satellite. The Polar Research Laboratory (PRL) package had been certified and thus was chosen. The collar and radio package had to be developed hastily to meet the deadlines set, which meant several aspects were not adequately field tested. The power supply was attached to a shaped stainless steel collar covered with molding. For the harness, stainless steel chain was covered with black tape and enclosed in a silicone sleeve. The harness was held together with a link which was supposed to corrode and release the unit about the time the radio ceased functioning (estimated to be 15 mon).

Twenty collars were built and 16 were put on bears during 1982 (5 near Svalbard, 3 in Labrador, and 8 in the NWT). Thor Larsen reported that of the five packages put on bears near Svalbard, three worked only the first day, one is moving, and the last is still signalling from the original location. D. Andriashek reported that the three packages used in Labrador, Canada lasted 1.5 to 3 months. They appeared not to be cycling properly, and the temperature sensors which indicate if the collar is still on the bear failed. He suggested a mortality mode be considered in future models. The eight put on in the NWT lasted for similar periods of time.

There was a discussion of the problems of finding a suitable transmitter, and of the merits of continuing research on satellite tracking. The Group agreed the work was important and should continue, but new harness and radio designs should be tested thoroughly, preferrably on bears which could be observed closely to assess fit and compatibility.

7. Population Modelling

M. Taylor gave an overview of the meeting at UBC in January 1983. The ANURSUS model, which was originally developed by K. Zinnel and D. DeMaster, has been revised several times. The present version of ANURSUS emphasizes data analysis. It is still being tested, and then it will be compared to other models - both more simple and more complex. Nils Øritsland is also doing some computer modelling in Norway, and he may be able to work with Taylor and Bunnell of UBC to derive a model for polar bear populations. Presently, the different models vary in some of their estimates, but this may be due in part to different basic assumptions about the populations. The Group agreed that the assumptions agreed to be checked by people familiar with the data and that all the models be compared carefully, before accepting predictions based on them. Alaska indicated a possible interest in supporting the modelling research if management of polar bears is returned to the state. There may also be some financial aid available from the IUCN for the next modelling workshop, which is likely to be in conjunction with the Canadian Polar Bear Technical Committee meeting in February 1984.

8. Deterrent Research

G. Stenhouse gave a slide and 16 mm film presentation to illustrate the research conducted in this area to date. Details are included in Appendix 2. There was some discussion of the effectiveness of different methods and deterrents tried. Tests so far show the microwave detection units work well at permanent installations to detect approaching bears, while rubber bullets repelled bears under all the circumstances tested, including bears feeding on whale meat. There is currently some research to develop a smaller-gauge rubber bullet. It was suggested that weather stations in NE Greenland and a Polish scientific station on Svalbard might be good sites to test some detection methods such as microwave towers, and G. Stenhouse agreed to respond to any inquiries. It was the consensus of the group that this research should continue.

9. Remote Sensing of Polar Bears

R. Schweinsburg suggested that other methods be investigated for indicating population trends and estimating population size, since the present mark-recapture technique is expensive and time-consuming. Some ultra-violet and infra-red wavelengths have been identified by N. Øritsland as potentially useful for detecting bears. These might be tested, as a possible student project. S. Amstrup said he would be interested in following this up to determine the feasibility of conducting a project.

10. Publicity, Media, and Tourism

In the last few years, there has been a great increase in the attention focussed by the media on polar bears, and especially on the research at Churchill. There are now several thousand tourists coming to Churchill each fall, which creates the potential for conflict between tourism and research, since tagged bears often have dye markings (which make them less photogenic), and tourists are often nearby during tagging.

There was some discussion of the effects all this publicity may have on the bears and on research. Most felt it is important to keep the public informed by co-operating with responsible journalists and film-makers, and having lectures and poster displays in towns such as Churchill.

11. Waiver for Polar Bears from Canada under the Marine Mammal Protection Act

Since 1972, it has not been possible to import the hides from legally-taken Canadian polar bears into the United States. It is legal for U.S. citizens to hunt polar bears in some areas of the Northwest Territories, Canada, although they cannot take their trophies home with them. At present, sport-hunting does not occur in any other jurisdictions. Last year, the Safari Club International asked the U.S. Fish and Wildlife Service (USFWS) to apply for a waiver under the MMPA to make it legal for sport-hunters who kill polar bears in Canada to bring their hides back into the U.S.

In June 1982, Director Jantzen of the USFWS met with members of the Canadian Federal-Provincial Administrative Committee for Polar Bear Research and Management in Whitehorse, Yukon, to discuss the possibility of a waiver application. Subsequently, there was a much more detailed meeting between Canadians and Americans in Winnipeg, Manitoba, in late July. At that meeting, the concensus of the Canadians was that a waiver should apply to all legally-taken Canadian polar bear hides. Bears killed by sport-hunters amount to less than 5% of the total at the moment and administrators are equally, or more, concerned about legalizing an avenue to the U.S. for sale of hides from polar bears killed by Inuit hunters. In fact, Canada would not be prepared to support a waiver that was restricted to bears killed by sport-hunters.

It was agreed that if a waiver was applied for, the USFWS would be the proponent for the waiver and Canada would provide technical and administrative information and testimony as required. A series of problem areas, such as definitions of Optimum Sustainable Population (OSP), shooting of nursing young or lactating females, and so on were raised.

In the meantime, the USFWS were sent copies of all Canadian reports to review, relative to the waiver. They reviewed the research and management of polar bears on a country-wide basis; they did not, however, address all of the technical, legal points raised. The matter is still under consideration and no decisions have been made.

12. Melanism

C. Vibe had a photograph taken in 1973 of a polar bear paw showing possible melanism, but it was difficult to tell from the photo alone if the hair was black or if the hair was rubbed thin and some black skin showed through. T. Larsen reported seeing some dark brown spots on cubs on Svalbard. No one else had seen black or dark hair on any of the bears they handled.

13. Climatic Fluctuations

Christian Vibe distributed copies of a paper summarizing some of his work on periodic cycling in biological and environmental systems and requested comments.

14. Arctic Pilot Project

In a resolution at their 1981 meeting, the PBSG noted their concern about ice-breaking tankers coming through Baffin Bay and Davis Strait, because of possible detrimental effects on polar bears and marine mammals. The Greenland Fisheries have addressed the issue and Petro-Canada have been funding some studies along the proposed route. Public hearings were held in Canada and, as a result, further development of the project was suspended in 1982.

15. Lyster's Book on the International Agreement

I. Stirling reported that Simon Lyster, a British writer, has included a chapter on the International Polar Bear Agreement in a draft of a book he is presently writing. Some of the material included from the IUCN meeting in Oslo appears to be used out of context. I. Stirling and T. Larsen have both written to him to correct errors. R. Scott reported that Lyster is a responsible individual, and has a good background in both law and biology. Consequently, the errors must have resulted from a misunderstanding. R. Scott offered to contact Lyster as well and keep the other members informed.

16. Classification of the Status of Polar Bears

A reassessment is presently underway on the classification of many of the species of concern to the IUCN. Legal aspects of the classifications, and the different definitions used in different countries are being reviewed. Polar bears are presently listed as 'vulnerable' by the IUCN, but CITES and the U.S. MMPA have other classifications. The NWT uses an 'endangered' classification so quotas can be set. R. Scott requested suggestions.

17. Work with a Threatened Species

There was some discussion of the ethics and problems of working on a 'threatened' species, and of the IUCN position because of the earlier request by this Group for clarification of IUCN's position. The basic question is whether or not a research procedure can be justified if it might cause discomfort to, or even necessitate the sacrifice of, an individual from a threatened species, if another species cannot be substituted, and if a long-term benefit appears likely. A meeting on the ethics of research on bears was scheduled by the IBA and members of the IUCN group agreed to support and contribute to that effort.

18. Hunting of Females with Cubs

There is presently no legislation in the U.S. (Alaska) or Quebec, Canada, under which the killing of bears in dens or females with cubs can be prohibited, bag limits set, or hunting seasons established. Also, the use of aircraft is not presently illegal in Alaska. Quebec is currently discussing the need for quotas and regulations with the Inuit hunters. R. Scott indicated this situation was a matter of serious concern to the IUCN and would be viewed as such by the international conservation community.

19. Species Survival Commission Newsletter

I. Stirling has received two requests from Maisie Fitter of the SSC Newsletter for news of the Group's present activities and for a review of the PBSG history and achievements, including an account of the 1965 meeting. It was also noted that IUCN had expressed an interest in having a report on the history of the group a few years ago. This was begun by Moira Warland, but the present status of the project was not known.

I. Stirling will respond to the first request, and J. Lentfer will draft the second note, in consultation with C. Vibe and other members. The SSC newsletter will be sent to PBSG members.

20. Concerns Noted

At the end of the discussions, the Group identified the following subjects as being of most pressing concern.

Protection of Adult Females and Cubs

Under the U.S. Marine Mammal Protection Act, polar bears may be taken in Alaska for subsistence use. There are no seasons, quotas, or limitations on killing females with cubs and females in maternity dens.

Similarly, in the Province of Quebec in Canada, there are no seasons or quotas at present. Previously-existing protection for females with cubs and females in dens has been removed.

Because adult females are the most valuable component of polar bear populations, the Group recommends that steps be taken to re-establish proper protection in both these areas at the earliest possible date.

Action on Resolutions Passed in 1981

In 1981, the Polar Bear Specialists Group passed resolutions identifying the following as areas of high priority for future research: population estimations, population modelling, conventional and satellite tracking, and deterrent studies. While some research has been conducted in each of these areas, progress to date is far from adequate. The Group wishes to reaffirm that these areas should continue to receive the greatest amount of attention possible.

Absence of Soviet Scientists

The scientists at the Technical Workshop noted with regret that the Soviet scientists were unable to attend. Their contribution to the discussions was missed.

21. Species Survival Commission - Polar Bear Specialists Group

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POLAR BEAR MANAGEMENT IN CANADA 1980-82

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Since the January 1981 meeting of the IUCN Polar Bear Specialist Group, 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 1982 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 four provinces (Manitoba, Newfoundland, Ontario and Quebec), two territories (Northwest Territories and the Yukon Territory) and the Federal Government continued to meet annually to discuss research results and to make management recommendations. Research programs arising from these meetings are outlined by Stirling *et al.* in these proceedings.

The polar bear quotas by jurisdiction are based on recommendations by the Federal-Provincial Committees. The quotas and numbers of polar bears killed in 1980-81 and 1981-82 are summarized and recommended quotas for 1982-83 are also given (Table 2). Changes in the boundaries of some zones have been proposed for discussion but no action has yet been taken.

---

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[2] NWT Wildlife Service, Government of NWT, Yellowknife, NWT X1A 2L9
[3] Wildlife Research Section, Ontario Ministry of Natural Resources, Box 50, Maple, Ontario L0J 1E0
[4] Manitoba Department of Natural Resources, 1495 St. James St., Winnipeg, Manitoba R3H 0W9
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Table 1. Summary of regulations covering polar bear management in Canada as of 31 December 1980.

Category	Jurisdiction					
	MANITOBA	NFLD.	N.W.T.	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 -1981-82 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

Table 1. Continued.

Category	Jurisdiction					
	MANITOBA	NFLD.	N.W.T.	ONTARIO	QUEBEC	YUKON
Bears in den protected	-no	-yes	-yes	-no	-no	-yes
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	-$5.00 Royalty fee -must be sealed	-permit required from Conservation Officer

Table 1. Continued.

Category	Jurisdiction					
	MANITOBA	NFLD.	N.W.T.	ONTARIO	QUEBEC	YUKON
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 Act 1969 -Order-in-Council 3234-1971 Bill 28-1978	-Wildlife Act, 1981: Wildlife Regulations
Fur Dealer authority	-Wildlife Act Licences $10.00 restricted, $25.00 general, $25.00 travelling	-Wildlife Act Licence $2.50 for each store, $2.50 travelling	-$10.00 Fur Dealers Licence, $100.00 Travelling Fur Dealers Licence	-Game and Fish Act -$10.00 Licence	-$50.00 licence (one location) -$100.00 licence (ambulant)	-Trapping Regulations: $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		-Wildlife Regulations: $25.00 Resident Licence, $30.00 Non-resident Licence
Tanner's authority	-$10.00 licence	-no legislation at present	-$25.00 Tanners Licence	-Game and Fish Act (fee currently under review)	-$50.00 Tanner's Licence	-Wildlife Regulations: $2.00 Resident, $10.00 Non-resident

Table 1. Continued.

