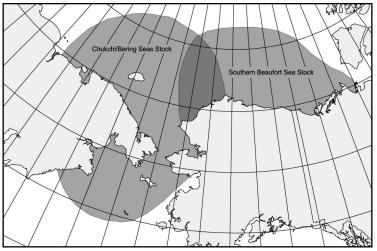## POLAR BEAR (*Ursus maritimus*): Southern Beaufort Sea Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Polar bears are circumpolar in their distribution in the northern hemisphere. They occur in several largely discrete stocks or populations (Harington 1968). Polar bear movements are extensive and individual activity areas are enormous (Garner *et al.* 1990, Amstrup 1995). The parameters used by Dizon *et al.* (1992) to classify stocks based on the phylogeographic approach were considered in the determination of stock separation in Alaska. Several polar bear stocks are known to be shared between countries (Amstrup *et al.* 1986, Amstrup and Demaster 1988). Lentfer hypothesized that two Alaska stocks exist, the Southern Beaufort Sea, and the Chukchi/Bering Seas, based upon: (a) variations in levels of heavy metal contaminants of organ tissues (Lentfer 1976, Lentfer and Galster 1987); (b) morphological characteristics (Manning 1971; Lentfer 1974; Wilson 1976); (c)

Figure 1. Approximate distribution of the Southern Beaufort Sea polar bear stock. Dark shaded area represent distribution overlap with the Chukchi/Bering seas stock.

physical oceanographic features which segregate stocks (Lentfer 1974) and; (d) movement information collected from mark and recapture studies of adult female bears (Lentfer, 1983, Amstrup 1995) (Figure 1).

Past studies (Amstrup 1995) have shown that the eastern boundary of the Southern Beaufort Sea stock occurs south of Banks Island and east of the Baillie Islands, Canada. The western boundary is near Point Hope. The southern boundary of the northern Beaufort Sea stock in the Canadian Arctic was delineated by Bethke *et al.* (1996). There is minimal overlap between the southern and northern Beaufort Sea populations (Amstrup and Durner In prep). An area of overlap between the Southern Beaufort Sea stock and the Chukchi/Bering seas stock occurs between Point Barrow and Point Hope, centered near Point Lay (Garner *et al.* 1990, Garner *et al.* 1994, Amstrup 1995). Also telemetry data indicates that adult female polar bears marked in the Southern Beaufort Sea spend about 25% of their time in the northeastern Chukchi Sea, whereas females captured in the Chukchi Sea spend only 6% of their time in the Southern Beaufort Sea (Amstrup 1995). Activity areas of Southern Beaufort Sea females averaged 162,124 km^2 (range 12,730 to 596,800 km²) (Amstrup 1995).

Analysis of mitochondrial DNA indicates little differentiation of the Alaska polar bear stocks (Cronin *et al.* 1991, Scribner *et al.* 1997). Using 16 highly variable micro satellite loci, Paetkau et al. (1999) determined that polar bears throughout the arctic (16 populations) were very similar genetically. Genetically, polar bears in the Southern Beaufort Sea differed more from polar bears in the Chukchi/Bering Seas than from polar bears in the northern Beaufort Sea (Paetkau et al. 1999).

Past management regimes have consistently distinguished between the Southern Beaufort Sea and the Chukchi/Bering Seas stocks based on the biological evidence of the preceding information. The Inuvialuit of the Inuvialuit Game Council (IGC), Northwest Territories, and the Inupiat of the North Slope Borough (NSB), Alaska, polar bear management agreement for the Southern Beaufort Sea stock was delineated on stock boundaries described previously (Brower *et al.* in prep, Nageak 1991, Treseder and Carpenter 1989) and reaffirmed by the information in this stock assessment report.

POPULATION SIZE

Polar bears occur at low densities throughout their circumpolar range (DeMaster and Stirling 1981). They are long lived, mature late, have an extended breeding interval, and have small litters (Lentfer *et al.* 1980, DeMaster and Stirling 1981). Accurate population estimates for the Alaskan populations have been difficult to obtain because of low

population densities, inaccessibility of the habitat, movement of bears across international boundaries, and budget limitations (Amstrup and DeMaster 1988, Garner *et al.* 1992).

