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

STOCK DEFINITION AND GEOGRAPHIC RANGE

Polar bears are found throughout the circumpolar arctic and occur in 19 subpopulations (http://pbsg.npolar.no/en/status/; Obbard et al. 2010), also known as stocks (Figure 1). Polar bear ranges are extensive and individual activity areas can be large (up to 167,000 km^2) (Garner et al. 1990, Amstrup et al. 2000). Six polar bear stocks have ranges extending into two or more countries (Amstrup et al. 1986, Amstrup and Demaster 1988, Obbard et al. 2010). Two polar bear stocks occur in Alaska, the Southern Beaufort Sea (SBS) and the Chukchi/Bering Seas (CBS) stocks (Figure 1). Together, the two stocks range throughout the Beaufort and Chukchi Seas, including the nearshore habitats. The stocks overlap seasonally in the eastern Chukchi and western Beaufort Seas. The SBS stock is managed by the United States and Canada and is also referred to as the Southern Beaufort Sea subpopulation when described by the International Union for Conservation of Nature, Polar Bear Specialists Group (IUCN- PBSG; Aars et al. 2006).

The distinction between the SBS and CBS stocks was originally determined by: (a) movement information collected from capture-recapture studies of adult female bears (Lentfer 1983); (b) physical oceanographic features that segregate stocks (Lentfer 1974); (c) morphological characteristics (Manning 1971; Lentfer 1974; Wilson 1976); and (d) variations in levels of heavy metal contaminants of organ tissues (Lentfer 1976, Lentfer and Galster 1987).

An extensive 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 2000, Amstrup et al. 2000, 2001a, 2002, 2004, 2005). 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).

Despite their overlap in ranges (Figure 2) and uncertainty in the exact delineation, the existence of two stocks is further supported by more recent information on contaminants (Evans 2004a, b; Kannan et al. 2007), movement data from satellite-linked collars (Garner et al. 1994, Amstrup et al. 2004, 2005), and population responses to sea ice loss (Rode et al. 2014). Additionally, very few bears in the CBS stock are observed denning within the range of the SBS stock (Rode et al. 2015), and similarly, very few bears in the SBS stock are observed denning in the range of the CBS stock (Durner et al. 2010).

Contaminants

Mercury (Hg), selenium (Se), and cadmium (Cd) concentrations in polar bear liver and kidney tissues were significantly higher in the SBS stock than in the CBS (Evans 2004a, Kannan et al. 2007, Routti et al. 2011), while the concentration of vanadium (V) in kidney tissue was higher in the CBS stock than in the SBS (Evans 2004a). In addition, Kannan et al. (2007) reported concentrations of trace elements of silver (Ag), bismuth (Bi), barium (Ba), copper (Cu), and tin

(Sn) were significantly higher in the CBS stock than the SBS stock.

In a separate study, Evans (2004b) analyzed the persistence of organochlorine (OC) contaminants, including polychlorinated biphenyls (PCB) congeners; dichlorodiphenyltrichloroethane (DDT) and its metabolites, including dichlorodiphenyldichloroethylene (DDE); and chlordane-related compounds (CHL) in polar bears from both stocks. While concentrations of OCs in the SBS and CBS stocks were relatively low compared to other polar bear stocks, concentrations of OCs were higher in the SBS than in the CBS stock. Dietz et al. (2015) also found that concentrations of organohalogen contaminants exceeded a toxic effect threshold for bears in Alaska, although the levels found there were the lowest of the stocks considered. Similarly, McKinney et al. (2011) found that polar bears in Alaska tended to have higher levels of DDT contamination than other regions.

Genetics

Several modern studies have investigated the genetics of polar bears throughout their range. Analysis of mitochondrial DNA and microsatellite DNA loci indicates little differentiation between the SBS and CBS polar bear stocks (Cronin et al. 1991, 2006, Scribner et al. 1997). Using 16 variable microsatellite loci, Paetkau et al. (1999) observed small differences in genetic distances between the SBS stock and CBS stock; however, a lack of dramatic genetic variation led researchers to conclude that polar bears belong to a single evolutionary significant unit. More recently Peacock et al. (2015) and Malenfant et al. (2016) characterized genetic structure of polar bears subpopulations into large clusters. Peacock et al. (2015) identified four clusters, and Malenfant et al. (2016) identified six clusters, with the SBS and CBS occupying the same cluster in both studies. While genetically similar, demographic and movement data indicate a degree of site fidelity, suggesting that the stocks should be managed separately, while recognizing that delineation of the CBS and SBS stocks includes a region of overlap (Amstrup 2000, Amstrup et al. 2000, 2001, 2002, 2004, 2005).

Distribution

The SBS polar bear stock is distributed predominantly throughout the central Beaufort Sea region. The western edge of their range is near Icy Cape, although the exact boundary between the SBS and the CBS stocks is uncertain. Amstrup et al. (2000) reported that the eastern boundary of the Southern Beaufort Sea stock occurred south of Banks Island and east of the Baillie Islands, Canada. However, analysis of polar bear movements using satellite telemetry from 2000 to 2006 (Amstrup et al. 2004, 2005), capture-recapture data (Regehr et al. 2006, Stirling et al. 2007), and harvest information suggest the eastern boundary for the SBS stock may be more appropriately located further west, near the village of Tuktoyaktuk, Canada.