Category	Jurisdiction					
	MANITOBA	NFLD.	N.W.T.	ONTARIO	QUEBEC	YUKON
Live Animals Capture	-Ministerial permit	-illegal unless authorized by permit from Minister for scientific purposes	-$5.00 licence to capture live wildlife -$3000.00 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, 1980-81 and 1981-82.

	NWT	Ontario	Manitoba	Nfld.	Quebec	Yukon	Norway	Total
1980-81[1]								
Suggested quota	609[2]	30[3]	35	4	*	1	5[4]	684
Bears killed[5]	620	29	5	2	23	0	2	681
Bears captured, held in zoos	0	0	1	0	0	0	0	1
1981-82								
Suggested quota	614	30	35	4	*	1	5	689
Bears killed[5]	625	45	11	0	50	0	0	731
Bears captured; held in zoos	0	0	0	0	0	0	0	0
1982-83								
Suggested quota	610	30	35	4	*	1	5	685

[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 kills, problem kills, illegal kills, bears found dead, and handling deaths.

Northwest Territories

There have been few changes in polar bear management since the last summary of December 1980. Five tags were transferred to NWT from the Yukon and were assigned to the community of Aklavik as red tags in the spring of 1981. In 1982, five red tags were given to Eskimo Point. For the season of 1982/83, the tags previously issued to the outpost camp at Wager Bay were divided between Repulse Bay and Chesterfield Inlet with the same conditions applying, i.e. tags will be red tags and bears will be taken at Wager Bay.

Changes in the regulations were made to allow Lake Harbour to harvest four bears between October 1 and November 30 - while the remaining nine bears must be taken after December 2. This change was made to allow the people of Lake Harbour to replenish some of their meat supplies. Changes in the regulations were also made to allow problem bear hides to be given to the regional Hunters and Trappers Association (HTA) which in turn, can dispose of the hide to the benefit of the regional association or return the hide to the hunter and thereby reduce the settlement quota for that year by one. Problem bears killed prior to the opening of the regular season can also be treated in this manner. This regulation change was initiated in an attempt to reduce the number of bears taken over and above the regular quota.

Special Licence (Sports) Hunts

The sport-hunt in the NWT continued in 1981 and 1982 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 allotted 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. At present, these firms are not routinely required to provide statistical information, reports, or biological specimens from the polar bears killed. As usual, the number of applicants for the sport-hunt has been greater than the number of tags made available for such hunts by the settlements. This situation has arisen for a number of reasons. Because of the ubiquitous use of snowmobiles, there are few trained and

conditioned sled dogs and few experienced dog handlers. 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. Consequently, sport-hunts are not licensed unless enough suitable dogs are available in the settlements requesting the permission. Also, 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.

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

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 will be completed early in 1983.

The Manitoba Department of Natural Resources continued the annual Polar Bear Control Program without incident during the fall period in 1981-82. Objectives of the Program are:

1. to ensure the safety of people and the protection of property from damage by polar bears; and,
2. to ensure that polar bears are not unduly harassed or killed.

Bears encountered within inhabited areas were deterred or removed through application of the following procedures (listed in order of priority):

1. scaring bears from an area using cracker shells / bird bombs;
2. live trapping using culvert traps; or
3. shooting, when scaring and live-trapping were ineffective.

During 1981, the control period extended from September 1 to December 19. The program required 200 staff-days at an estimated operating cost of $ 15,000 to investigate and

handle 56 reports of problem bears in the Churchill area. In 1982, the number of reports was up (76) but this is still lower than the long term average (115).

In 1982, a Polar Bear Holding Facility with 20 holding cages was completed. The intent was to minimize the need to destroy problem bears by holding them in captivity until the ice on Hudson Bay became landfast and solid. In addition to holding problem bears, family groups were removed from the Churchill garbage dump and placed in the Holding Facility until freeze-up. As a result, no bears were killed during the 1982 Control Program.

The annual quota of polar bears for Manitoba is 35. All known polar bear mortalities are recorded as part of this quota since there is no hunting harvest.

Newfoundland

There are no immediate plans to reopen the polar bear season, which has been closed since 1970. Although there is no intent of taking a harvest, Newfoundland will retain their quota of four for problem bears.

Ontario

Polar bears are classified as furbearers (O.Reg. 115/71, Game and Fish Act, R.R.O. 1980 Reg. 401), and are being managed according to the policies outlined in a formal policy statement entitled "Policies for the Management of Polar Bears in Ontario". This statement received Ministerial approval in August, 1980, and was verbally agreed to by the Native Band Councils of Fort Severn, Winisk and Attawapiskat in December, 1980. Polar bears are now being managed according to the policies contained in the statement.

The main precepts of the policy statement are as follows:

1. The Ministry of Natural Resources will manage polar bears to maintain their present population level as the minimum acceptable.
2. The Ministry of Natural Resources will designate habitat which is critical to the welfare of polar bear populations and will plan and manage for its protection.
3. To the extent possible, the Ministry of Natural Resources will protect and manage the major food species which sustain polar bears.

4. The Ministry of Natural Resources will actively support research, inventory and other management studies of polar bears.
5. The Ministry of Natural Resources will allow the taking of polar bears by those Indians of Treaty No. 9 who are residents of the communities of Fort Albany, Kashechewan, Attawapiskat, Winisk (including Hawley Lake) and Fort Severn.
6. The Ministry of Natural Resources will set quotas for the harvest of polar bears within Ontario according to the recommendations of the Canadian Polar Bear Technical Committee.
7. The Ministry of Natural Resources will continue to ensure that pelts of all polar bears taken in Ontario are sealed in the recognized manner prior to sale by the hunter. Currently, sealing quotas are in effect, i.e. only a specified number will be sealed and therefore can be legally sold each year / community. Present sealing quotas are: Fort Severn - 12; Winisk - 12; Attawapiskat, Fort Albany and Kashechewan - 6.
8. Ontario will enact legislation, as required, to regulate the taking of polar bears, to prevent their harassment and to reduce their potential hazard to human life.
9. The Ministry to Natural Resources will work toward cooperative management of polar bears through guidelines and regulations with the coastal Indian communities. Once legally sealed, the sale of hides is at the discretion of the hunter, and / or the local Band Council.

Quebec

The relationship between the number of polar bears killed on the Quebec coast and the sustainable yield for that population is not known. The Inuit harvest study for the period 1973-80 done under the James Bay and Northern Quebec Agreement was completed at the end of 1981 and a final report is expected in 1983. The age / sex composition of the harvest is not available. Based principally on that report, a guaranteed level of harvest of polar bears for Inuit use will be negotiated between the Ministere du Loisir, de la Chase et de la Peche and the Quebec Inuit. Following this procedure, it is hoped that a quota similar to those existing elsewhere in Canada can be arrived at, in consideration of all pertinent data available at that time and with the participation of the Inuit.

A separate study is now being done by the Makivik Corporation in northern Quebec that will be similar to the Land Use and Occupancy Study done in the Northwest Territories. This project is being supported by the James Bay and Northern Quebec office of the Federal Department of the Environment and by the Canadian Wildlife Service.

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 1975-79 were included in the management reports prepared for the previous two IUCN meetings. The 1980 and 1981 data are summarized in Table 3. Most of the exported hides were destined for Japan.

Table 3. Number of polar bears, polar bear hides, and polar bear parts legally exported from Canada, 1 January 1980 to 31 December 1981 (from Heppes and McLean 1981 and 1982).

	1980	1981	Total
Live polar bears[1]	5	5	10
Polar bear hides[2]	310	327	637
Pieces of fur	3	-	3
Claws	111	30	141
Gall bladders	-	124	124

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

References

Heppes, J.B. and R.S. McLean. 1981. 1980 annual report for Canada. Can. Wildl. Serv. CITES Rep. No. 8. 47 pp.

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Stirling, I., R.E. Schweinsburg, G.B. Kolenosky, I. Juniper, M. Shoesmith, S. Luttich and W. Calvert. 1983. Research on polar bears in Canada, 1980-82. Rep. to IUCN Polar Bear Specialist Group. February 1983.

APPENDIX I: NWT SETTLEMENT QUOTAS AND CONDITIONS - December 1, 1982

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
1.	B	Arctic Bay	12		See paragraph (e). See Baffin Island A Special quota conditions.
2.	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.
3.	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.
4.	B	Broughton Island	22		Lower jaw of each must be given to an officer.
5.	B	Cambridge Bay	10	5	See paragraph (e).
6.	B	Cape Dorset	10		
7.	I	Chesterfield Inlet	8		See paragraph (e). See Keewatin A Special quota conditions.
8.	B	Clyde River	45		The lower jaw of each must be given to an officer.
9.	B	Coppermine	2	4	See paragraph (e).

10.	J	Coral Harbour	65		
11.	J	Eskimo Point	15	5	See paragraph (e). See Keewatin A Special conditions.
12.	B	Frobisher Bay	18		8 of which must be taken north of 62° 30' n. and west of 65° 10' W.
13.	B	Gjoa Haven	9	5	See paragraph (e).
14.	A	Grise Fiord	33		At least 6 of which must be taken from Norwegian Bay.
15.	B	Hadley Bay	4	4	See paragraph (e).
16.	I	Hall Beach	7		
17.	B	Holman Island	16	4	See paragraph (e).
18.	I	Igloolik	18		
19.	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.
20.	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.
21.	A	Melville Island	12		
22.	B	Pangnirtung	14		
23.	C	Paulatuk	13	4	See paragraph (e).
24.	I	Pelly Bay	10	5	See paragraph (e).
25.	B	Pond Inlet	15		See paragraph (e). See Baffin Island A Special quota conditions.
26.	J	Rankin Inlet	10		See paragraph (e). See Keewatin A Special quota conditions.
27.	I	Repulse Bay	20		12 must be taken after 15 November and the remainder after 01 December.

28.	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.
29.	B	Sachs Harbour	18	4	See paragraph (e). Special quota polar bears must be hunted north of 73° 00' N.
30.	J	Sanikiluaq	20	5	See paragraph (e).
31.	B	Spence Bay	22	5	See paragraph (e).
32.	C	Tuktoyaktuk	22	4	See paragraph (e). Special quota bears must be hunted west of 135° 00' W.
33.	I	Wager Bay		4	See paragraph (e).
34.	J	Whale Cove	12		See Keewatin A Special quota conditions.
		Total	529	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.

RESEARCH ON POLAR BEARS IN CANADA 1980-82

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INTRODUCTION

Most polar bear research in Canada continues to be carried out by Federal, Provincial and Territorial governments. This situation has arisen largely because of the cost involved, but also because of the management responsibilities of those governments. Some research is carried out by universities and these projects are coordinated with government research through bilateral discussions and the Federal-Provincial Polar Bear Technical Committee. This report summarizes the research conducted, and lists reports completed, between 1980 and 1982.

COOPERATIVE STUDIES

Computerized Data Base and Modelling

Tagging and hunter-kill data continue to be entered into the computer as they are collected, edited and corrected. A copy of the CWS/NWT/U of A formatted MS file is now also on the Government of NWT computer in Yellowknife and is accessible with SPSS. There are now more than 10,000 separate records on file, including the mark-recapture data and data on all the native kills.

A modelling workshop was held in Vancouver during January 1982 in conjunction with the Federal Provincial Polar Bear Technical meeting. Mitchell Taylor (a post-doctoral student)

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presented and explained a population model he had written. A discussion ensued, examining the methods of calculating the population parameters and their application in the model. As a result, Taylor subsequently revised ANURSUS (analysis package) and made modifications to his population model. The revised version of ANURSUS (ANURSUS II) was brought to Yellowknife in November 1982, debugged and put on the NWT computer along with the population model. Both systems are now undergoing peer review and when finalized should be an important tool for polar bear management.

Research on New Immobilizing Drugs

Work on testing new immobilizing drugs continued in conjunction with Dr. J.C. Haigh of the Western College of Veterinary Medicine, Saskatoon, Saskatchewan. Twenty three bears were successfully immobilized with carfentanil in 1981 and a report on the drug will appear in the Journal of Wildlife Diseases in the spring of 1983.

