



DAVIS STRAIT POPULATION SURVEY  
INTERIM REPORT - 2007

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## **Davis Strait Population Survey Interim Report – 2007**

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### **Project Partners:**

- Nunavut Wildlife Management Board
- The Qikiqtaaluk Wildlife Board
- Hunter and Trapper Organizations (HTOs) of the communities of Pangnirtung, Iqaluit and Kimmirut, Nunavut
- Newfoundland & Labrador Department of Environment and Conservation, Rebecca Jeffery
- Makivik Corporation, Dr. Bill Doidge
- Parks Canada, Angus Simpson

### **Project Title: Davis Strait Population Inventory**

### **Summary**

This document reports on interim progress and preliminary results of the Davis Strait polar bear population survey conducted by the Department of Environment, Government of Nunavut and its partners. The third and final field season of a 3-year mark-recapture survey of the Davis Strait polar bear population occurred in 2007. The preliminary results reported here include capture information from all three years, a population estimate and preliminary survival estimates based on the 3-years of mark-recapture effort. We estimate the population size to be approximately 2,200 polar bears. The survival estimates are known to be biased low because of the relatively short capture histories (three years), compared to the life span of polar bears. In the coming year, we will work on a complex population estimation model that will incorporated 34 years of mark, recapture and harvest data to better estimate both survival and population size. This

information will then be used to evaluate population growth and status (*i.e.*, is the population increasing, stable or decreasing). From this assessment of status, we will determine if the total allowable harvest will need to be reconsidered.

## Introduction

Here we report on the 2007 field season of mark-recapture work on the Davis Strait (DS) polar bear (*Ursus maritimus*) population. The 2007 field season was the final annual season in a 3-year mark-recapture survey. The primary goals of the population survey have been to estimate population size and demographic rates to ultimately provide a recommendation for a revised Total Allowable Harvest (TAH) for the population.

The Davis Strait polar bear population ranges from approximately Nain, Labrador (56° 32' N, 61° 40' W) north to Cape Dyer, Nunavut (66° 40' N, 61° 22' W), on Baffin Island (Figure 1; Taylor *et al.* 2001). The population is bounded to the west by the Baffin Island, and extends into Hudson Strait, where it is bounded to the west near Kimmirut, Nunavut and to the south by Ungava Bay in northern Quebec. In the southern range of the population, the population is delineated by the eastern coast of Labrador. The population extends during winter east and north on the sea ice to the southwest coast of Greenland.

The south Baffin and Labrador portion of the DS population was last inventoried in the mid 1970's by the Canadian Wildlife Service (Stirling *et al.* 1980, Stirling and Killian 1980). The fieldwork at this time was done in spring, when most of the bears were offshore and unavailable to capture teams. The resulting population estimate was 750 (DS + 70 (Labrador) = 820 (Stirling *et al.* 1980, Stirling and Killian 1980, Stirling and Parkinson 2006), and would not have sustained the combined (Nunavut, Quebec, Labrador, and Greenland) kill over the last 20 years. However, recent observations suggest that the population has increased in number and expanded in range. Based on traditional knowledge, the population estimate was increased to 1400 in 1996, the number required to sustain the historical kill. This estimate was increased to 1650 in 2004 based on traditional knowledge reports of a continued increase in numbers.

The DS population is managed within jurisdictions of Greenland (Denmark), Newfoundland and Labrador, Quebec and Nunavut. The Canadian federal and provincial/territorial Polar Bear Technical Committee currently considers the DS population to be stable. However, the uncertain nature of the population estimate makes any status determination subjective, and presents an obstacle to economic development (sport hunting and quota increase), and to the development of inter-jurisdictional co-management agreements between Nunavut, Labrador, Quebec, and Greenland. Within Nunavut, polar bears are harvested from the DS population by residents of Pangnirtung, Iqaluit, and Kimmirut. Currently, the combined annual quota for these communities is 46 bears. This includes bears taken by sport hunters outfitted from these

communities and any defense kills. Residents of communities in Quebec, Labrador, and Greenland also harvest from this population. Labrador has a harvest quota of 6 bears and Quebec does not restrict the number of polar bears that are hunted by a quota system. Greenland instated a quota system for the first time on January 1<sup>st</sup> 2006, though few bears are harvested from the DS population.

### **Project Objectives (2007)**

- Complete the final field year of the 3-year mark-recapture survey.
- Provide a preliminary size estimate for the DS polar bear population.
- Provide preliminary annual apparent survival estimates.