Responses to Changing Sea Ice Conditions

In response to changes in sea ice characteristics and declines in sea ice habitat over the continental shelf during the summer and late autumn (Stroeve et al. 2014), some polar bears of the SBS stock have shifted their ranges to search for seals on ice and to access the remains of subsistence-harvested bowhead whales on land (Schliebe et al. 2008, Atwood et al. 2015a). Changes in distribution and movements, including increased land use during the summer, are expected to occur with increasing frequency in the future (Durner et al. 2009, Amstrup et al.

2007, Schliebe et al. 2008, Atwood et al. 2015a) and could lead to greater levels of human-polar bear conflict. Changing sea ice conditions have also led to more frequent observations of long-distance swims by polar bears in the SBS stock with the potential for significant energetic costs and impacts to survival (Durner et al. 2011, Pagano et al. 2012).

In addition, polar bears from the SBS stock have historically denned on both the sea ice and land, but thinning of sea ice in recent years may have contributed to a decline in the proportion of polar bears denning on the sea ice. Fischbach et al. (2007) found that the proportion of dens on the pack ice declined from 62% during the period from 1985 to 1994 to 37% during the period from 1998 to 2004. Currently, the primary terrestrial denning areas for the SBS stock in Alaska occur on the barrier islands from Barrow to Kaktovik, and along coastal areas up to 25 miles inland, including the Arctic National Wildlife Refuge to Peard Bay, west of Barrow (Amstrup and Gardner 1994, Amstrup 2000, Durner et al. 2001, 2006, 2013).

Polar bears are generally expected to experience nutritional stress as loss of Arctic sea ice continues (e.g., Stirling and Parkinson 2006, Amstrup et al. 2010, Rode et al. 2010). In some regions ice loss has apparently led to negative demographic effects (Regehr et al. 2007, 2010, Bromaghin et al. 2015), while in other regions polar bear subpopulations appear stable or increasing (Stirling et al. 2011, Peacock et al. 2013, Rode et al. 2014). In a recent study, Rode et al. (2014) found that SBS stock bears were responding differently to changing sea ice conditions compared to bears in the CBS stock. During the period from 2008 to 2011, bears inhabiting the Chukchi Sea were in better condition, larger, and appeared to have higher reproductive rates than bears inhabiting the southern Beaufort Sea (Rode et al. 2014).

In another study investigating climate effects on bears, Hunter et al. (2010) used the relationships between sea ice and polar bear vital rates estimated during the period from 2001 to 2006 to project the long-term status of the SBS stock under sea ice conditions as forecast by global climate models. The projection suggested there could be a high probability of significant population decline in the 21st century for the SBS stock. More recently, Bromaghin et al. (2015) analyzed demographic data from 2001 to 2010, and found similar evidence to Regehr et al. (2010) for expected low survival of all sex and age classes of polar bears in the mid-2000s. However, Bromaghin et al. (2015) also found survival of most sex and age classes of polar bears in the SBS stock increased during the period from 2007 to 2010, despite continued declines in the availability of sea ice.

POPULATION SIZE

Polar bears occur on sea ice at low densities throughout much of their range (DeMaster and Stirling 1981). Accurate estimates of abundance for the SBS stock have been difficult to obtain because of low population densities, inaccessibility of habitat, movement of bears across management and international boundaries, and budget limitations (Amstrup and DeMaster 1988, Garner et al. 1992). Research on the SBS stock began in 1967 and is one of only four polar bear subpopulations with long term (greater than 20 years) data.

Long term capture-recapture studies in the Beaufort Sea have provided several estimates of abundance of the SBS stock; however, direct comparison may be inaccurate due to varied sampling strategies and analyses. Amstrup et al. (1986) estimated abundance of the SBS stock to be 1,778 bears during the period from 1972 to 1983. The abundance in 1992 was estimated at

1,480 animals (Amstrup (1995). In 2001, Amstrup (USGS, unpublished data) approximated an abundance of 2,272 bears based on an estimate of 1,250 females and a sex ratio of 55% females (Amstrup et al. 2001b). In 2006, a capture-recapture study that sampled American and Canadian portions of the Beaufort Sea region from 2003 to 2006 estimated abundance of the SBS stock in 2006 to be 1,526 individuals (Regehr et al. 2006). A subsequent capture-recapture analysis during the period from 2004 to 2010 suggested a reduction in survival and abundance from 2004 through 2007 and subsequently, the population appeared to stabilize with improved adult and cub survival (Bromaghin et al. 2015). From this analysis they calculated an abundance estimate of approximately 900 bears in 2010 (Bromaghin et al. 2015). Possible negative biases in abundance estimates may exist due to variation in the intensity and geographic coverage of capture-recapture sampling (specifically, a lack of systematic sampling in some portion of the stock's Canadian range during the period from 2007 to 2010; Bromaghin et al. 2015). Thus, such possible negative biases necessitate a cautious interpretation of trends and point estimates of abundance for the SBS stock. Conservatively, the decline in abundance of the SBS stock seemed unlikely to have been less than 25%, but may have approached 50% (Bromaghin et al. 2015). Abundance estimates in Bromaghin et al. (2015) and previous analyses were based on capture-recapture sampling that ended at Barrow and did not extend farther west to where some polar bears from the SBS stock may be found. Data collection is ongoing and updated population estimates are expected in the future.