Ketamine and xylazine (Rompun) have essentially replaced phencyclidine (Sernylan) in the larger studies. However, because they come in such low concentrations, it is sometimes necessary to give a large bear more than one dart right away. As well, the effects of the drug combination are less predictable and so far two bears have been shot in defense.

Collection of Male and Female Reproductive Tracts

NWT, in conjunction with CWS, collected reproductive tracts from several settlements across the Arctic in 1981 and 1982. Coral Harbour, Resolute Bay and Clyde River provided most of the samples. The information will be compared with results obtained from a more intensive study of polar bear reproductive biology conducted by CWS in the Churchill area.

Collection of Blood Samples

In 1981 and 1982, blood was collected from captured bears on NE Baffin Island, NWT, and Churchill, Manitoba. Samples were sent to Dr. J.C. Haigh of the Western College of Veterinary Medicine, University of Saskatchewan for biochemistry on serology and to Dr. J. Clayton of Government of Canada's Department of Fisheries and Oceans for phylogenetic

investigations. Serological analysis of blood of bears from NE Baffin Island have shown no presence of antibodies to either *Leptospirosis sp.* or *Trichinella spiralis*. The phylogenetic investigations are not yet completed and more samples will be collected in 1983.

Monitoring of Pollutant Levels in Polar Bear Tissue

The NWT Wildlife Service, in conjunction with the Dr. Ross 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 from approximately 80 bears were collected from four areas of the NWT: Beaufort Sea, Central Arctic, Barrow Strait and Holman Island, and analyzed for heavy metals and organochlorides. The study is expected to continue in the 1983/84 hunting season with collections being concentrated in the Eastern Arctic.

Satellite Telemetry

The Canadian Wildlife Service, the NWT Wildlife Service and the Norwegian Polarinstitutt maintained their interest in satellite telemetry.

The development of a harness and collar design was coordinated by Mitchell Taylor, while Polar Research Labs of Santa Barbara produced a satellite transmitter. The system was used during the 1982 field season. NWT placed units on eight estrous females in Barrow Strait, NWT, during May. CWS placed three on polar bears in Labrador and the Norsk Polarinstitutt put three on in the vicinity of Svalbard. The transmitters developed to date had more difficulties than anticipated and two-thirds of them stopped working after about three months. The rest will probably follow suit. For one more year, or until the external funds expire, CWS will continue to work at a low level on development of a workable harness and collar system and try to improve the reliability of the electronic package. CWS will continue to test collars, harnesses and radios at Churchill, Manitoba, where they can observe bears for test periods of variable lengths and be reasonably sure of recovering the instruments.

Effect of Crude Oil on Polar Bears

The complete report on the results of this study has now been published (Øritsland *et al*. 1981). The following are the Rationale and Conclusions and Recommendations sections from that report's Summary.

It is widely perceived by the general public that oil spills and oil well blowouts will occur in Arctic marine areas as a result of offshore petroleum development and that these may have detrimental effects on wildlife populations. The actual extent or severity of such accidents particularly with respect to Arctic environments is not, however, well understood.

The polar bear is, at present, not considered an endangered species. Its position on top of an ecological food chain, however, determines that the population remains at a low level relative to seals, its main food source. Assuming that hunting quotas and methods will continue to be regulated according to results of contemporary population research, it is the increased human occupation and pollution of polar bear living areas that present the greatest threat to survival of this species.

An investigative study was designed to simulate an arctic oil spill and determine its effect on polar bears experimentally exposed to the crude oil, a Midale crude. The impact of coating was to be assessed particularly on thermoregulation in the polar bear, with effects related to the characteristics of the oil, its changes with exposure, and its uptake from external coating as measured by plasma residue levels. An ongoing health program would monitor any shifts occurring in stress indices. As a consequence of the unexpectedly severe toxicity effects of oil exposure on the bears, it became necessary to extend the study program to include further assessments of hydrocarbon residues in body tissues and fluids, as well as a more extensive clinical assessment, and a detailed post-mortem examination of the two polar bears that died. Recovery of one bear was effected, and monitored closely to assess treatment possibilities for future accidental exposures.

A general conclusion which may be drawn from this study is that the polar bear is a potentially greatly impacted species when exposed to oil spills. An initial effect of coating with

oil is that thermoregulatory and metabolic stresses develop which may cause serious disability if protracted in the wild. Oil fouling of the fur led to grooming and licking of the oil from the fur, with consequent ingestion of the oil, and absorption into the body from the gut. Residence of oil in the fur may be expected to be long if the animal is not cleaned completely, prolonging exposure by grooming/ingestion activities. Uptake of petroleum hydrocarbons and their distribution to body tissues led to behavioural abnormalities, including anorexia, as well as to tissue damage. A wide range of tissues were found to be affected, much of the effect related to uremia and severe dehydration. Peripheral hemolysis and a lack of bone marrow erythropoietic response resulted in an acute anemia in all oiled bears. The systematic toxicity effects were latent, not becoming pronounced until weeks after the initial exposure. Renal changes were the most serious under the laboratory conditions and can be assessed as the direct cause of death in two of the three oil exposed polar bears.

On the basis of the information available on the crude oil effects in the polar bears as a result of this study, it could be stated with a reasonable degree of confidence that it would be very unlikely that polar bears would again be lost from similar exposure to crude oil under the laboratory conditions.

Insofar as exploration for oil and other oil-related activity is a necessary reality in the Arctic, so is the possibility of oil spills. Therefore, information is needed that would form a basis for rational therapeutic and other contingency measures to deal with oiled bears in the wild, possibly many of them at the same time. Without this information we could be faced with a dilemma: whether to treat and possibly prolong the misery, or needlessly destroy many bears that otherwise could be saved with effective therapy if we were more knowledgeable about the oil effects. This leads to recommendations for further studies to be able to assess the total impact of oil spills on this species.

Priority should be given to studies of polar bear behaviour (including physiological indices) in response to a natural, but oil-fouled environment. A large enclosure is envisioned for such studies, facilitating observation in conjunction with monitoring by implanted radio-transmitters. A

comprehensive study should assess the polar bears' reaction to oil, to oil on fur, and to oil-contaminated seal offered as food.

Concurrent laboratory studies should be performed, with the objective of resolving the problems revealed by this study concerning potential fever and skin reactions to crude oil. The question as to whether oil may cause fever in polar bears is recognized but is not fully analyzed in the present report. An eventual fever effect of oil has important implications for handling procedures of oil-contaminated animals, however, and should be pursued by further experimentation.

Priority should also be given to study of the thermal properties of fur samples coated with oil and subjected to cold air temperatures.

Although this study has identified that oil spill exposure is detrimental to polar bears, it has not been able to address in any way the possible effects of oil spill dispersants. The use of oil dispersants may be anticipated in a spill situation, particularly if such an accident were to occur in a sensitive area.

Other recommendations may be made for administrative action.

Governmental agencies involved in development of oil resources in the Arctic should spearhead the formation of an independent committee, with the mandate of developing contingency plans to deal with potential oil spills or blowouts. The committee should also review existing information and suggest research priorities designed to anticipate and minimize the environmental effect of oil exploration on polar bears. The committee would include system biologists and physiologists, but should also be fortified with individuals having expertise in toxicity and the logistics of arctic operations.

SINGLE AGENCY RESEARCH

Canadian Wildlife Service

The long-term goal of the Canadian Wildlife Service 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 management-oriented 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 Studies

This project is concerned with the ecological relationships between polar bears, seals, sea ice conditions, and polynyas. In the last three years, our major efforts have been concentrated on: aerial surveys of the distribution and abundance of seals in the High Arctic; developing a monitoring study of the distribution and abundance of seals in relation to offshore activity in the eastern Beaufort Sea; analysis of data on the distribution and abundance of polar bears in the eastern Beaufort Sea in relation to sea ice habitat types; producing a review of the state of our knowledge about polynyas in the Canadian Arctic; initiating field observation studies of the activities of polar bears and pinnipeds around the Dundas polynya in the early spring; and evaluating the use of underwater vocalizations as a tool for studying the distribution and abundance of overwintering seals in the High Arctic (includes an M.Sc. study on bearded seals).

We will continue studies of polar bear habitat, behaviour and interspecific relationships during the next two to four years. An emphasis will be placed on writing up past research for publication.

Reproductive Biology of Polar Bears in Western Hudson Bay

This project, a Ph.D. study, is designed to study two aspects of the reproductive biology of polar bears which are critical to the sound conservation and management of the species. These two aspects are closely related and can be studied simultaneously.

1. Fidelity of adult female polar bears to maternity denning areas

Throughout the Arctic, extensive exploration and development activities are either underway or expected to begin in the foreseeable future. Many of these projects involve the potential for extensive disturbance of polar bear maternity denning areas as a result of activities such as pipeline construction, road-building and the establishment of logistic support installations.

In most areas of the Arctic in which polar bears have been studied, the geographic scale and logistic costs have been too large to facilitate studying the fidelity of female polar bears to their maternity denning areas.

For three consecutive spring seasons, a large sample of adult female polar bears will be captured and tagged with their new-born cubs as they are leaving the denning area south of Churchill. Measurements will be taken and specimens collected for age determination. If a large enough sample is captured, we should be able to clearly demonstrate:

a. fidelity to the denning area and possibly to specific areas within it;
b. the length of the reproductive cycle of females;
c. age of first reproduction; and
d. longevity of females.

The Manitoba Department of Natural Resources is providing significant support and assistance to this project.

2. The reproductive cycle of female polar bears

In order to make recommendations on safe levels at which polar bear populations can sustain continued harvesting by Inuit hunters, accurate data are required on the age at which females first reproduce and on their litter size, breeding interval and longevity. Population models are now being developed in which these data can be used to the maximum benefit of the species.

In most areas of the Northwest Territories, the Inuit Hunters' and Trappers' Associations understood and accepted the changes recommended from modelling done to date. However, on the Keewatin coast of northwestern Hudson Bay and on Southampton Island, most polar bear hunting has traditionally taken place during the fall when the bears were on land. Inuit of the Keewatin settlements from Eskimo Point north to Repulse Bay argue that the female bears they kill along the coast are not pregnant. They maintain that pregnant females have already gone inland to den by October. The Inuit may or may not be correct but there are limited data available with which to clear up the point.

Reproductive specimens and lower jaws (for age determination) will be collected from polar bears killed by Inuit hunters on the Keewatin coast of Hudson Bay and Southampton Island. The Wildlife Service of the Northwest Territories is providing maximum cooperation in the collection of specimens. Analysis of these specimens in the laboratory will enable us to demonstrate:

a. whether or not female polar bears being killed in the fall are pregnant;
b. corroborate conclusions on the age of first reproduction, breeding interval and longevity drawn from the mark and recapture studies in the maternity denning area; and
c. provide new insights into the extent and possible significance of intra-uterine mortality, missed pregnancies and reproductive senility.

Ecological significance of supplemental food sources to polar bears summering on land

In Hudson Bay, the sea ice melts and disappears from about mid-July to mid-November. This means that the polar bears must spend the intervening four months on shore where they are unable to hunt seals, their main food (Stirling *et al*. 1977). Pregnant females come ashore in mid-July and do not return to the ice to hunt seals again until eight months later, by which time they have given birth to their cubs (usually two) and nursed them to a weight of 10-15 kg. Russell (1975) documented food habits of polar bears during the summer and autumn and found that birds were most commonly eaten by bears on the coastal mainland of southwest Hudson Bay. Both Knudsen (1978), on North Twin Island and Latour (1981), at Cape Churchill, reported that polar

bears fed very little while on land, 3.2% and 1.25% of the total times observed respectively. The overall impression is that the polar bears feed very little while ashore and live mainly on fat stores accumulated during the spring.

However, there is one constantly present source of supplemental food, the dump at Churchill, Manitoba. Preliminary observations showed that bears using the dump were feeding 44.6% of the total observed time (14.8% based on 24 hours, assuming they were not feeding when they were away from the dump and thus not observed).

Polar bears that feed at the dump use a supplemental food source that is variable in amount and quality. This food source is one that can be relied upon to be there each year. Although the dump is available all year round, polar bears do not appear to use it until late September and early October, even though bears may be observed in the area earlier. From data collected to date, it appears that younger bears, especially males between the ages of two and five years, plus females with cubs appear to be the major users of this food source.