### **Materials and Methods**

#### ***Field work***

In 2007 we conducted the survey during August - September, when the bears are restricted to land due to open water. At this time, bears occur on the east coast of Labrador, the Nunavut islands in Ungava Bay, Hudson Strait, the Ungava Coast of Quebec, and the southern coast of Baffin Island east of Kimmirut into the distal ends of Frobisher Bay and Cumberland Sound, and the east coast of Baffin Island north to Cape Dyer (Figure 2). We used a Bell 206L Helicopter to survey the entire coastline of the study area, including off-shore islands. Inland transects were also flown. Every bear observed was captured, providing that the capture was safe for bears and crew. Bears were immobilized with Pseudarts and Palmer darts with Zoletil (tiletamine hydrochloride and zolazepam hydrochloride) at approximately 5 mg/kg. Each immobilized bear was given a unique capture number (ear tags and lip tattoo). Capture numbers were recorded for the recaptured bears. The data collected from each bear included straight line body length, greatest breadth of zygomatic arch, chest girth, an index of body condition, approximate age, tooth wear, sex and location and date of capture. Research samples collected from each bear include hair, tissue, claw tips and a premolar tooth.

#### ***Estimates of Population Size and Survival***

We used the open population Cormack-Jolly-Seber model to estimate apparent survival (*i.e.*, not natural survival; these estimates include harvest) estimates from three years of mark-recapture data. These survival estimates will be biased low as they only use 3 years of data, yet the polar bear is a long-lived species. Therefore these survival estimates must be treated as preliminary, until a large model including the 34 years of mark-recapture-recovery data for Davis Strait is created and analyzed.

An abundance estimate was derived using the Horvitz-Thompson estimator (McDonald and Amstrup 2001),  $n_i/p_i$ , where  $n_i$  is the number of animals marked in year  $i$ , and  $p_i$  is the catchability of bears in year  $i$ .  $p_i$  is derived, along with survival,  $Phi_i$ , with a Cormack-Jolly-Seber open population model. With these three years of data, an estimate of population size, referenced to the middle year, 2006, is available, although data from 2005 – 2007 were used. Abundance,  $p_i$  and  $Phi_i$  were estimated for each sex and age class separately. We used multi-model inference and the Akaike information criterion,  $AIC_c$  (Burnham and Anderson 1998) to evaluate whether  $p_i$  and  $Phi_i$  were better estimated for each sex separately or together. We used parameters from the class-specific model with the lowest  $AIC_c$ .

### **Preliminary Results**

In 2007, 886 polar bears were caught and released in Davis Strait. There were three capture mortalities (Appendix). Table 1 shows the number of polar bears caught and released in each year of the mark-recapture effort, and Figure 1 shows the distribution of captures of bears in all three years. In 2007, the proportion of the animals that were recaptured from previous marking efforts was 0.48. Table 2 shows the numbers and proportions of bears caught in all three years in the different sex and age classes.

The abundance estimate estimated using the Horvitz-Thompson estimator is  $2252 \pm 72$  (SE) polar bears in Davis Strait. The apparent (*i.e.*, total) survival rates and capture rates for all sex and age classes are shown in Table 3. Apparent survival includes mortality due to harvest. These survival estimates should be treated as preliminary, as it is very likely that actual survival rates are higher. A large model containing 34 years of data from Davis Strait is currently being built; such a model is more appropriate for the estimate of survival of long-lived animals such as polar bears.

Over the course of the three years in this mark-recapture effort, there were 2,360 immobilization-capture events of polar bears in Davis Strait; this represented 1,063 different individuals. Over these three years, this represents a capture mortality rate of 0.003 ( $n = 7$  events).

### **Discussion and Management Implications**

An estimate of 2,252 polar bears in Davis Strait is higher than the estimate upon which the current TAH is based (1,650 bears). However, it is premature to recommend with confidence changes to TAH based on this estimate, as we have yet to estimate status of the polar bear population, *i.e.*, whether it is currently stable, increasing or decreasing.

Table 1. Polar bears caught and released in the different jurisdictions of the Davis Strait Population from 2005 – 2007.

	Labrador			Nunavut			Quebec			Davis Strait (Total)		
	2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
Adults	34	83	90	381	437	466	8	16	18	423	536	574
Sub-adults	2	11	19	97	136	117	5	8	5	104	155	141
Yearlings	3	15	24	36	56	73	2	2	4	41	73	99
COY	1	23	12	49	52	47	5	2	2	55	77	61
All Bears	40	132	147	563	681	714	20	28	29	623	841	886

Table 2. Polar bears of different reproductive status caught (not necessarily released) and in parentheses, the frequency by total caught, in the Davis Strait Population in from 2005 – 2007.