Minimum Population Estimate

Under the Marine Mammal Protection Act of 1972, as amended (MMPA), a "minimum population estimate" (N_{MIN}) is defined as "an estimate of the number of animals in a stock that is based on the best available scientific information on abundance, incorporating the precision and variability associated with such information; and provides reasonable assurance that the stock size is equal to or greater than the estimate."

For polar bears in the SBS stock, the most recent population estimate is approximately 900 animals in 2010, based on analysis of data during the period from 2001 to 2010 (Bromaghin et al. 2015). The corresponding N_{MIN} is calculated based on the lower 20th percentile of the sampling distribution for population size, using the methods of Wade (1998), as follows: $N_{MIN} = N/\exp(0.842 * (\ln(1+CV(N)^2))^{½}) = 782$ animals, where N = 900 animals and the coefficient of variation (CV) = 0.17 (Bromaghin et al. 2015).

This estimate may be biased low because the western extent of the study area (Point Barrow) fell short of the SBS stock range, which extend west of Point Barrow to Icy Cape (Obbard et al. 2010).

Current Population Trend

Although no quantitative information is available to estimate population status prior to the 20th century, polar bear harvest during that period was largely conducted by Alaskan Natives for subsistence (Schliebe et al. 2006), and the stock is, therefore, believed to have existed at or near its environmental carrying capacity. Harvest by non-Alaska Natives became common in the early 1960s, and the size of the stock declined substantially (Amstrup et al. 1986, Amstrup 1995). Sport harvest in Alaska was eliminated after passage of the MMPA in 1972, and the SBS stock increased in numbers for the following 20 years. This increase was based on: (a) capture-recapture data; (b) observations by Alaska Natives and residents of coastal Alaska; (c) live-capture of polar bears per unit effort indices (USGS unpublished data); and (d) harvest statistics. Additionally, recapture data from the SBS stock indicated a population growth rate of 2.4% from 1981 to 1992 (Amstrup 1995).

However, the SBS stock experienced little or no growth during the 1990s (Amstrup et al. 2001b). Evidence suggests that SBS stock experienced negative effects from habitat loss due to climate change. Declines in body size, body condition, and recruitment in recent decades have been associated with declining sea ice availability (Regehr et al. 2006, Rode et al. 2010, 2014). Further, Regehr et al. (2010) suggested several years of reduced sea ice in the mid-2000s were associated with low breeding probability and survival, leading to a negative population growth rate.

Relationships between sea ice and polar bear population dynamics in the southern

Beaufort Sea are complex and likely reflect a combination of factors, such as ecological variation and density effects. Reduced spatial and temporal availability of sea ice is expected to be an increasingly important factor in population dynamics of SBS stock polar bears. As the climate continues to warm, polar bears will likely experience reduced access to prey, reduced cub survival, and deficient body condition. Based on all available data, the IUCN-PBSG considered the current trend of the SBS population to be in decline (PBSG 2015). The Service supports this determination.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Direct estimates of maximum net productivity rates (R_{MAX}) are not available for the SBS stock, although values can be inferred based on capture-recapture studies in the region and knowledge of polar bear population dynamics. The following information was used to estimate R_{MAX}. During the period from 1981 to 1992 the population of SBS stock was increasing and vital rates of polar bears were as follows: average age of sexual maturity (females) was 6.0 years; average cub of year (COY) litter size was 1.7; average reproductive interval was 3.7 years; and average annual natural mortality ranged from 1.0-3.0% for adult age classes (Amstrup 1995). Using these data, Amstrup (1995) projected an annual intrinsic growth rate (i.e., natural mortality excluding human-caused mortality) of 6.0% for the SBS stock. More recently, survival and reproductive rates for the SBS stock for the period from 2004 to 2006 (Regehr et al. 2010) indicated that, under favorable sea ice conditions, the population was capable of increasing between 6.0% and 7.5% annually (Hunter et al. 2010). Because the SBS stock was not at a greatly reduced density when any of the preceding estimates were made, these estimates are likely lower than the maximum intrinsic growth rate for the population. For the purpose of this assessment, we use R_{MAX} of 7.5% as the current net productivity rate for the SBS stock but acknowledge that potential current and future effects of sea ice loss could lead to lower realized growth rates (Regehr et al. 2010, 2015 Bromaghin et al. 2015).