Data from past years show that some bears use the dump regularly (in the fall only) while others never do. Some use the dump for a year or two and not thereafter. By studying polar bears that use the dump and those which do not, several questions may be answered:

1. What ages and sex classes of polar bears use the dump and why?
2. What are the benefits and costs to both groups of polar bears by either using the dump as a food source or not using the dump as a food source?
3. Do individual bears use the dump as a supplemental food source for only one or two seasons or do they return for many years?

This study is being done as an M.Sc. project. The Manitoba Department of Natural Resources is providing significant support and assistance to it.

NWT Wildlife Service

Polar Bear Studies on Northeastern Baffin Island

During April and May 1981, 65 polar bears were tagged on northeast Baffin Island. With the exception of 10 bears captured the previous summer, this was the first tagging project undertaken in the area. The objectives of the study were:

a. to determine population size, range and distribution

b. to assess quotas for Clyde River and Broughton Island

c. to assess the impact of oil development.

Capture success was about half of what was anticipated, because most bears were a considerable distance offshore. A paucity of fresh snow made tracking difficult, and the density of bears appeared to be low. No concentrations of bears were observed and vast areas held few or no bears. Most bears were located at the floe edge, which was composed of unconsolidated ice over large expanses. Immobilization was not attempted in these areas due to the danger of drugged bears drowning.

Not withstanding these factors, the capture success rate was low, and subjective feelings were that there were few bears spread over a vast area. Bears or their tracks were found offshore as far as the tagging crew travelled (160 km). Previously, LGL Ltd. has reported bears as far offshore as 250 km in Baffin Bay.

Nine of the 65 bears captured were already marked. Three came from southeast Baffin, three from the Lancaster Sound area, two from Boothia Peninsula, and one was tagged in the study area the previous summer.

In April and May 1982, bad weather and helicopter problems hampered the collection of a larger sample. Seventeen bears were captured, marked and released. None of the bears captured had been marked previously. The capture rate in 1982 (0.37 bears/h flown) was lower than that in 1981 (0.47 bears/h) and considerably lower than that experienced in Lancaster Sound (1.2 bears/h). As in 1981, the subjective feeling was that very few bears were spread over a large area.

Eleven (16.4%) of the bears shot by Inuit hunters at Clyde River and Broughton Island in 1981/82 were tagged. Hunters from Clyde River also reported finding the remains of cubs in the stomachs of 2 females.

Without further studies it is difficult to determine what all these results indicate. The low density of bears and the long movements of marked bears into the study area are unusual. The relatively large number of tagged bears appearing in the kill may indicate over-hunting, but larger samples are needed to clarify these findings and studies are planned to continue in 1983.

Denning Surveys

Two denning surveys were conducted in the Central Arctic during the spring of 1982. One survey took place on Gateshead Island and was a repeat of a similar 1977 survey. Results indicated that this region is a well used polar bear denning area. The second survey was conducted along the NE coast of Boothia Peninsula and was unsuccessful in locating any denning.

Bear Detection and Deterrent Research

The Northwest Territories Wildlife Service in conjunction with government and industry initiated a bear detection and deterrent research program in the spring of 1981.

To date, support for this research has been provided by: Cominco Ltd.; Department of Energy, Mines and Resources (EMR - Polar Continental Shelf Project); Mobil Oil Ltd.; Petro-Canada Ltd.; Gulf Canada; B.P. Minerals; Department of Indian Affairs and Northern Development (DIAND); Government of the NWT - Renewable Resources; Yukon Dept. of Renewable Resources; Manitoba Dept. of Natural Resources; and the Canadian Wildlife Service.

Initial tests were completed on polar bears at Cape Churchill, Manitoba, from 16 September to 23 November, 1981. The Canadian Wildlife Service loaned their observation tower to the field crew. It served both as living quarters and as an observation post. Field testing included the use of microwave detection units, syringe.darts, a recording of barking dogs, a 38 mm multi-purpose riot gun employing rubber bullets, and an electrified barbed wire fence.

Although preliminary, the results collected during the first season suggested there may be effective techniques for detecting and detering bears. Additional information on the 1981 research can be obtained from Stenhouse (1982).

The 1982 research program was also conducted on polar bears at Cape Churchill, from 16 September to 5 November. Field testing included the use of microwave detection units with audio sirens, flare/bird scaring cartridges, a recording of barking dogs and a 38 mm multi-purpose riot gun employing rubber bullets.

Four major changes were made from the previous year's field testing. First, the NWT Wildlife Service, in conjunction with the Canadian Wildlife Service, undertook a program to mark bears in order to determine return rates of bears and the success of the deterrent systems on known individual bears.

Second, for a deterrent to be truly effective, it must have the capability of moving a bear from a food source. Tests were initiated to determine whether or not bears could be repelled from whale and seal meat at a bait site.

Third, tests were initiated to determine the response of bears to rubber batons fired from the ground. This was done with the aid of a larger steel cage (2.5 m^3) which provided protection for the tester in the event that a bear charged when hit with a rubber bullet.

Fourth, a flood-light system was installed so that tests could be conducted at all hours of the day and night.

Approximately 250 polar bears were tested during the 1982 field season. Although the final report is still in preparation, the following conclusions can be drawn.

Polar bears could be repelled from a food source with rubber bullets. After being hit with a rubber bullet, most bears ran from the bait site. Some bears required more than one hit before they would leave. None of the bears which were hit by rubber bullets charged the shooter, regardless of whether he was firing from inside or outside the cage.

The microwave motion detection units, equipped with audio sirens, were successful in detecting approaching bears. However, the audio sirens did not prevent bears from approaching the bait site. The sirens would be useful in warning personnel working in bear habitat of an approaching bear. The flare/bird scaring cartridge proved useful and dependable in free-ranging situations. A significant advantage of this cartridge is its ability to illuminate the area around the problem bear when the cartridge explodes.

In the upcoming year, additional tests on polar bears will occur. The program will also be expanded to test grizzly and black bears. At present, the NWT Wildlife Service is preparing an education and training course to instruct wildlife officers and others working in bear habitat on bear deterrent techniques.

The Effects of Artificial Islands on Polar Bears in the Beaufort Sea

Petroleum exploration and production plans in the Beaufort Sea call for the construction of numerous artificial drilling islands. Depending on their distance from shore, some of these islands will be located in the transition zone between landfast and moving pack ice. Polar bears favour the transition zone between landfast and pack ice, hence concern has arisen over the presence of artificial islands and their possible effects on polar bear movement and distribution.

We flew transects radiating out from an existing artificial island (Tarsiut) and a proposed island (Uviluk) plus identical control sites adjacent to each of the two experimental sites. All polar bear tracks, their direction of travel, sighting of bears, and ice types were recorded. Variability in the study areas between survey periods, especially changing ice conditions, made interpretation of the data difficult.

Track data indicates that bears were concentrated in the eastern portion of the study area, particularly off Baillie Islands. It was unclear what factors affected the orientation of the polar bears. No directional trends in bear movement were detected but, once again, our interpretation was confounded by variability and the nature of the two experimental sites. However, this study was preliminary, serving mainly to assess the study design and provide data with which to address the research question. Study design modifications are required if a long-term approach is

adopted to examine the effects of artificial islands on polar bears in the Beaufort Sea petroleum exploration and production zone.

Manitoba

Fall aerial surveys of polar bears along the Manitoba coastline were conducted in 1981 and 1982. An unusually low number of bears observed in 1981 corresponded with a noticeable increase in bears along the Ontario coastline during the same period. Possibly, this southern shift in bear distribution resulted from a very late ice breakup on Hudson Bay and many bears were carried further south on the ice than normally occurs. In 1982, bear distribution returned to normal with an increased number of bears seen in the vicinity of Churchill and Bird Cove.

In July 1982, a summer tagging program was initiated along the Hudson Bay from Cape Tatnum to the Pen Islands. The program was curtailed early when four bears died as a result of drugging procedures. However, new information on the distribution and movement of twelve bears in this area was obtained.

Manitoba provided logistical assistance and man power to the intensive fall tagging program conducted by the Canadian Wildlife Service.

Ontario

Aerial surveys to monitor numbers and distribution of polar bears in Ontario were continued for the 19th and 20th consecutive years in 1981 and 1982 (Prevett 1981; Abraham 1982). Objectives of the surveys were to provide an index of annual abundance and determine preferred areas of summer sanctuary. A knowledge of numbers and distribution is required to (i) ensure native harvests do not exceed sustainable yields and, (ii) permit delineation of critical habitat in advance of possible resource development in the region.

The 1981 survey was conducted on 31 August and 1 September, and the 1982 survey from 2 to 4 September. Despite some problems with weather and visibility, the total of 183 polar bears sighted in 1981 was the highest ever recorded. The percentage of young (16.2) was the fifth highest during the 20 year survey period. Two females, one south of Cape Henrietta

Maria, and the other on Akimiski Island, each had three cubs. That represented only the third time that triplets were observed during the fall surveys.

In 1982, the total of 136 ranked fifth among all years, but was 26% less than the 1981 count. The total of 27 in Manitoba ranked third among the 17 years for which data were available. The above figure was considered conservative because poor weather in the vicinity of Anabusko Island precluded a thorough search. The number of females with young (12) was similar to the average during the five preceding years and 46% higher than the 20-year mean.

Areas of concentration during both years were similar to other years with the Pen Islands and Cape Henrietta Maria again harboring the largest number of bears. A small island approximately 50 km west of Cape Henrietta Maria had 31 bears in 1982, but only 15 in 1981. The distribution of bears in each of the three major coastal regions of Ontario is reviewed by Prevett and Kolenosky (1982).

In 1981, the total of 14 on Akimiski Island was the second highest tally recorded during the survey period. Family groups comprised 71% of that total. In 1982, only nine were spotted, but family groups again comprised the largest percentage (67). Apparently, the island is an especially attractive summer sanctuary for family groups and immatures. Whether both sexes are included in the latter group is not known. Large bears, presumably adult males, appear to occur less frequently.

A 12-year old male tagged 10 November, 1978 at Cape Churchill, Manitoba was shot near Fort Severn, Ontario 24 November, 1980. An adult female tagged with two cubs of the year on 16 March, 1981 in the denning area south of Churchill was shot 8 km NW of Fort Severn in March 1982. During a goose survey in late September, a bear marked near the Kaskattama River, Manitoba in late July, was sighted at approximately 56° 57'N, 89° 40'W. The above results indicate that some movement of bears between Ontario and Manitoba occurs, reflected by the reciprocating high and low counts between the two jurisdictions (Prevett and Kolenosky 1982). These sightings further reinforce the need for a tagging study to clarify movement patterns and numbers sighted annually.

The annual kill of polar bears approached the sealing quota of 30 in 1980-81 and exceeded it by 50% in 1981-82. The excessive kill during the past year appeared to be directly related to the delayed freeze-up caused by the mild early winter. On 13 December, 1981, trappers reported that open water was still visible less than 2.6 km off the shore of Hudson Bay. That effectively restricted the bears to the shoreline and greatly extended the period of fall vulnerability. The annual quota of 12 for each of the villages of Winisk and Fort Severn remained in effect, so excess pelts will not be sold until next year.

An additional 13 skulls for age determination and morphometric studies were collected. Collection of skulls and annual fall aerial surveys will continue.

Quebec

A survey in August 1981 of islands in Hudson and James bays recorded a total of 27 bears, 18 of which were on North Twin Island. In March 1982, part of the Smith Range was surveyed by helicopter, but no bears, tracks, or evidence of denning was seen.

Yukon

Some research on possible maternity denning is being considered for the coastal areas and Herschel Island to try to assess habitat and the impact of proposed development. There is also the possibility of a cooperative study with Alaska, depending on funding.