Sex/Age-class/Family status	2005	2006	2007
Female COY	20 (0.03)	40 (0.05)	28 (0.03)
Female yearlings	15 (0.02)	34 (0.04)	56 (0.06)
Female sub-adults (2-5)	61 (0.10)	74 (0.09)	74 (0.08)
Female adults with no cubs	81 (0.13)	99 (0.12)	152 (0.17)
Female adults with 1 COY	22 (0.04)	22 (0.03)	14 (0.02)
Female adults with 2 COY	16 (0.03)	27 (0.03)	17 (0.02)
Female adults with 1 yearling	14 (0.02)	24 (0.03)	23 (0.03)
Female adults with 2 yearlings	13 (0.02)	25 (0.03)	25 (0.03)
Male COY	35 (0.06)	37 (0.04)	34 (0.04)
Male yearlings	26 (0.04)	39 (0.05)	42 (0.05)
Male sub-adults (2-5)	43 (0.07)	81 (0.10)	67 (0.08)
Male adults	277(0.45)	339 (0.40)	346 (0.39)
Total Bears	623	841	

Table 3. Apparent survival, catchability and abundance for age-sex classes of polar bears in Davis Strait. These survival estimates are expected to be biased low because of the short, 3-year data set.

	Apparent Survival	SE	Catchability	SE	Abundance	SE
<u>COY</u>						
females	0.59	0.15	0.25	0.10	160.00	24.13
males	0.59	0.15	0.25	0.10	144.00	22.89
<u>Yearlings</u>						
females	0.97	0.20	0.48	0.12	70.83	9.27
males	0.97	0.20	0.48	0.12	83.33	10.06
<u>Sub-adults</u>						
females	0.96	0.19	0.26	0.08	284.62	30.23
males	0.90	0.05	0.64	0.13	126.56	8.91
<u>Adults</u>						
females	0.82	0.03	0.25	0.03	791.39	49.33
males	0.76	0.04	0.57	0.05	591.23	21.31
<u>TOTAL</u>					2251.96	71.93

