Potential effects of diminished sea ice on open-water swimming, mortality, and distribution of polar bears during fall in the Alaskan Beaufort Sea

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Photo by Scott Schliebe

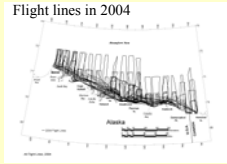
Abstract: The Minerals Management Service Bowhead Whale Aerial Survey Project has recorded 329 sightings of 852 polar bears (*Ursus maritimus*) during flights over the Alaskan Beaufort Sea and associated coastlines since 1979. Since 1992, the average latitude of sightings is 62 km further south and the average longitude is 130 km further east than in previous years. Proportion of observations associated with ice has declined, whereas proportion of observations associated with land and open water has increased. From 1979-1991, polar bears tended to be dispersed across the region, and were frequently observed near the leading edge of annual pack ice or swimming among ice floes along the shelf break. Since 1992, observations have been dominated by bears swimming near shore, or resting on barrier islands or the mainland coast near Kaktovik. These observations may be at least partly explained by the tendency for bears to be associated with bowhead whale carcasses in the Kaktovik area and a lengthened open-water period, forcing the bears onshore to await fall ice formation. During aerial surveys in early-September, 2004, an unusually large number of polar bears were seen swimming > 2 km offshore near Kaktovik. Subsequently, polar bear carcasses were seen floating offshore. Extrapolation of survey transect data suggests that on the order of 40 bears may have been swimming and that many of those probably drowned as a result of rough seas caused by high winds. We speculate that mortalities due to offshore swimming during late-ice (or mild ice) years may be a relatively important and unaccounted source of natural mortality given energetic demands placed on individual bears engaged in long-distance swimming. We suggest that drowning-related deaths of polar bears may increase in the future if the observed trend of regression of pack ice and/or longer open water periods continues.

Photo by Scott Schliebe

INTRODUCTION

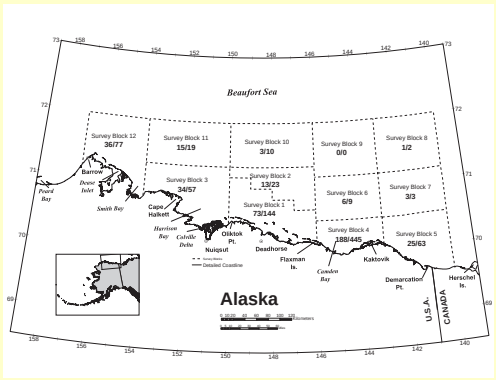
Polar bears depend on the vast expanses of Arctic sea ice for hunting their primary prey species, ringed (*Phoca hispida*) and bearded (*Erignathus barbatus*) seals (Stirling and Derocher 1993, Stirling et al. 1993), and locating potential mates. However, there is evidence that total extent of Arctic sea ice has declined at an annual rate of 3-5% over the past several decades, although these declines are not consistent across the Arctic (Gloersen and Campbell 1991; Johannessen et al. 1995; Maslanik et al. 1996; Parkinson et al 1999; Vinnikov et al. 1999). Warming trends in the Arctic (Comiso 2003) also appear to be affecting thickness of multiyear ice in the polar basin (Rothrock et al. 1999) and perennial sea ice coverage (declines 9% per decade) (Comiso 2002a; 2002b). Concerns have been raised over apparent declines in the minimum extent of summer ice pack and temporal increases in the open water period, and the potential for impacts on polar bears and their populations (Stirling and Derocher 1993; Struzik 1993; Tynan and DeMaster 1997; Stirling et al. 1999; Krajick 2001; Stirling 2002; Derocher et al. 2004).

The primary purpose of the Minerals Management Service (MMS) Bowhead Whale Aerial Survey Project (BWASP, 1979-Present) is to monitor the fall migration of bowhead whales in the Alaskan Beaufort Sea. However, systematic observations have been made of all marine mammals encountered, including polar bears, and sea ice. This poster summarizes observations on observed changes in polar bear distribution and sea ice. We also present some observations of potential effects of those changes.