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ABSTRACTS OF RESEARCH PAPERS, NORWAY

Larsen, T., H. Tegelstrom, R. Kumar Juneja and M.K. Taylor 1983. Low protein variability and genetic similarity between populations of the polar bear (*Ursus maritimus*)

Blood samples from a total of 460 polar bears from various Arctic regions, but excluding the USSR, were collected during the period 1967-1981 to study electrophoretic variation in different proteins. Two hundred and one samples from Alaska, 48 from the Canadian Arctic, 89 from Svalbard, and 21 from Northeast Greenland were collected during the period 1967-1973 and were analysed by vertical polyacrylamide gel electrophoresis to study transferrin and hemoglobin polymorphism. Thirty-one samples collected in 1974 were analysed by starch gel electrophoresis for 14 enzyme systems in serum and red blood cells. Seventy samples collected from Alaska, the Barents Sea, and Canada in 1980-81 were studied by starch gel electrophoresis, and further analysed for protein variation by thin-layer isoelectric focusing, horizontal polyacrylamide gel electrophoresis, and two-dimensional electrophoresis. In all, about 75 loci were analysed for variation. The degree of protein and enzyme variation in the polar bear was observed to be relatively low. Starch gel electrophoresis revealed variation of an unidentified serum protein. The distribution of this protein indicates a closer connection between bears in Alaska and Canada compared to those in Greenland and Svalbard, but the differences were not significant. As in many large mammals, the information from protein variation in polar bears has limited use for management purposes. We could not find any simple system usable for identification of discrete populations. On the basis of protein variation as sole criterion, the populations investigated could not be separated. Possible explanations for the uniformity of blood proteins can be exchange of bears between geographical areas and/or a high selective pressure in polar bears.

Larsen, T. and B. Kjos-Hanssen. 1983. *Trichinella* sp. in polar bears from Svalbard, in relation to hide length and age.

Diaphragms and masseter muscles from 376 polar bears (*Ursus maritimus*), 252 ringed seals (*Phoca hispida*), 84 bearded seals (*Erignathus barbatus*), and 77 arctic foxes (*Alopex lagopus*) from Svalbard were examined for *Trichinella*. Infection rates in polar bears varied between 23 and 58%, and between 3 and 67% in arctic foxes. None of the seals were infected. *Trichinella* in polar bears is probably transferred through cannibalism and scavenging upon polar bear carcasses. Infection rate in arctic fox was high when they preyed upon polar bear carcasses before polar bear hunting was prohibited in 1973. A low infection rate seems more natural when such prey is not available. No difference could be found in infection rate between male and female polar bears. There is only a slight increase in infection rate with age, as calculated from hide lengths, and many adult animals remain uninfected. Geographical isolation of polar bear populations may explain differences in *Trichinella* infection rates between bears from arctic America and arctic Europe. Possible explanations are that discrete polar bear populations have different food habits, or that they are exposed to different *Trichinella* strains.

Hansson, R. and J. Thomassen. 1983. Polar bears in the denning area - catalogue and activity budget.

Social, communicative and cognitive training, and a high activity level, are considered especially important for the development of young mammals. The behaviour of polar bear cubs is thus expected to include these factors. Likewise, polar bear females should be expected to maximize their cubs' abilities for engaging in these activities.

Behaviour and time budget of polar bear females (n=25) and cubs (n=48) was recorded in March and April 1978 and 1979 in a denning area at Kongsoya, Svalbard.

A catalogue of 22 behaviour categories was made. The categories are compared with available data on bear behaviour. Special attention is given to adaptive significance of play and investigative activities in cubs. These behaviours were found to meet the above mentioned demands for cub development.

The bears spent ca. 85% of their total time in den, where females, and to a great extent cubs, are supposed to be mainly inactive. Outside den females were inactive 65.3% of the time, cubs 41.7%. Play and investigative behaviour made up ca. 38% of the cubs' time outside den. Females did not play, and spent ca. 15% of their time outside den in investigative activity. Strong wind and low temperatures restrained the activity outside den. Cubs are probably vulnerable to bad weather.

In sum, the results support our hypothesis. Females were mainly inactive, thus conserving energy that the cubs in turn could utilize for adaptive training. Staying in the denning area after emergence while feeding active and rapidly growing cubs must represent a great energetic cost for the female. The benefit of this investment must thus be a highly increased survival of the cubs.

Thomassen, J. and R. Hansson. 1983. Behavioural development of polar bears in the denning area.

Behavioural studies on polar bear females (n=25) and cubs (n=48) were made in March and April 1978 and 1979 in a denning area at Kongsoya, Svalbard.

The data for all bears were adjusted to a common starting point, and pooled for 3 and 3 days. Bears that stayed 13 days in the denning area ("short time bears", n=15) and bears that stayed 14 days ("long time bears", n=10) were treated separately. Three methods were used to find possible changes in cub and female behaviour through the period in the denning area. Special attention was paid to possible factors decisive for emergence from dens and desertion of the area.

Change in activity budget: Significant change was found in only 2 out of 32 tests. However, there was a general tendency towards less time spent in den for all bears, and towards increased activity in cubs. Long time bears went through a similar development as short time bears. Change in diversity of cub behaviour: The diversity of short time cub behaviour stayed at about 1.8 bit through the period. The diversity of long time cub behaviour increased significantly from 1.3 to 2.1 bits.

Change in distance from den: All bears walked further away from their dens by the end of the period than in the beginning. Long time bears stayed closer to dens the first half of the period than did short time bears, but then increased the distance to the same level as them.

The small changes in time budget may be due to a) too crude behaviour categories, or b) that real changes in individual bears are obscured by pooling the data.

Generally, however, the results indicate increased motoric abilities in cubs, and increased independence of the dens. Also, upon leaving the area the cubs' levels of development were less different than upon emergence from dens. This indicates that the cubs should reach a threshold level of behaviour before leaving the denning area.

SUMMARY OF ALASKAN POLAR BEAR HARVEST CHARACTERISTICS

1980-1982

by

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ABSTRACT

The Marine Mammal Protection Act (MMPA) of 1972 prohibited the hunting of all marine mammals except by Alaska coastal-dwelling natives for subsistence purposes or for creation of authentic handicrafts, providing that the taking is in a non-wasteful manner and the population is not found to be depleted. Since 1980, the U.S. Fish and Wildlife Service has collected harvest data from Alaskan Eskimos to document the sex, age, chronology and locations of the harvest. Hunters from 14 villages located along 1600 linear coastline miles were found to have harvested polar bears during the last 2 years.

The documented minimum polar bear harvest for the 1980/81 hunting period was 106 polar bears while 90 bears were taken in the 1981/82 season. A minimum of 21 bears were harvested from 1 January to 30 July 1980 (Alaska Department of Fish and Game records) and have been included in the pooled sample of 217 bears (Fig 1 and Table 1). Of this total 134 (61.8%) represent bears for which complete sex and age information was obtained; 52 (23.9%) represent bears for which adequate sex and/or age class information was obtained; and 31 (14.3%) represent bears known to have been killed for which sex and age information is unknown.

The sample of 134 known sex and age bears consisted of 27% litter members (cubs of the year, yearlings, and 2-year olds), 31% females greater than 3 years of age and 42% males greater than 3 years of age (Table 2). The sex ratio was 81 (60.4%) males to 53 (39.6%) females (Table 3). The sex ratio for captured versus killed bears was significantly different. The mean age of males and females was 7.3 ± 4.8 years. Male mean age was 5.8 ± 3.9 years and female mean age was 9.0 ± 5.4 years. A significant negative (avoidance) correlation was determined for harvested female cubs less than 3 years, female subadults 4-5 years and females age 6-10 years. A significant positive (preference) correlation was determined for females 10 years or older, subadult males and adult males 6 years or older.

From January 1980 to April 1982 a minimum average annual removal of 38 females occurred. This figure excluded 31 unknown sex or age bears. If the percentage of adult females of known sex and age bears is applied to the 31 excluded bears then the average annual female harvest is 44 bears. Polar bears were harvested during each month of the year except

September. Of 197 bears sampled, 123 (62.4%) were harvested during November, December, and January (Fig 2). Forty-five bears (22.8%) were harvested in October and November primarily in North Slope villages. The chronology differs markedly from that of the sports-hunting era which concentrated the harvest during February through April.

Of the 124 hunters who killed 217 polar bears during 1980-82, 37 (29.8%) killed more than one bear and of these hunters, 27 (73.8%) killed more than 2 bears. Snowmachines (89.5%) were the most common hunting transportation form, small boats (6.8%) ranked second and other means accounted for the remainder of the harvest.

Table 1. Alaskan polar bear harvest by village, 1980-82.

Village	Jan. 1980 to July 1980 ADF&G Data	July 1980 to May 1981 USFWS	May 1981 to June 1982 USFWS
Kaktovik	-	23	1
Barrow	3	7	5
Nuiqsut	1	-	-
Wainwright	3	8	13
Pt. Lay	-	1	4
Pt. Hope	-	9	7
Kivalina	-	-	1
Shishmaref	-	29	22
Wales	5	6	11
Little Diomede	-	1	3
Gambell	2	6	1
Savoonga	7	16	21
Emmonak	-	-	1
Total	21	106	90

Table 2. Annual harvest rates of independent adults and dependent young by sex.[1]

	Independent Adults			Dependent Young		
	Male	Female	Unknown	Male	Female	Unknown
January 1980 to June 1980	11	6	3	-	-	-
July 1980 to June 1981	27	29	7	14	4	9
June 1981 to April 1982	37	25	-	9	2	3
Total	75	60	10	23	6	12
Percent	40.3	32.3	5.4	12.4	3.2	6.4

[1]Includes 134 known sex and age bears and 52 bears for which sex or age class is adequate for assignment to a tabular category; excludes 31 bears for which sex and age information is unknown.

Table 3. Sex and age composition of Alaskan polar bears harvested during 1980-82.

	MALES		FEMALES		TOTAL	
Age	Number	Percent of total bears	Number	Percent of total bears	Number	Percent of total bears
1	1	0.7	0	0.0	1	0.7
2	10	7.5	4	3.0	14	10.5
3	14	10.4	7	5.3	21	15.7
4	13	9.8	1	0.7	14	10.5
5	7	5.3	1	0.7	8	6.0
6	8	6.0	4	3.0	12	9.0
7	4	3.0	5	3.7	9	6.7
8	8	6.0	3	2.2	11	8.2
9	6	4.5	5	3.7	11	8.2
10	1	0.7	2	1.5	3	2.2
11	0	0.0	3	2.2	3	2.2
12	2	1.5	5	3.7	7	5.2
13	1	0.7	1	0.7	2	1.5
14	1	0.7	3	2.3	4	3.0
15	2	1.5	1	0.7	3	2.2
>15	3	2.2	8	6.0	11	8.2
Total	81	60.5	53	39.4	134	100