Minimum Population Estimate

Amstrup *et al.* (1986), Amstrup (1995), Amstrup *et al.* 2001, and McDonald and Amstrup (2001) present population and variance estimates. Amstrup *et al.* (1986) estimated the Southern Beaufort Sea stock at 1,778 (S.D. $\pm$ 803; C.V. = 0.45) during the 1972-83 period. Amstrup (1995) estimated the Southern Beaufort Sea stock at around 1,480 animals in 1992.

Amstrup (unpublished data) using data for the 1986-98 period, excluding 4 years when sampling was not conducted, estimated the population size as 2,272 in 2001. This total population estimate was based on as estimate of 1,250 females (C.V. 0.17) and a sex ratio of 55% females from the best model (Amstrup and McDonald 2001). N_{min} is calculated as follows $N/\exp(0.842 * (\ln(1+CV(N)^2))^{\frac{1}{2}})$ and is 1,973 bears for population size of 2,272 and C.V. of 0.17. The female sex ratio estimate is treated as a constant and does not include an estimate of error. The population estimate applies to an area that extends from Pt. Barrow in the west, east to the Baillie Islands in Canada.

Current Population Trend

Prior to the 20th century, when Alaska's polar bears were hunted primarily by Natives, both stocks probably existed near carrying capacity (K). Once harvest by non-Natives became common in the Southern Beaufort Sea, the size of these stocks declined substantially (Amstrup 1995). Since passage of the Marine Mammal Protection Act (MMPA) in 1972, both stocks seem to have increased based on: (a) mark and recapture data; (b) observations by Natives and residents of coastal Alaska and Russia; (c) catch per unit effort indices (Amstrup et al. unpublished data); (d) reports from Russian scientists (Uspenski and Belikov 1991); and (e) harvest statistics on the age structure of the population. Recapture data on survival and recruitment for females from the Southern Beaufort Sea stock indicates a population growth rate of 2.4% from 1981 to 1992 (Amstrup 1995).

The most recent analysis confirms that the Southern Beaufort Sea stock experienced growth during the late 1970's and 1980's and then stabilized and experienced little or no growth during the 1990's (Amstrup et al. 2001). The indication that the population level appears to have stabilized is noteworthy. This stock has been assigned a recovery rate F_R of 1.0.

MAXIMUM NET PRODUCTIVITY RATES

Default values for R_{MAX} for Alaska polar bear stocks were not established at the La Jolla PBR workshop (Wade and Angliss 1997). Taylor et. al. (1987) estimated the sustainable yield of the female component of the population at < 1.6% per annum. The following information is used to understand the R_{MAX} determination. From 1981-92, vital rates of polar bears in the Southern Beaufort Sea were as follows: average age of sexual maturity (females) was 6 years; average COY litter size was 1.67; average reproductive interval was 3.68 years; and average annual natural mortality (nM), which varies by age class, ranged from 1-3% for adults (Amstrup, 1995). Natural mortality rates for juveniles are not available.

A Leslie type matrix of recapture data, which incorporated the best reproductive rates, and the best survival rates determined by the Kaplan Meir method, projected an annual intrinsic growth rate (including natural mortality but not human-caused mortality) of 6.03% for the Southern Beaufort Sea stock (Amstrup 1995). This calculation did not include human-caused mortalities and therefore represented the "natural" survival rate. This analysis mimics a life history scenario where environmental resistance is low and survival high. The calculation also assumes a 50M:50F population sex ratio which may result in a conservative estimate of R_{max} when populations are biased toward females (Amstrup, pers comm). More recent modeling efforts acknowledge that sustainable harvest rates are prone to effects from anthropogenic and natural changes as well as shortcomings in population knowledge. Issues involving global climate change and potential effects of persistent organic pollutants have also highlighted the uncertainty and risks inherent in making management decisions for polar bear populations.