POTENTIAL BIOLOGICAL REMOVAL (PBR)

The MMPA defines Potential Biological Removal (PBR) level as the product of the minimum population estimate of the stock, one-half the maximum theoretical or estimated net productivity rate of the stock at a small population size, and a recovery factor (F_R) of between 0.1 and 1.0: $PBR = N_{MIN} X\ 0.5R_{MAX} X\ F_R$. Wade and Angliss (1997) recommend a default recovery factor (F_R) of 0.5 for a threatened population or when the status of a population is unknown. Therefore, we have calculated a PBR of 14 bears per year for the SBS stock using a N_{MIN} of 782, a R_{MAX} of 7.5%, and a F_R of 0.5.

ANNUAL HUMAN CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Polar bear stocks in Alaska have no direct interaction with commercial fisheries activities. Consequently, the total fishery mortality and serious injury rate for the SBS stock is zero.

Total Mortality

1. **Native Subsistence Harvest**

Alaska Natives have hunted polar bears for subsistence purposes for centuries (Lentfer 1976), and polar bears continue to be an important resource for the Inupiat and Yupik peoples of coastal communities throughout northern and western Alaska (Brower et al. 2002, Johnson 2002). Polar bears provide a source of meat and raw materials for clothing and handicrafts, and polar bear hunting is a source of pride, prestige, and accomplishment for Native hunters. Although polar bear hunting was prohibited by the MMPA in 1972, an exemption was made for Alaska Natives living in coastal communities to allow them to hunt polar bears for subsistence purposes and for the creation and selling of authentic native articles of handicraft and clothing, provided that take was not accomplished in a wasteful manner.

For the SBS stock, subsistence harvest is addressed through an agreement between the Inuvialuit of Canada and the Inupiat of Alaska (I-I Agreement; Brower et al. 2002). In 2010, Commissioners of the I-I Agreement recommended that the combined U.S.-Canada quota be reduced from 80 bears to 70 bears, shared equally between the countries (USFWS 2011). Subsequently, in Canada, the boundary of the SBS stock with the neighboring Northern Beaufort Sea (NBS) stock was adjusted through polar bear management by-laws in the Inuvialuit Settlement Region in 2013, affecting Canadian quotas and harvest levels from the SBS stock, the current subsistence harvest of 56 bears total (35 in the United States and 21 in Canada) reflect this change. For the most recent 10-year period, 2006-2015, an average of 19 bears per year were removed from the U.S. portion of the SBS stock (see Figure 3, which provides the annual estimated removals above each graph bar). The average sex composition of removals during this period was 27% female, 50% male, and 23% unknown. During the same time period the average Canadian harvest for the SBS was 14.2 bears per year with a sex ratio of 56 males to 44 females.

2. Other Mortality

Other forms of bear removals include those associated with accidental mortality during scientific research, during industrial activities, defense of life, and placement of orphaned cubs. Two research-related mortalities have occurred between 2005 and 2015. One removal occurred in 2005 and the other removal happened in 2009. Two mortalities occurred as a result of deterrence activities. In 2011, a bear was killed during a deterrence action by an oil and gas company. In 2012, another bear was killed during a deterrence action by a village bear patrol.

Under section 109(h) of the MMPA, orphaned cubs can be removed from the wild and maintained in a facility for the protection or welfare of the cub. Such a situation occurred in 2011, when an orphaned cub was removed from the Beaufort Sea coast and placed into a long-term care facility that has cooperative agreement with the Service, after it was discovered near an industrial facility.

In 2012, one adult female and her two-year old male cub were found dead on an island in northern Alaska. The true cause of their deaths remains unknown.

In 2014, two defense-of-life mortalities by non-Alaska Natives occurred with humans engaged in recreational activities. The first incident occurred in August 2014 at Bullen Point and the second occurred a week later in the Arctic National Wildlife Refuge.

STATUS OF STOCK

On May 15, 2008 (73 FR 28212), the Service listed all polar bears across their range as "threatened" under the Endangered Species Act of 1973, as amended (ESA). Due to this listing under the ESA, the polar bear is considered "depleted" under the MMPA, and the SBS stock is considered to be a strategic stock under the MMPA.

OTHER FACTORS THAT MAY BE CAUSING A DECLINE OR IMPEDING RECOVERY OF THE STOCK

1. Climate Change

Climate change has been identified as the primary threat facing polar bear populations, with the SBS stock occurring in an ecoregion with a high probability of becoming greatly decreased by mid-century (Atwood et al. 2016). Polar bears are adapted to life in a sea ice environment. They depend on the sea ice-dominated ecosystem to support essential life functions. Sea ice provides a platform for hunting, denning, feeding, and resting; seeking mates and breeding; movement to terrestrial maternity denning areas; and long-distance movements (Stirling and Derocher 2012). The sea ice ecosystem supports ringed seals (*Phoca hispida*), the primary prey for polar bears, and other marine mammal prey (Thiemann et al. 2008, Rode et al. 2014). In 2012, the National Marine Fisheries Service (NMFS) listed two prey species of polar bears, the Arctic subspecies of ringed seal (*Phoca hispida hispida*) and the Beringia distinct population segment (DPS) bearded seal

(*Erignathus barbatus nauticus*), as threatened species under the ESA (77 FR 76706 and 77 FR 76740; December 28, 2012). Both species were listed due to climate change and declines in population of either or both of these important prey species may have deleterious impacts on polar bears.