FIGURE 1

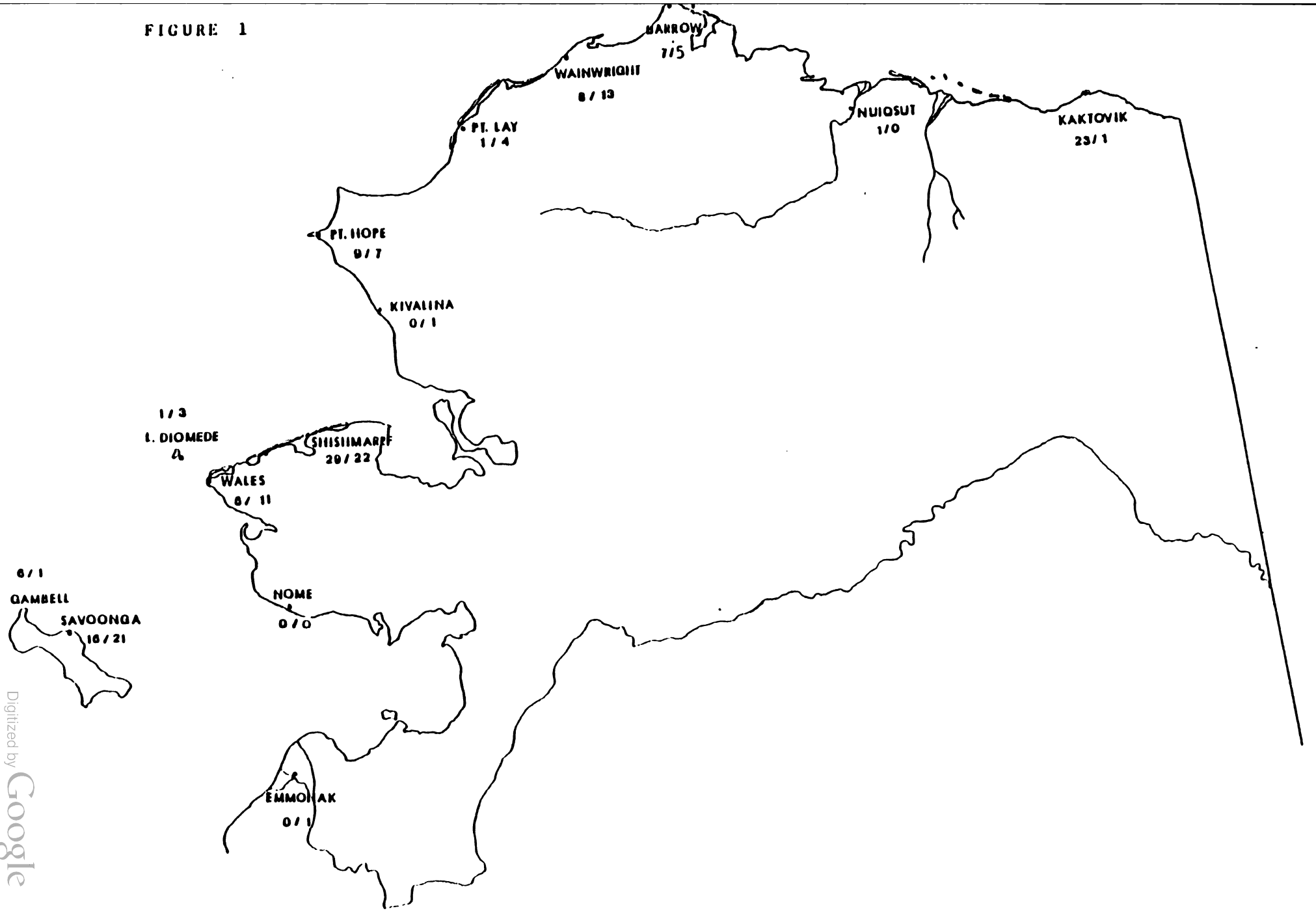
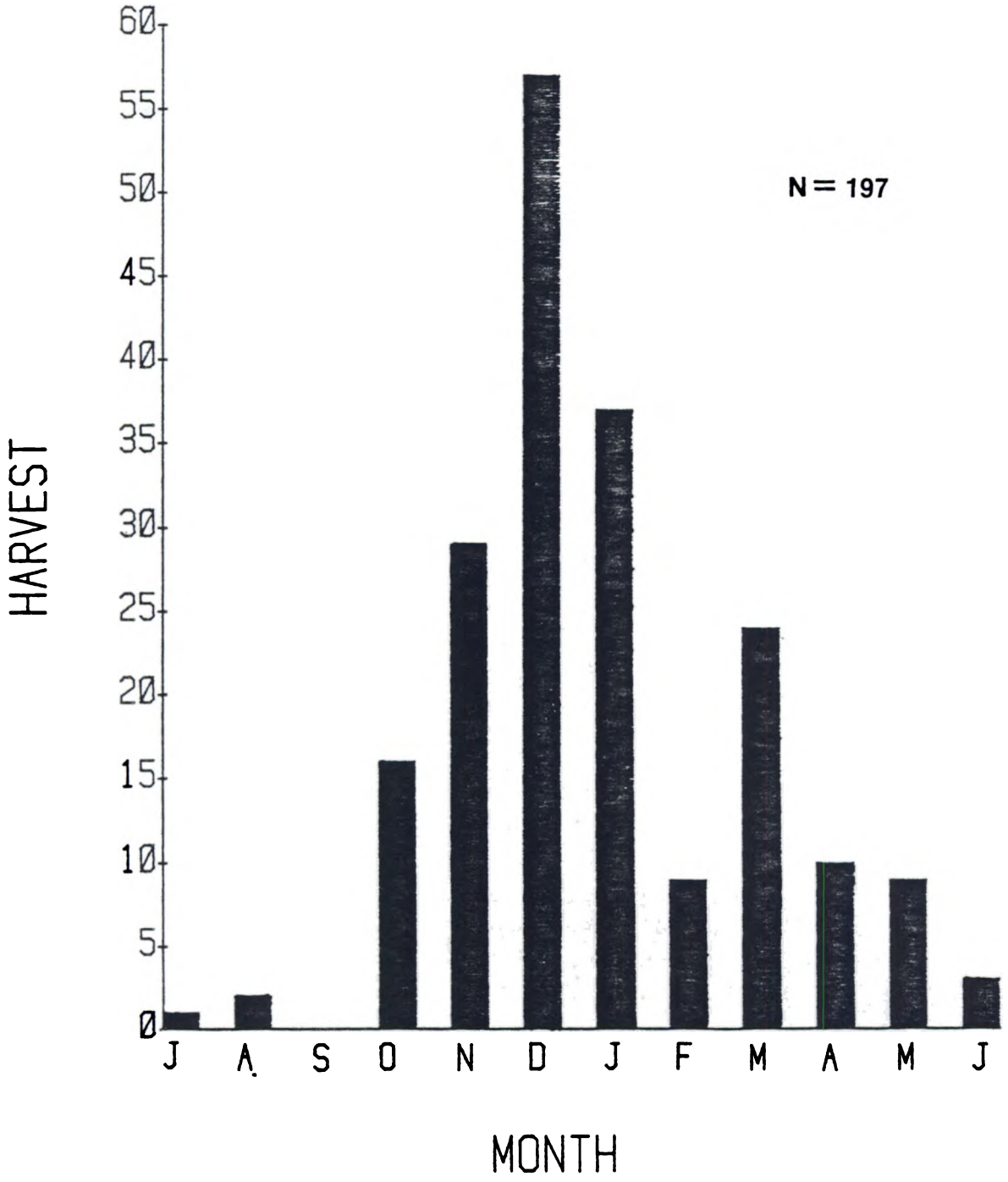


FIGURE 2.

CHRONOLOGY OF ALASKAN POLAR BEAR HARVEST, 1980-82



Polar Bear Research in Alaska
1980-82

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Cooperators: Alaska Department of Fish and Game
Alaska Regional Office, U.S. Fish and Wildlife Service
Arctic National Wildlife Refuge
Bureau of Land Management
Canadian Wildlife Service
Dome Petroleum Ltd.
National Oceanic and Atmospheric Administration
North Slope Burough Game Management Committee
Northwest Territories Wildlife Service

Key Words: Bear, Polar, Marine, Mammal, Arctic, Population Dynamics, Alaska

Subproject: Alaska Marine Mammals 904.2
Work Units: 904.21, 904.23, 904.24

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Objectives:

A. Determine the size and trends of polar bear population(s) in Alaska.

   1. Evaluate and improve methods of population assessment.

   2. Determine mortality rates, natality/recruitment rates, sex and age composition, and other parameters of Alaskan polar bear population(s) and describe factors influencing them.

   3. Describe effects of human activities in the Arctic on polar bears and their habitats and develop procedures to minimize those that are considered detrimental.

B. Determine movement and distribution patterns of Alaskan polar bears.

   1. Establish seasonal ranges and distributions.

   2. Evaluate seasonal and annual fidelity of polar bears to particular activity areas.

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

   1. Locate and describe maternity denning sites in Alaska.

   2. Establish the degree of fidelity of female bears and their progeny to particular denning areas.

   3. Describe effects of human activities, particularly oil and gas exploration and development, on maternity den selection and occupation and survival of young. Develop procedures to minimize the detrimental effects.

   4. Develop den survey procedures to be included in routine polar bear management activities.

Introduction

An investigation of the ecology and population dynamics of Alaskan polar bears has continued since 1967. As part of that program, U.S. Fish and Wildlife Service personnel conducted polar bear capturing and marking programs near Cape Lisburne Air Force Base in spring 1981, and near Barter Island in October and November 1981, and March and April 1982. We also captured and tagged polar bears in the Prudhoe Bay area in April 1982. Prudhoe Bay, the starting point of the famous Alaskan Oil Pipeline lies on the Beaufort sea coast at approximately 70°18' N. 148°25' W. Barter Island lies 100 miles east of Prudhoe Bay at 70°08' N. 143°38' W. Cape Lisburne Air Force Base (AFB) lies on the extreme NW coast of Alaska at 68° 52' north latitude 166° 09' West longitude.

This report describes activities addressing all project objectives. Polar bear studies are continuing. Results are reported here, and inferences are drawn in order to stimulate thought, speculation, and discussion and should not be viewed as final.

Methods

Polar bears were located by flying over the ice at speeds of 80-100 mph and elevations of 50-500 feet. 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. Drugs used to immobilize or tranquilize bears during 1981 and 1982 are listed in Table 1. Some captured bears were given prophylactic injections of penicillin (Flo-cillin, 300,000 units per ml). We injected 6 ml Erythromycin (50 mg/ml) into the dart wounds of other captured bears.

After darting, bears were kept in sight until immobilization occurred. Several bears had to be injected two or more times to effect complete induction. Additional injections were delivered from the helicopter or on the ground depending upon circumstances. Twenty-one projectile syringes were lost when they missed their mark or fell out of injected bears before induction.

Once immobile, bears were fitted with polyethylene number coded, button type eartags. Both upper lips of captured bears were tattooed with numbers corresponding to those on the eartags. 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. Ten ml blood was extracted from the femoral vein of adults captured, and selected adult females were fitted with radio-transmitting collars.

When all operations were complete, drugged bears were positioned with their backs to the wind, and their heads such that aspiration of snow or water during recovery was not possible. Bears immobilized with M-99 were injected with the antagonist M-5050, just before investigators departed the scene.

In an effort to reduce flying time required for catching polar bears we experimented with baiting to artificially concentrate them. On 24 September 1981, we moved 12,700 pounds of whale scraps left on the beach at Barter Island by Eskimo whalers to Beaufort Lagoon about 30 miles east of Barter Island. An additional 3,500 pounds were moved to Camden Bay approximately 30 miles west of Barter Island. On 19 March 1982, we placed 150 pounds of fur seal blubber at each of the previously mentioned sites.

Results

Spring 1981:

We captured 36 of 42 polar bears observed between 7 and 26 March 1981. The capture was comprised of nine adult and subadult males, nine family groups and six barren adult females. Three of the 36 bears captured this spring (#1106, #1857, and #6126) had been captured in previous years.

Autumn 1981:

We captured 43 of 72 polar bears observed near Barter Island between 18 October and 7 November 1981. The capture was comprised of 11 family groups, 11 subadults and only 5 single adults. Compared with spring captures of 1981 and 1982 the autumn capture was composed of a far higher proportion of family groups and a lower proportion of single bears, particularly adult males (Table 2). From a management standpoint this composition may be very significant. During autumn 1981 bears were encountered and captured much closer to shore and to coastal population centers than during our spring seasons. Therefore, those bears were more vulnerable to the existing land based, central place, hunting for polar bears. Since there are currently no regulations protecting females or young, this appears to be a period of great vulnerability for this critical population segment. Four bears captured during autumn 1981 had been previously captured.

Spring 1982:

We captured, marked, and released 50 of 53 polar bears seen near Barter Island, Alaska, between 17 March and 2 May 1982. We also captured 23 bears seen near Prudhoe Bay between 22 and 30 April 1982. Relatively fewer family groups and more single adults, particularly large adult males, were captured during the 1982 spring season (Table 2).

Fifteen bears tagged during previous years were recaptured during spring 1982. Only one of these had been marked near Barter Island in autumn 1981 (#6142) and it was recaptured near Prudhoe Bay. Four of the recaptures had originally been marked in Canada, two near Barter Island, and the remainder had been originally marked near Barrow.

The distribution of polar bear captures in spring 1982 was similar to that of other spring tagging seasons and different from the fall 1981 season in that most bears were caught well away from shore on active ice. Although some bears and tracks were encountered in the fast ice zone, the rate at which sign was encountered increased markedly after crossing the shear zone into active ice.

Drugs

We successfully immobilized 130 bears with M-99 (Etorphine). Fourteen other bears were immobilized with combinations of phencyclidine HCl and various tranquilizers. Although drug idiosyncrasies, equipment disfunctions, and imprecise dart placement resulted in some variability between individuals, responses to M-99 were uniform enough for effective field application. A broad range of dosages proved effective and polar bears seemed reasonably tolerant of M-99. Responses to M-99 were more uniform and predictable in fall 1981 and spring 1982 than during spring 1981.