POTENTIAL BIOLOGICAL REMOVAL (PBR)

In the following calculation: $(N_{MIN})(\frac{1}{2} R_{MAX})(F_r) = PBR$ (Wade and Angliss 1997) the minimum population estimate, N_{MIN} was 1,972; the maximum rate of increase R_{MAX} was 6%; and the recovery factor F_R was 1.0 since the population is believed to be within OSP. Assuming an equal sex ratio in the harvest, the PBR level for the Southern Beaufort Sea stock is 59 bears per year. In the Southern Beaufort Sea, the sex ratio of the harvest is approximately 2M:1F and thus the PBR level could be adjusted to 88 bears per year to account for male harvest bias. No more than 30 females may be harvested annually at the currently estimated population size.
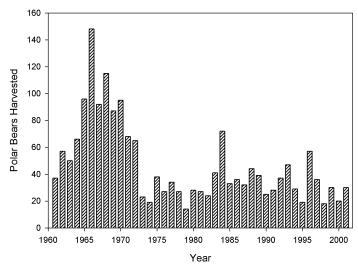
ANNUAL HUMAN CAUSED MORTALITY

Fisheries Information

Polar bear stocks in Alaska have no direct interaction with commercial fisheries activities.

Sport and Native Subsistence Harvest

Historically, polar bears have been killed for subsistence, handicrafts, and recreation. Based upon records of skins shipped from Alaska, the estimated annual statewide harvest for 1925-53 averaged 120 bears taken primarily by Native hunters. Recreational hunting using aircraft was common from 1951-72, increasing annual harvest to 150 during 1951-60 and to 260 during 1960-72 (Amstrup *et al.* 1986; Schliebe *et al.*1995). Aerial hunting has been prohibited since 1972. This reduced the mean annual combined harvest for both stocks to 105 during 1980-2001 (SD=53; range 41-297) (FWS unpubl. data). Figure 2 illustrates harvest rates and trend for the Southern Beaufort Sea stock from 1961-2001.

During the 1980-2001 period the Alaska harvest from the Southern Beaufort Sea

Figure 2. Annual Alaska polar bear harvest from the Southern Beaufort Sea stock, 1961-2001.

accounted for 34% of the total Alaska kill (annual mean=33 bears). The sex ratio of the harvest from 1980-2001 was 68M:32F.

A management agreement between Canadian Inuit and Alaskan Inupiat of the North Slope has been in place since 1988 (Nageak et al. 1990, Brower et al. in prep). Since initiation of this local user agreement in 1988, the combined Alaska/Canada mean harvest from this stock has been 55.1 bears per year which is less than the previously calculated annual harvest guideline of 81 (Brower et al. in prep.) and a PBR level of 59 bears, or the adjusted PBR level of 88 bears, as reported here. The harvest in Canada is regulated by a quota system. The harvest in Alaska is regulated by voluntary actions of local hunters provided the population is not depleted.

More recently, the 1995-2000 average Alaska harvest for the Southern Beaufort Sea in Alaska was 32.2 and the sex ratio was 71M:29F. During the same time period the average Canadian harvest for the Southern Beaufort Sea was 19.6 and the sex ratio was 62M:38F. The combined average annual Alaska and Canada harvest during the past five years was 51.8.

Other Removals

Orphaned cubs are occasionally removed from the wild and placed in zoos: two cubs were placed into public display facilities during the past five years. Also one research mortality occurred. Activities authorized through "incidental take" regulations, associated with the exploration, development, production, and transportation of oil and gas, may potentially impact polar bears and their habitat. Regulations to authorize incidental take of polar bear by industry may be developed if the effects of the activity result in negligible impact to the population. During the past five years no lethal take of polar bears occurred. Historically, three lethal takes related to industrial activities have been documented in the Southern Beaufort Sea: one at an offshore drilling site in the Canadian Beaufort Sea (1968); one bear at the Stinson site in the Alaska Beaufort Sea (1990); and one bear that ingested ethylene glycol stored at an offshore island in the Alaska Beaufort Sea (1988). Also in 1993, a polar bear was killed at the Oliktok remote radar defense site when it broke into a residence and severely mauled a worker.

STATUS OF STOCK

The Southern Beaufort Sea Stock is not classified as "depleted" under the MMPA or listed as "threatened" or "endangered" under terms of the Endangered Species Act. This stock is assumed to be within optimum sustainable

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population levels. The calculated PBR levels (59 or 88 adjusted) are greater than the average annual human harvest (55) and greater than the annual harvest guidelines (81) of the user group agreement between the Inuvialuit of Canada and the Inupiat of Alaska. The stock does not experience any incidental loss to commercial fishing. The Southern Beaufort Sea stock appears to be stable and is experiencing little or no growth. The Southern Beaufort Sea stock of polar bears in Alaska is designated a "non-strategic stock."

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