Sea ice is rapidly diminishing throughout the Arctic (Stroeve et al. 2012) and large declines in polar bear habitat have occurred in the southern Beaufort and Chukchi Seas between the period from 1985 to 2006 (Durner et al. 2009). In addition, it is predicted that the greatest declines in 21st century polar bear habitat will occur in Chukchi and southern Beaufort Seas (Amstrup et al. 2007, Durner et al. 2009, Douglas 2010). Patterns of increased temperatures, earlier onset of and longer open water periods, later onset of freeze-up, increased rain-on-snow events, and potential reductions in snowfall are occurring. In addition, positive feedback systems (i.e., the sea-ice albedo feedback mechanism) and naturally occurring events, such as warm water intrusion into the Arctic and changing atmospheric wind patterns, can operate to amplify the effects of these phenomena. The following changes have been documented in the southern Beaufort Sea: increased fragmentation of sea ice; an increase in the extent of open water areas seasonally; reduction in the extent and area of sea ice in all seasons; retraction of sea ice away from productive continental shelf areas during the summer; reduction of the amount of multi-year ice, and declining thickness and quality of shore-fast ice (Parkinson et al 1999, Rothrock et al. 1999, Comiso 2003, Fowler et al. 2004, Lindsay and Zhang 2005, Holland et al. 2006, Comiso 2006, Serreze et al. 2007, Stroeve et al. 2008).

The SBS stock appears to be experiencing effects of changing sea ice conditions (Hunter et al. 2010, Regehr et al. 2010, Rode et al. 2010, 2014, Bromaghin et al. 2015). Behaviorally, polar bears in the stock are have been observed shifting to greater use of land during later summer and autumn (Gleason and Rode 2009). Although relationships between sea ice and vital rates for polar bears are more complex than previously hypothesized (Bromaghin et al. 2015), sea ice loss and associated ecological changes are expected to have the greatest impact on SBS stock population dynamics, and long-term polar bear population declines are forecast if sea ice loss continues (Amstrup et al. 2007, Hunter et al. 2010). Traditional knowledge suggests that polar bears in the SBS stock may be getting smaller and changing denning patterns, potentially in relation to changing sea ice and climate conditions (Joint Secretariat 2015). The SBS stock appears to be vulnerable to large-scale, dramatic seasonal fluctuations in ice movements; decreased abundance and access to prey; and increased energetic costs of hunting. Hence, the Service is working with multiple partners on measures to protect polar bears and their habitats.

2. Subsistence Harvest – Combined U.S. and Canada

Recognition that management of polar bears in the SBS stock is shared between Canada and Alaska led to the development of the Inuvialuit-Inupiat Agreement (I-I Agreement) between the Inuvialuit of the Inuvialuit Game Council, Canada, and the Inupiat of the North Slope Borough, Alaska, in 1988 (I-I Agreement, Nageak et al. 1991, Treseder and Carpenter 1989, Prestrud and Stirling 1994, Brower et al. 2002). During the period from 1988 to 2014 (the most current data), the combined Alaska and Canada mean harvest from the SBS stock has been approximately 56 bears per year (USFWS unpublished data). During the more recent time period (2006-2015), removals due to human causes have been lower (approximately 33 bears per year in Alaska and Canada). The harvest in Canada is regulated by a quota system (Prestrud and Stirling 1994, Brower et al. 2002), which has resulted in accurate harvest reporting, strict controls on harvest, and efficient monitoring and enforcement. Between July 2011 and June 2016, 90 bears were harvested in the Canadian portion of the SBS, below the quota of 143 bears. The two most recently reported annual harvest in the Canadian portion of the SBS was 9 bears in 2014-2015 and 9 bears in 2015-2016; below the annual quota of 21 bears. The harvest quota established under the I-I Agreement in Alaska is voluntary and less efficient, overall, compared to the Canadian system (Brower et al. 2002).

Given the change of management boundary between the SBS and NBS stocks in Canada and evidence for population decline of the SBS stock (Bromaghin et al. 2015), harvest quotas should be reassessed to ensure harvest remains at a sustainable rate. Additionally, population data for the SBS stock need to be updated. The Service and its partners, including the North Slope Borough and Inuvialuit Game Council, are currently conducting harvest risk analyses and working with stakeholders to identify potential adaptive management strategies for the SBS stock.

3. Oil and Gas Development

Oil and gas development and shipping occur within the range of SBS stock polar bears. Increases in circumpolar Arctic oil and gas development, coupled with increases in shipping due to the lengthening open water season, increase the potential for an oil spill to negatively affect polar bears and their habitat. Oiled polar bears are unable to effectively thermoregulate, and may be poisoned by ingestion of oil during grooming (Øritsland et al. 1981) or eating contaminated prey (St. Aubin 1990). In addition, polar bears can be attracted to petroleum products and actively investigate oil spills. They also are known to consume foods fouled with petroleum products (St. Aubin 1990; Derocher and Stirling 1991).