When a bear was encountered it was usually classified into one of several classes and dose administered according to our experiences with other members of that class of animals. Doses administered most commonly were:

Yearlings	3.5 mg
2-year olds	3.5 mg
Adult females accompanied by cubs	5-7 mg
Adult males	10 mg
Subadults	5-7.5 mg

Within each age group it appeared that bears were somewhat fatter in fall than spring. However, we maintained the same dosage schedule through both seasons with no observable differences in response. This suggests that M-99 has a fairly broad tolerance range when applied to polar bears. It may also suggest that response to M-99 correlates better with the lean weight of the animal involved than it does with the amount of fat deposited. On the other hand, our experiences with phencyclidine hydrochloride, which is very lipophilic, suggested that higher doses were required when bears carried larger fat deposits.

Incorrect classification of bears prior to darting resulted in incorrect initial doses of M-99 being administered to several bears. In most cases, however, these animals reacted satisfactorily. For example, adult male #6195 was given 7.5 mg M-99 rather than the 10 he would have been given had his size been correctly assessed. Yet, he reacted perfectly to the drug, becoming immobile in 9 minutes. Subadult male #6123 was observed following an estrus female and assumed to be a large male. He was thus shot with the 10 mg typically given to adult males, and the response was perfect. Instances such as these corroborate the earlier suggestion that many polar bears have a broad tolerance for M-99.

Another observation regarding response to M-99 is noteworthy. Adult female #6237 was injected with 5 mg M-99 at 1236 on 23 April 1982. She momentarily got out of sight and crossed a freshly refrozen lead leaving no track. Although she only moved about one-third mile before collapsing, we burned too much fuel looking for her and had to return to base for fuel enough to continue the search. When we relocated her at 1545, she was already capable of biting and some head movement and a supplemental dosage of M-99 was given to protect investigators. The short distance traveled and the tracks in the snow suggested she dropped quickly and had been completely immobile. However, recovery had begun without administration of the antagonist within a period of scarcely over 3 hours. Hebert et al. (1980) also suggested that bears may recover fairly quickly from unantagonized doses of M-99.

Because of the darting procedure, ear tagging, and tattooing, we felt that prophylactic injections of antibiotics were in order. Some bears were given injectable penicillin. However, aqueous solutions of penicillin proved difficult to handle in sub-zero temperatures, and often froze within the syringe before injection could be achieved. Administration of Erythromycin (another broad spectrum antibiotic) with the aid of intramammary probes designed for treatment of mastitis in cattle proved more suitable, however. Comprised of a viscous liquid, this substance resisted freezing and required less concern under adverse field conditions. It also had the advantage of applying the drug to the place where it was probably most needed. Doses were administered by simply inserting the end of the probe of the pre-loaded syringes into the bears dart wounds and pushing the plunger forward. Since it worked so well, we plan to continue use of this product.

Distribution of the Catch

Most bears were captured during the spring of 1981 by travelling north and northwest of Cape Lisburne. We covered an area of 4728 nm^2, and bears were caught between 13 and 100 miles from shore. The distribution of our catch was very comparable to that of previous years, but less dispersed than the catch of spring 1982 (Table 4).

During the spring of 1982 we achieved perhaps the greatest aerial dispersion of tagging effort ever. The bear distribution within the sample area was patchy. What's more, "bear patches" were motile. That is, the presence of several bears and much sign in a particular search quadrant on one sample day did not necessarily predict that bears would be in that area the next day. Over the entire study period, however, capture sites and presumably bears appeared to be distributed rather uniformly.

The capture and bear distributions during autumn 1981 were substantially different. There was essentially no sea ice near shore during that period, and bears were concentrated along the coast near Barter Island and to a lesser extent Beaufort Lagoon and Camden Bay. Bears were apparently artificially concentrated by the Bowhead whale remains at these points and that is where bears were encountered and captured.

The presence of bears along the coast in the absence of sea ice brings up some interesting questions. Lentfer (1972), DeMaster and Stirling (1981), and Uspenski and Kistchinski (1972) concluded the distribution of bears is closely related to the presence and condition of the sea ice. It has usually been assumed that polar bears frequent the Alaska coast only when "the ice is in." By 20 September 1981, however, bears were frequenting Alaska's northeast coast at a time when the pack ice was over 100 miles from shore. Perhaps an undetected ice bridge to land occurred east or west of the Barter Island area and once ashore bears moved along the coast toward the attractive whale remains. Perhaps an early freeze created enough ice for a short time that many bears were able to walk ashore. Or perhaps offshore winds brought the scent of putrifying whale to the distant ice pack and bears swam in to find it. We can only speculate how the bears got there, and clearly there is room for a better understanding of late summer and autumn movements. However, it is apparent that some retrenching from the view that polar bears come to the Alaska coast only "with the ice" may be in order.

The Grain in Polar Bear Distribution

Common sense, field intuition, and our data tell us the distribution of polar bears, like other large mammals, is clumped. However, the map of 1982 capture locations also suggests that, at least in Alaska's eastern Beaufort Sea, those clumps are fairly evenly distributed. Locations of bear "patches" or clumps seemed to change from day to day. However, over the course of the spring 1982 capture season, we caught bears in all principal ice covered directions we hunted from both Barter Island and Deadhorse. Except to say that active ice was more productive than fast ice, neither consistently productive nor unproductive areas could be identified.

1981-1982 Catch-Effort Results

During the spring of 1982 the polar bear research crew was on site and available to work with operational aircraft between 3/15 and 3/27 and between 4/6 and 5/2 inclusive. During those 39 days we hunted or could have hunted on 28 days. All or part of 6 days during the March period and 22 days during April were suitable for hunting bears by helicopter. We also spent 9 days in the Deadhorse area during April 1982. Although we attempted to hunt on 8 of those 9 days, weather was really amenable only on 7 days. Thus, during the 1982 spring Beaufort Sea work we could have attempted to catch bears on 35 of 48 days (73%). This compares very favorably with the 15 days (63%) we could have hunted between March 3 and 27, 1981, at Cape Lisburne.

We also spent October 18 to November 7, 1981, on Barter Island. During those 20 days we worked parts of 13 (65%). However, this is really not comparable to the spring work. During autumn we had little or no ice and searched close to the village and close to land most of the time. Because of that, we actually worked on several days that would have been unsuitable for hunting over the sea ice as is done in the spring.

During the spring of 1982 we flew 139.2 hours of which 108 were spent hunting bears. We observed 76 (60 groups) bears and caught 73 (59 groups) for a rate of 1.91 flight hours and 1.48 search hours per bear captured. The capture/encounter rate for the whole spring season was similar to those for 1980, 1981 and previous years. We flew fewer than half as many hours in the Deadhorse area as we did in Barter Island. However, the available data suggest bear densities as reflected by respective capture rates were comparable.

Although the encounter rate did not vary between areas, it varied substantially with time. Whereas in April and May we caught one bear for each 1.31 hours search time, in March it took 3.74 hours of searching to produce a bear.

During March the sea ice was tightly consolidated. Openings in the ice were essentially nonexistent. Bears that were captured were found near widely scattered small fractures measuring from a few inches to a few feet across. Because March temperatures hovered constantly between -30^{o} and -40^{o} F, all openings were ephemeral. Aerial surveys conducted in March suggested the tight ice extended from Point Barrow to at least Herschel Island in a band at least 100 miles offshore. The extreme solidity of the ice was exemplified by efforts to recover our disabled helicopter approximately 17 miles north of Barter Island. The ice in this area typically flows from east to west along the coast. This flow is revealed by the massive pressure ridge system which develops along the shear zone between fast ice and the moving pack. In 1980 an airplane disabled near Point Barrow moved 7 miles with the ice in fewer than 24 hours, demonstrating the flow can be very rapid. This year, however, despite the fact that the helicopter was on the ice for approximately 72 hours, no change in its position was detectable.

An interesting observation related to the ice condition was that the density of bears available for capture seemed to increase immediately following loosening of the ice. If the low March density we observed was due to bears having moved to more suitable hunting grounds, they had to have rapidly migrated back to the Barter Island area when conditions changed. Since the tight ice band extended at least from Point Barrow to Canada, such a migration would have been remarkable indeed. Further, since the loosening of ice in April seemed to occur simultaneously across the north slope, why would bears so far away cross so much suitable habitat just to get back to Barter?

It seems at least as likely as a mass emigration and rapid immigration that many bears remained in the Barter Island area throughout the cold, tight ice period. They probably spent much of that time in temporary dens conserving heat and energy, and waiting for more suitable conditions. In this scenario, one does not have to postulate movements across hundreds of miles of seemingly suitable habitat by large numbers of bears following a warming trend or windstorm. It also seems more consistent with our observation of a relatively even distribution of bears in Alaska's eastern Beaufort Sea.

During the autumn of 1981 we achieved the highest catch per unit of effort recorded for the Alaskan Polar Bear Project. This appeared to be a result of three factors. First, villagers in Kaktovik killed three Bowhead whales during the 1981 whaling season. After butchering there were still over 50 tons of whale remains on the beach at Barter Island. These remains proved to be tremendous polar bear bait. A majority of the bears we caught were within a few miles of Barter Island as a result. In addition to the whale remains at Barter Island, we moved approximately 16,000 pounds of remains to points 30 miles east and west of Barter. This proved to be the second factor increasing our catch efficiency as several more captures occurred near those bait sites. Finally, there was no ice in September or October, 1981. Somehow bears had gotten to shore. Perhaps they reached shore during an ephemeral freeze. Perhaps they came ashore at some point east or west of Barter Island and moved along the coast. In any event numerous bears occupied a very narrow band of shore and fast ice habitat for much of October. The small amount of occupied habitat and additional concentration due to the bait sites combined to give us a very high catch for a relatively small effort in autumn 1981. This situation was obviously not comparable to spring conditions.

Two notes concerning baiting seem appropriate here. On 24 September 1981, we moved 12,700 lb of whale scraps to Beaufort Lagoon, about 30 miles east of Barter Island. Conservatively, 4-5,000 lb of that was nonskeletal and thus edible. By 19 October, all edible portions had been consumed. This is a consumption rate of 167-208 pounds per day, so either a lot of bears passed by the bait or fewer bears ate a lot. Since adult polar bears are capable of eating over 100 pounds of food at a time (Uspenski 1977), it would not take very many hungry bears to decimate a bait site. Therefore, the keys to effective baiting of polar bears are to use a lot of bait and be attentive.

In an effort to improve our efficiency by baiting, we put out two 150-pound blocks of fur seal blubber obtained from the Pribilof Islands on 19 March 1982. One of these baits placed in the Camden Bay area remained unmolested throughout our stay on the slope. The other appeared unscathed until March 29 and disappeared sometime between then and 19 April. The bait that disappeared by 19 April was adjacent to a fox den and had been attracting ravens. Feeding by those animals might have accounted for its disappearance, or bears might have cleaned it up. However, in neither case was evidence of polar bear activity observed near the bait sites.

Unlike the fall, most spring bears were caught well out on the sea ice. It may be that our baits were simply too small to attract most bears from sea ice, particularly when seals appeared to be abundant. Another factor might be the type of bait. Smith (1980) has shown that polar bears avoid rutting male ringed seals relative to other classes of seals. Such avoidance is apparently related to taste and smell. Most fur seals killed on the Pribilofs are sexually mature (although nonbreeding) males. It is therefore possible that the blubber we used as bait had similar scent characteristics to those making breeding male ringed seals undesirable to bears.

Polar Bear Movements

Movement histories of 25 radiocollared polar bears in the Beaufort Sea are being developed. Several animals have now been monitored for periods exceeding one year. Relocation data are still too few to draw sweeping generalizations about specific timing, direction or extent of polar bear movenments. However, some conclusions that are relevant to management of polar bears seem to be inescapable.