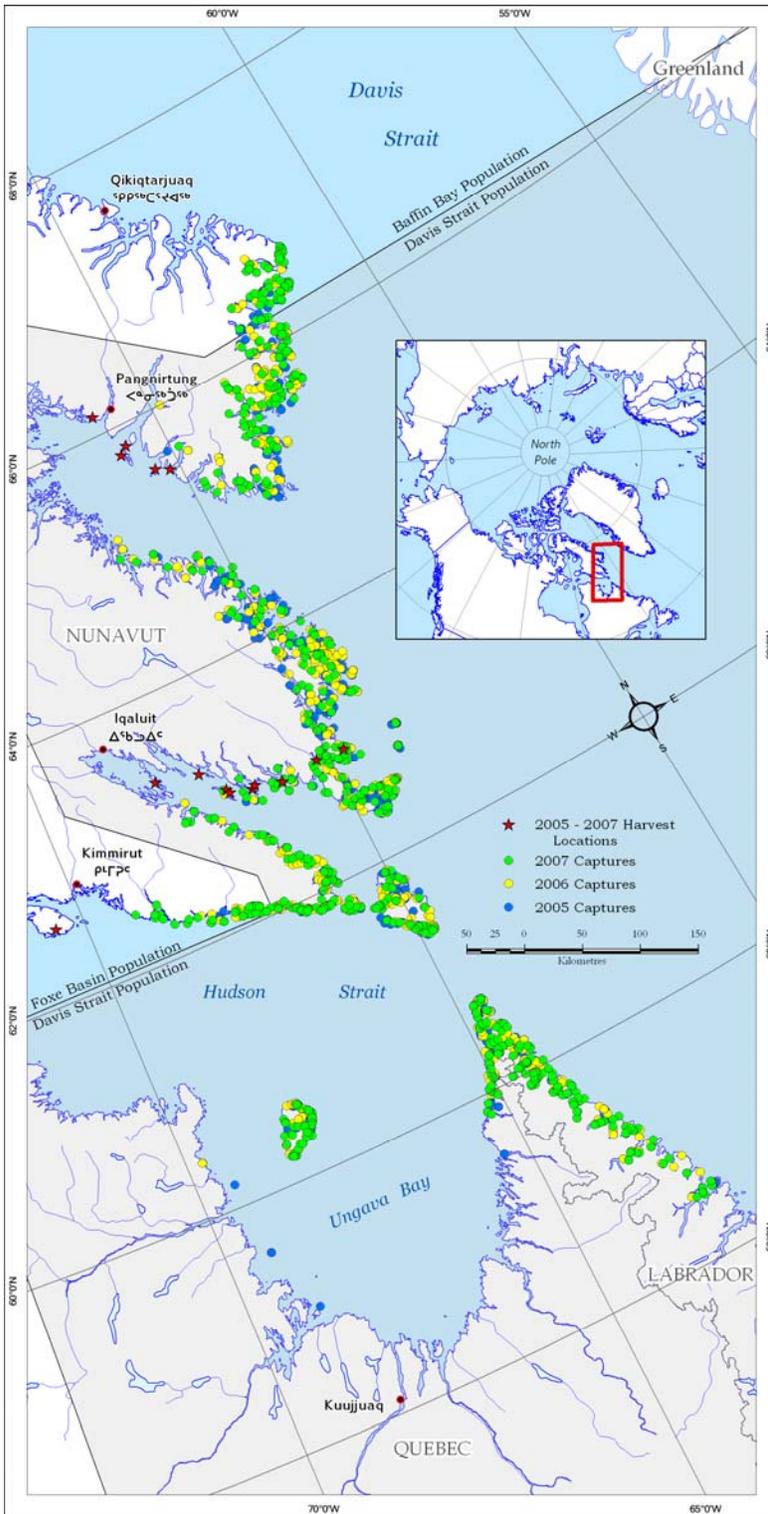


Figure 3. Distribution of Davis Strait Polar Bear captures in from 2005 through 2007.

## **Reporting to Communities**

All of the affected communities in Nunavut were visited 3-4 times for general consultations on polar bear research and management in association with the Polar Bear Memorandum of Understanding (MOU) initiative, which was signed by all the communities and the Qikiqtaaluk Wildlife Board (QWB). Each community in Nunavut and the Regional Hunter's and Trapper's Organizations (HTO) were visited again in 2000 and 2003, and at the QWB annual general meeting in fall of 2000, 2001, 2002, and 2003.

Community consultation took place in 1997, 2005 and 2006 specifically for the Davis Strait Population Inventory; the communities are fully in support of this work. The biologist also recently reported on the status of the Davis Strait population survey in November 2006. An additional community consultation occurred in Nain, Labrador in December 2006. The biologist gave a summary of results of the 2007 season at the Qikiqtalluq Wildlife Board meeting in Iqaluit, Nunavut in November 2007.

Makivik Corporation contributed in terms of in-kind support of fuel, groceries and staff time for the portion of the inventory occurring in Nunavik, Quebec. The Labrador Inuit Association (LIA) also supports our population survey.

Local hunters and Government of Nunavut wildlife officers have participated in the research. A local representative from Nain, working for Parks Canada, participated in the research in Labrador.

A Wildlife Research Permit was requested and reviewed by the affected communities each year.

The results of this study will be provided to the community in several formats. Both interim and final results will be provided as translated summaries.

On completion of the data analysis, the results will be conveyed to the communities during a series of workshops culminating in revised polar bear MOU's. Formats will include computer graphics, posters, handouts, local radio, and oral presentations. File interim reports will provide timely detailed summaries until the results have been published in peer-reviewed journals.

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## **Appendix: Polar bear capture mortalities**

### **August 10<sup>th</sup>, subadult female, Labrador**

On 24 August 2007, a dead polar bear was found on Upernavik Island, Saglek Fiord, Labrador. This bear had not moved from the site of chemical immobilization on 10 August 2007.

The 2-year old female was immobilized using a cap-chur dart from a helicopter, and tagged (X18037) on 10 August 2007 on Rose Island, Labrador. This bear was captured previously as a cub-of-the-year in 2005 on Big Island, Saglek Fiord, Labrador. The capture sheet states that the bear was caught on Rose Island, Labrador. However, Torngat National Park field personnel who were present both during the capture and when the dead bear was found indicated that the bear had not moved since immobilization. Thus the field location of "Rose Island" is probably a mistake on the capture sheet.

All field capture procedures were followed as per protocol. The individual was large for being 2-years old and was identified as an adult from the air. She was 187 cm in length, 143 cm in girth, with a zygomatic arch of 18.9 cm. She was in good body condition, and given a 3+, on a scale of 1 – 5, which translates to 'above average.'