The Service works to monitor and mitigate potential impacts of oil and gas activities on polar bears through Incidental Take Regulations (ITRs), as authorized under the MMPA. Under these regulations, oil and gas activities must: 1) ensure impacts to small numbers of polar bears remain negligible, 2) minimize impacts to their habitats, and 3) ensure no unmitigable adverse impact on polar bear availability for Alaska Native subsistence use. The ITR program also requires monitoring and reporting to provide a basis for the evaluation of potential impacts of current and future activities on polar bears. The Service has concluded that at current levels, oil and gas exploration posed a relatively minor threat to the bears of the SBS stock (81 FR 52276; August 5, 2016). Current ITRs for the southern Beaufort Sea region will expire in 2021.

While polar bears could be impacted by future onshore or offshore oil spills, historically the SBS polar bear stock has not been impacted by oil spills in the Beaufort Sea. Between 1985 and 2013, eight crude oil spills of amounts greater than 500 barrels occurred on the North Slope of Alaska, within the range of the SBS stock (BOEM 2014). These spills posed little risk to polar bears and no impact to polar bears from the spills were documented because the spills occurred in heavily industrialized areas during times of the year when polar bear use was low. In addition, no offshore exploration wells have been drilled (an activity which would increase the risk of an offshore oil spill) in the Beaufort Sea since 2003 (BOEM 2014).

Nonetheless, oil spills remain a concern for polar bears throughout their range, especially given the challenges of cleaning up spills in arctic waters (National Research Council 2014). Polar bears are most vulnerable to oil spills during times when they aggregate near onshore food resources, such as autumn polar bear aggregations near subsistence-harvested bowhead whale carcasses at Point Barrow, Cross Island, and Kaktovik (76 FR 47010; August 3, 2011). Potential impacts from an oil spill depend on the size, location, and timing of spills relative to polar bear distributions; and also on the effectiveness of spill response and clean-up efforts. Bears could also be affected indirectly either by food contamination or by chronic lasting effects caused by exposure to oil (St. Aubin 1990).

Although the probability of an oil spill affecting a significant portion of Alaska's polar bears in the foreseeable future is low, we recognize that the potential impacts from such a spill could be significant, particularly if subsequent clean-up efforts were ineffective. At present, the Service is working with industry, oil spill response agencies, public display facilities, and others to increase response capabilities for dealing with oiled or compromised bears in the event of a spill. In addition, the Service has updated its polar bear oil spill response plan. This plan is meant to help prepare and improve the Service's response capabilities by describing appropriate response strategies, clarifying response roles, obtaining the necessary training, and improving our capability for holding and treating oiled bears.

4. Shipping

Loss of Arctic sea ice has resulted in an increase of open water, which, in turn, has led to an increase in Arctic shipping. Given projections of an ice-free Arctic in summer months between 2020 and 2050 (Overland and Wang 2013) and an ice-free Arctic in the near future (Smith and

Stephenson 2013), the increase in shipping is expected to continue at a rapid pace.

Potential effects of shipping on polar bears include disturbance, increased fragmentation of sea ice habitat (from icebreakers), pollution, and the introduction of waste/marine litter (Polar Bear Range States 2015). Increased vessel traffic will also increase the chances of an oil spill from a vessel sinking, a tanker accident, ballast discharge, or discharges during the loading and unloading of oil at ports.

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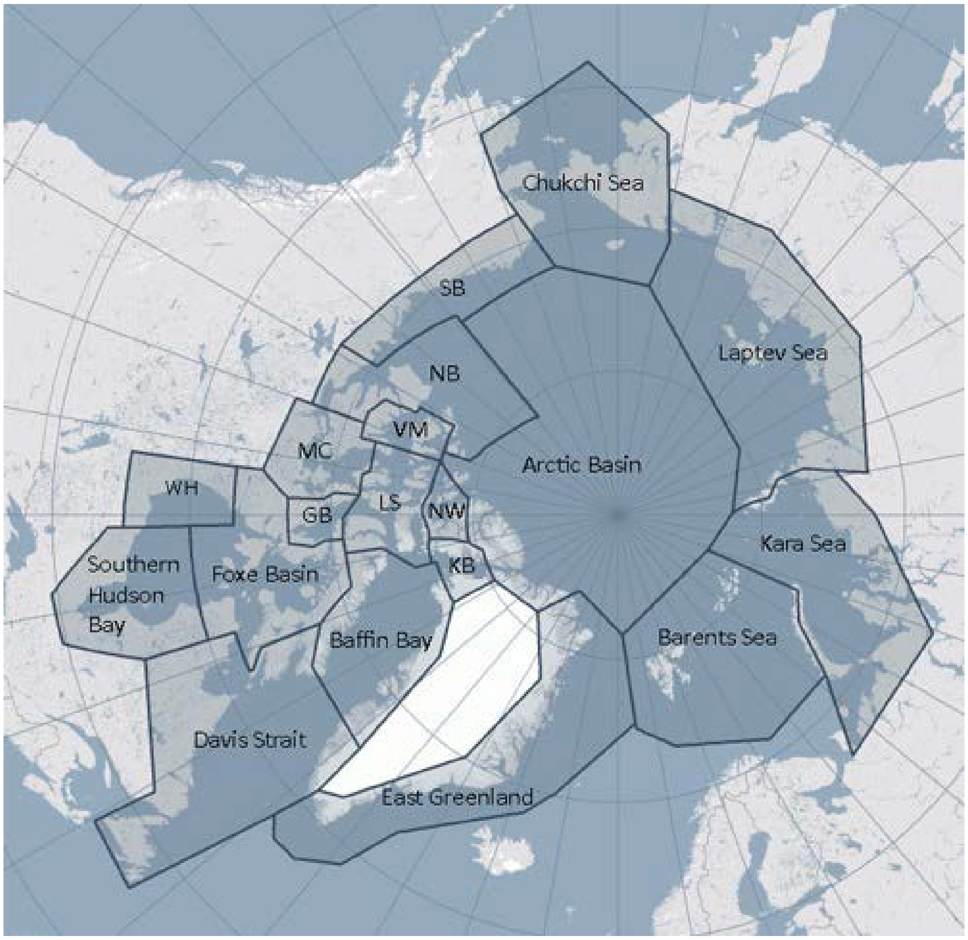