Many bears frequenting the Alaskan Beaufort Sea coast probably travel over areas of sea ice exceeding 20,000 square miles each year. Our recent data are from females only. However, the limited movements information available from mark and recapture do not suggest important differences in movements between males and females. Further, male black bears and grizzly bears usually travel more than do females of both species. Therefore, if travel by polar bears varies between the sexes, it seems most likely that movements of males would exceed those of females. Limited information from late 1982 and early 1983 suggest that movements will be somewhat different this year than they were in 1981. Therefore, one could surmise that occupied areas over a several year period greatly exceed those occupied during a single year. Radiocollared bears have never been relocated over 100 miles form the Alaskan coast. During winter, the only time that they interact frequently with our coast, instrumented bears have seldom been relocated more than 70 miles to the north of land. Thus, the principal component of north slope bear movements is easterly and westerly. It does not seem unreasonable to assume that over a period of several years most bears would wander over the principal portion of the mainland Beaufort sea coast.

During any single year most polar bears that might be encountered in the Alaskan sector of the Beaufort Sea will likely spend considerable time in the Canadian sector. If our radiocollared bears are representative, most bears captured or encountered, at any time, east of the Colville River probably spend as much of their time in Canada as they do in Alaska. The frequency of border crossings may be high enough that neither an Alaskan nor Canadian segment of the populataion can be identified. Rather, Beaufort Sea bears should probably be referred to only in international terms.

Both the Canadian and Alaskan sectors of the Beaufort Sea are currently being explored and developed for hydrocarbon resources. If these activities or any others affect bears in one sector of the Beaufort, those effects will undoubtedly be felt in the other sector. To assure the welfare of polar bears, cooperative management decisions appear to be mandatory.

Population Size and Trend

The most common question asked of Alaskan polar bear researchers is "how many are there?" Intense interest in this question among scientists and managers was also evident at the last IUCN Polar Bear Specialist Group meeting in Oslo, Norway. Although we can not yet provide definitive descriptions of population size and trend, we have access to several indicators that give us a better handle on the size and trend of polar bear populations in Alaska than ever before. These indicatiors include; single season mark and recapture estimates; multi-year mark and recapture estimates; previously recorded observations of trophy hunters; aerial survey data and catch per unit effort estimates.

Confidence in any one of these population indicators is not great. however, remarkable agreement between them suggests two major conclusions. First, bear numbers in Alaskan waters are low. It takes at least 40 square nautical miles of sea ice ,on average, to support one bear. This makes polar bears the least numerous of all of Alaska's marine mammals, with the possible exception of some of the great whales. Second, although some short term fluctuations appear to have occurred, numbers of polar bears in Alaskan waters appear to have been relatively stable for at least the last 25 years. A manuscript detailing the current state of knowledge about Alaskan polar bear numbers and trends is now being prepared for publication.

Polar Bear Harvest

The documented Alaskan Polar Bear harvest for the 1981-82 and 1980-81 seasons was 79 and 106 (Schliebe unpubl.) These figures compare favorablywith the mean annual known harvest since 1973 of 86 bears. It should also be emphasized that these figures are minimal at best, because reporting of harvest has not been mandatory since 1972.

Simplistically, harvests of this level appear to be sustainable. However, because of spatial and temporal fluctuations in the kill closer scrutiny is necessary. For example, during the 1980-81 season the documented kill in the Barter Island area was 23 polar bears. The actual kill is reported by some village residents to be substantially higher. All of these bears were killed in the autumn when they were apparently attracted to whale remains left on the beach after the village butchering process. Similarly, we marked and released 43 bears drawn into the Barter Island area in autumn 1981 by the remains of whales killed that season. Only one adult male was observed near Barter Island in fall 1981, and the overall capture composition was heavily weighted toward adult females and young. This observation seems to corroborate that of Stirling et al. (1981) that females with young may occur more frequently in coastal areas than some other population segments.

The 1980-81 kill at Barter Island was apparently rather nonselective. If in fact composition of the kill was determined mainly by availability, it seems likely that females and family groups would be a major component. This hypothesis is born out by the available harvest. On site reports suggest that family groups were killed. Further, the nine recovered skulls were from small to medium sized bears. None were large enough to be from mature males, although many could have been from subadult males.

Although polar bear populations may be able to sustain fairly sizable harvests of the male segment, the sustainable yield of females is very small. The new information on polar bear movements sugests harvests of the size that occurred in autumn 1980 near Barter Island would, if repeated for just a few years cause widespread depletion of polar bears. Fortunately, the heavy kill near Barter Island was not repeated in 1981-82.

Polar Bear Maternity Denning 1982

Fourteen radio-tracking collars were attached to adult female polar bears during the fall 1981 catching season near Barter Island. Eight of those were accompanied by cubs at the time of capture and would not be expected to breed again until spring 1983. Three of the females were accompanied by yearlings and should have bred during spring 1982. We hoped that the remaining three females were pregnant at the time of instrumentation so they could be followed to their maternity dens.

Only one instrumented female (#697) is known to have entered a den during the winter of 1981-1982. Bear #6160 moved north and then east, and was located on 18 December 1981, at 70°14' N. latitude 139°10' W. longitude . This bear was estimated to be 5 years old at the time of capture. If she was pregnant in 1981, it would have been her first time. Although it is possible she could have denned after 18 December, it seems more likely that she was not pregnant at the time of capture. She was relocated again on 31 August 1982, at 70°20' N. 145°32' W. At that time she appeared in excellent condition but was still traveling alone suggesting she was not pregnant at the time of capture.

Bear #6173 was a large, parous female captured as she headed toward Camden Bay on 4 November. We assumed she was enroute to establish a den in that area. However, on 13 January 1982, her signal was relocated approximately 30 miles out to sea. She could not be seen, and the steady pulse suggested either she was inactive or that she had removed the radio. For a large bear she appeared to have a very small head and loss of the collar was feared. Subsequent relocations in February and March corroborated the hypothesis that she had removed her radio, since the movement during that interval corresponded with suspected ice movements. The ice was very active and motile in January and early

February at the time the transmitter moved westerly, and extremely tight and stable in late February and March, at which time the transmitter moved very little.

Bear #697, originally captured 50 miles northwest of Tuktoyoktuk in 1972, was tagged on Barter Island 19 October 1981. She was relocated 35 miles to the northwest of Barter Island on 15 November 1981, but turned around and was observed digging a den near Demarcation Bay (N. 69°32' W. 141°25') on 14 November 1981. She occupied that den until on or about 26 March 1982, when she emerged with two cubs. She was observed in or in the vicinity of the den between 29 March and 31 March at which time she headed out to sea at a rapid pace. By 18 April she had moved at least 40 miles eastward. Unfortunately, during this period aircraft problems prevented us from either recapturing her, or closely monitoring her progress. We do know, however, that she and her cubs moved between 6 and 8 miles during 4 hours of observation on the day they left the den site for the sea.

Although #697 was the only radio-collared female we tracked to a maternity den, three other dens were located. Bear #6212 and her two cubs were captured on 20 April approximately 6 miles west of the Barter Island DEW Site. They were found in a fast ice zone and tracks suggested they had been wandering around in an approximately 1/2 mi^2 area for at least a week. A heavily used den entrance was observed from the air near the center of the track marked area. Unfortunately it was dark by the time handling the three bears was completed so we elected to return to relocate and examine the den the next day. As might have been expected, a wind and snowstorm moved in that night erasing all traces of the den.

We can't be sure the den we saw was a maternity den. The opening was at the base of a weathered pressure ridge in secure land fast ice, and it could have been merely a temporary den. However, the bears had occupied that area for an extended period during which the weather was clear and mild. There was nothing to eat nearby suggesting the obvious activity in the area might have been related to acclimation of the cubs. The tracks seemed to mill about within an elliptical area and no obvious tracks led in or out. Even if the observed den opening we saw was not a maternity den, it seems likely that the den was nearby. After tagging, bear #6212 and cubs remained near Barter Island rather than moving rapidly eastward as #697 had done. Sixteen days after capture they were only 5 miles from the capture site.

On 19 October 1981, we observed a freshly dug hole in a steep snowbank near Pokok Lagoon N. 70°02' W. 142°41'. At a distance of one-fourth mile we could see fresh tailings and what appeared to be a bear's head protruding from the opening. For fear of disturbing the animal we did not fly closer. The opening was maintained by frequent digging despite several storms until at least 27 October. Some time between 27 October and 2 November, the bear discontinued maintaining the opening, but we suspected she was still there.

During spring 1982, we looked unsuccessfully for a sign this den was still in use. However, on 22 March during a period of several days when weather prevented flying, Jonas Ningeak and other residents of Kaktovik saw a female bear and two new cubs on the bluff right where the den had been in the fall. Coincidence seems an unlikely explanation of the juxtaposition of these bears and the den we observed, so I feel reasonably safe assuming the two were linked.

The last den located in 1982, was found on the Lisburne Peninsula by members of a NOAA survey team. It was located a few miles east of Cape Sabine (68°55' N. 164°14' W.) on a bluff only 100-200 feet from the beach. No bears were seen, but adjacent to the main den entrance were numerous tracks, depressions, and signs of digging suggesting a maternity den site. Tracks of at least one cub were observed. This den had apparently been abandoned by 8 April.

We obtained evidence of Alaskan polar bear denning in two other cases. In the first case, female #6222 and her new cub were captured on 27 April about 15 miles northwest of Barter Island (70°15' N. 144°03' W.). Presumably, these bears had emerged from a den in the Barter Island area. The second case involved a female with a new cub seen by seismic crews and by photographer Bill Bacon about 2.5 miles offshore in Harrison Bay (70°52' N. 151°15' W.) This sighting occurred on 3 March suggesting the pair could not have been far from their denning site, and perhaps that seismic or related activities had prompted the bears to make an early departure.

Future Studies

During the next two years Alaskan polar bear research programs will continue to address the objectives identified earlier. Particular emphasis will be applied to the issues of polar bear movements and the distribution of denning in the Beaufort Sea. Mark and recapture and conventional radiotelemetry will continue as important tools of our studies. Population modelling and other analyses of population structure will continue in cooperation with other nations involved in polar bear research. Also, we will continue to examine the possibilities of monitoring polar bear movements and activities by satellite.

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Table 1. Drugs used to immobilize and sedate polar bears during 1981 and 1982 tagging seasons.

Brand name	Generic name	Function	Concentration	Manufacturer
M-99	Etorphine	Immobilizer Anesthetic Analgesic	1 mg/cc	Lemmon Company
M-5050	Diprenorphine	M-99 antagonist	2 mg/cc	Lemmon Company
Sernylan	Phenyclidine hydrochloride	Immobilizer Anesthetic Analgesic	100 mg/cc	Parke, Davis & Company
Valium	Diazepam	Tranquilizer Muscle relaxant Sedative	5 mg/cc	Roche
Sparine	Promozine hydrochloride	Tranquilizer Muscle relaxant Sedative	50 mg/cc	Wyeth
Acepromazine	Acepromazine malleate	Tranquilizer Muscle relaxant Sedative	10 mg/cc	Ayerst

Table 2. Composition of polar bear catch, 1981-1982.

Sex/age group	Spring 1981[a]	Fall 1981[b]	Spring 1982[b]
M cubs	0	5	3
F cubs	0	6	0
M yearlings	5	1	7
F yearlings	2	4	4
M 2 year olds	0	0	1
F 2 year olds	5	0	3
M subadult	2	8	5
F subadult	0	2	4
M adult	7	3	25
F adult	15	14	21
Total	36	43	73

	Litter size	Cubs	Yearlings	2 year olds
Spring 1981[a]	1	0	3	3
	2	0	2	1
Fall 1981[b]	1	5	1	0
	2	3	2	0
Spring 1982[b]	1	1	3	2
	2	1	4	0

[a] Cape Lisburne area.

[b] Barter Island and Prudhoe Bay area.

Table 3. Comparison of locations where polar bear groups were captured in 1981 and 1982.

Distance from capture center*	Spring 1981 N = 24 Nautical miles	Autumn 1981 N = 27 Nautical miles	Spring 1982 N = 51 Nautical miles
Mean	40.3	10.7	34.5
High	100	32	80
Low	13	0	0
SD	17.4	11.93	15.8
Distance from coast			
Mean	34.8	6.4	28.2
High	98	30	54
Low	5	0	0
SD	19.8	8.7	13.1

* Cape Lisburne, Barter Island, and a combination of Barter Island and Prudhoe Bay, respectively, during spring 1981, autumn 1981, and spring 1982 seasons.