The 'chase' of the bear was short. From time of spotting to time of the dart strike was 4 minutes; this interval includes the time to drop off two field staff. Thus the actual chase was likely about 1.5 minutes. The bear was pushed into the water to cool off before darting. The temperature was cool (around 10°C). The bear was darted at 11:32 am in the large neck muscle. The bear was immobilized very quickly, in two minutes.

Likely because of her larger size, the biologist gave her a dose for an adult *i.e.*, 2,000 mg of zolazepam-tiletamine (ZT), likely resulting in the fast immobilization. Therefore she received approximately 10 mg/kg, assuming the bear was a typical size of a subadult. Therefore, with respect to the usual dose (5 mg/kg) the bear was overdosed by two-times. However, because of the size of the individual, she was likely overdosed at a lower margin (*i.e.*, between 5 and 10 mg/kg). The margin of error in overdose of ZT is wide. Stirling *et al.* (1989) reported 18 bears dosed between 11 – 22 mg/kg, all recovering normally. Further, personal communication from wildlife veterinarian Marc Cattet, after receiving the report of this particular incident, doubts that the dose would have resulted in non-recovery in a healthy bear. It is unlikely that this bear died due to an overdose.

The temperature in the days following the immobilization was low fluctuating between 3 and 10°C. In fact, the polar bear capture team worked only ½ day on 11 Aug, and did not work on 12 and 13 Aug due to poor weather (wind, rain). It is therefore unlikely that high ambient temperature interfered with thermoregulation of the immobilized bear.

The park personnel who found the dead bear were not trained in necropsy, and therefore it is unknown if there were any organ abnormalities, which may have exacerbated the stress of capture. No physical trauma was indicated during the capture. No evidence of predation was found.

The cause of this capture mortality remains unknown.

### **September 9<sup>th</sup>, Adult male, Nunavut**

On 9 September, 2007, the biologist darted a large adult male (approximately 10 - 12 years old) with 2,000 mg of ZT (5 mg/ml in a 10 ml cap-chur dart) by helicopter on a small off-shore island in Touak Fiord, Nunavut. The bear was at the edge of the water, but still in the water, when the dart hit the large neck muscle. The edge of water was defined by a steep bedrock slope. Within 10 seconds of the dart strike, the bear began to become immobilized and could not step up the rocks out of the water. As soon as the biologist realized that something very unusual had occurred, and that the bear was indeed becoming immobilized, she jumped out of the helicopter onto the rocks and attempted to get a rope around the still-active bear's neck. Unfortunately, due to the delay of about 30 seconds – 1 minute after the dart strike, the steepness of the rocks, the

immediate depth of the water and the large swells moving the bear's body, she was unable to get the rope around the neck. The bear died due to drowning.

Although unusual, sometimes a dart needle hits an arterial vessel. When the dart is placed in the neck (the intended target), in such instances, drug is delivered to the brain within a few seconds. This likely occurred in this situation.

The bear was skinned and examined. The heart and lungs were in healthy condition.

It will be difficult to avoid similar situations in the future, as the exact point of penetration of the dart cannot be controlled. Now that this has happened for the first time for this particular biologist, she will understand that this can happen and be better prepared. With these types of occurrence, comes experience. The only thing that can be done to better prepare for these unusual occurrences is primarily to know that it can occur, and to always have ropes ready for rescue. Lastly, avoiding steep areas can always be possible, however this can eliminate many successful captures.

### **September 13<sup>th</sup>, female cub-of-the-year, Nunavut**

On 13 September, the biologist darted a mother with two cubs-of-the-year and a mother bear (X18348) on the top of Mermaid Island in Mermaid Fiord, Nunavut. The cubs were both given appropriate dose of 5 mg/ml of ZT (3 mL pneu-dart) from the helicopter. They were darted on-land as they crouched, touching their immobilized mother. This is normal capture procedure. As also with normal procedure, the helicopter backed off, and the cubs remained with their mother. At this point, the biologist (in the helicopter) went to pick up two field staff that were dropped off away from the area of darting. When the field crew returned to the site of darting, the cubs had moved from the mother to a pond of water, approximately 15 yards from the mother. The biologist ran to the cubs and carried them out of the water. The cubs' mouths were in shallow water at the bank of the pond (approximately 10 cm). It appears that the cubs left the mother to drink water and then became immobilized at the banks' edge. The biologist was able to save one cub (male), but not the second (female). Field staff tried to resuscitate the cub using artificial respiration.

To avoid a similar situation in the future, the capture crew should not leave darted cubs to pick up other staff, until the cubs have become immobile. This will add some helicopter time, however it is worth not having the possibility of the cubs leaving the mother and getting into danger.