Figure 1. Map of the polar bear subpopulations: Southern Beaufort Sea (SB), Chukchi Sea, Laptev Sea, Kara Sea, Barents Sea, East Greenland, Northern Beaufort (NB), Kane Basin (KB), Norwegian Bay (NW), Lancaster Sound (LS), Gulf of Boothia (GB), McClintock Channel (MC), Viscount Melville (VM), Baffin Bay, Davis Strait, Foxe Basin, Western Hudson Bay (WH), and Southern Hudson Bay (source: Polar Bear Specialist Group: http://pbsg.npolar.no/en/status/population-map.html).

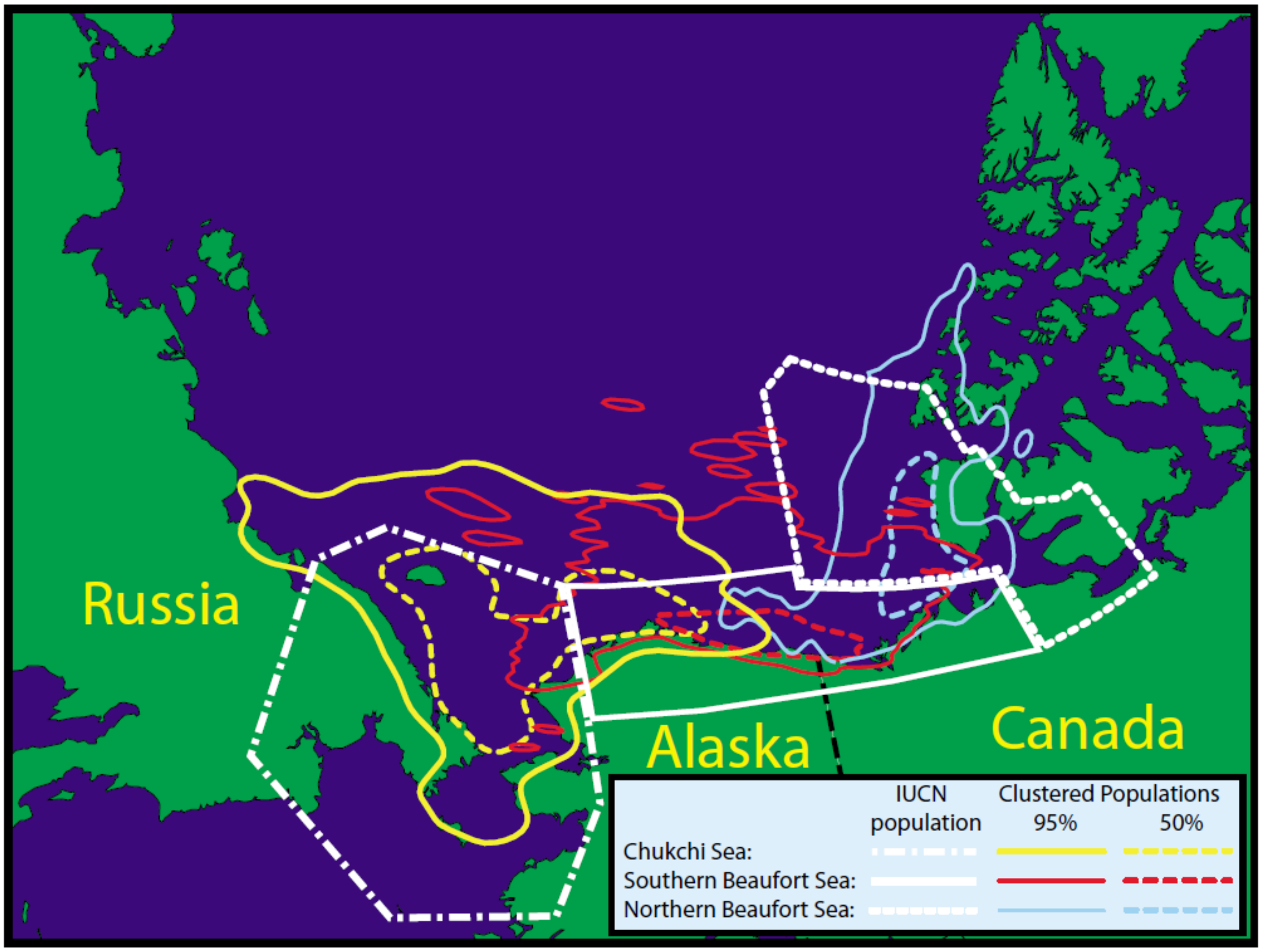

Figure 2. Approximate distribution of polar bears (the Southern Beaufort Sea, Northern Beaufort Sea, and Chukchi/Bering Sea polar bear stocks) in Alaska. Distributions are based on the 95% annual contours of utilization distributions developed from 1985 to 2003 satellite-collar data for the Southern Beaufort and Chukchi/Bering Sea stocks, and 1989-1991 for the Northern Beaufort Sea stock (Amstrup et. al 2005).

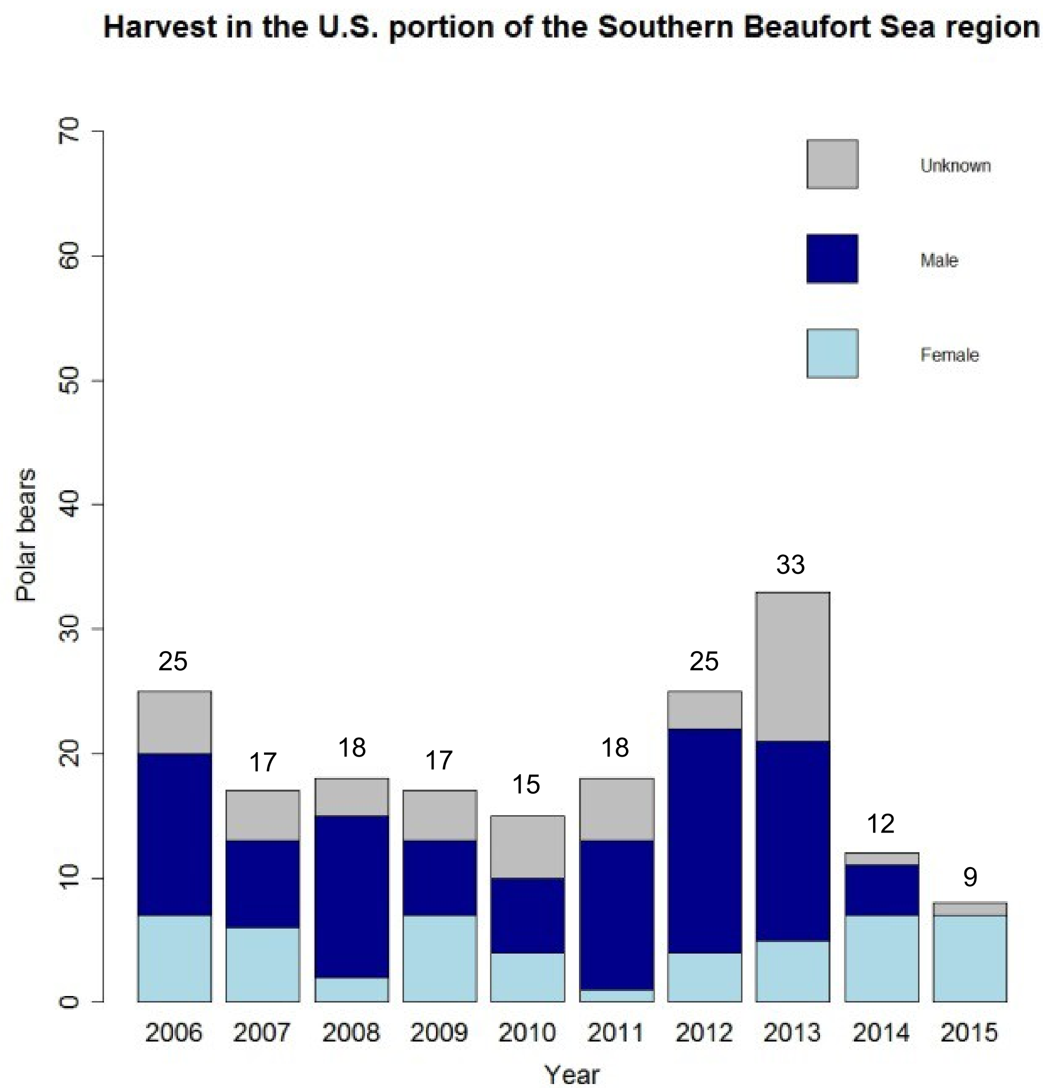

Figure 3. Polar bear harvest in the U.S. portion of the Southern Beaufort Sea stock, 2006-2015.