METHODS

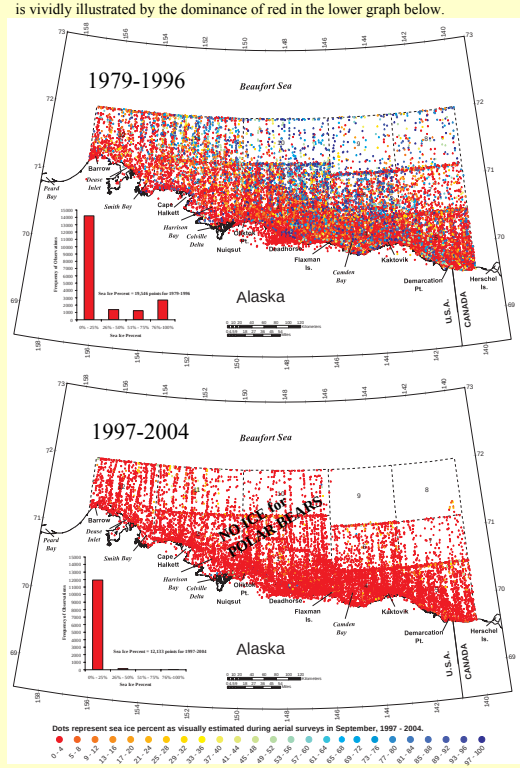
--Fixed-wing Aircraft Surveys
--During September & October
--From 1979 – to Present
--2 observers; Bubble Windows
-- Random Transects in Established Blocks
-- Including Connect & Search Segments
-- Flown at ~ 457 m and 200-250 k/h
--Data in MS Access and ArcGIS



Study area including aerial survey blocks (dashed lines) and important landmarks along the Alaskan Beaufort Sea coast. Values below or adjacent to block number represent polar bear sightings/number of polar bears observed during fall (Sept.-Oct.) aerial surveys in the Alaskan Beaufort Sea, 1979-2004.

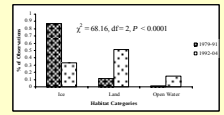
SEPTEMBER SEA ICE HAS BEEN VIRTUALLY ABSENT OVER THE ALASKAN OCS 1997-2004.

September is generally the month of maximum open water extent over the Outer Continental Shelf of the Alaskan Beaufort Sea. During other months the ocean is mostly covered with ice. Over 31,000 observations of sea ice coverage that have been recorded during September since 1979 indicate historical patterns may be changing. Approximately 1/5 of the observations during 1979 – 1996 were of coverage of 50% or greater. From 1997 – 2004, sea ice coverage of over 50% represented less than 1/100 of all observations and only occurred along the shoreline during early-September. The lack of sea ice in recent years is vividly illustrated by the dominance of red in the lower graph below.

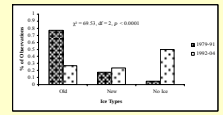


REDUCED ICE COVERAGE HAS HAD A STRONG EFFECT ON POLAR BEAR HABITAT ASSOCIATIONS IN SEPT/OCT.

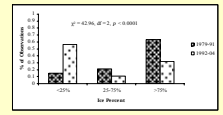
POLAR BEARS ARE NOW MORE LIKELY TO BE FOUND:



On land or swimming in the ocean



Associated with new ice or no ice

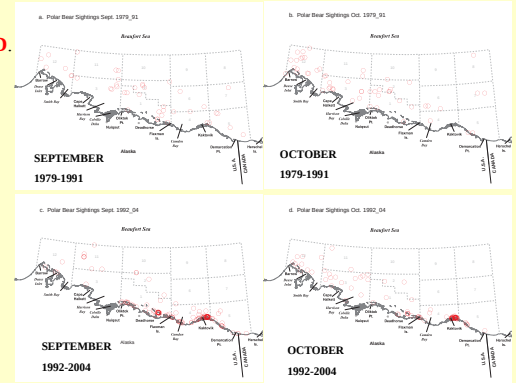


Associated with discontinuous ice

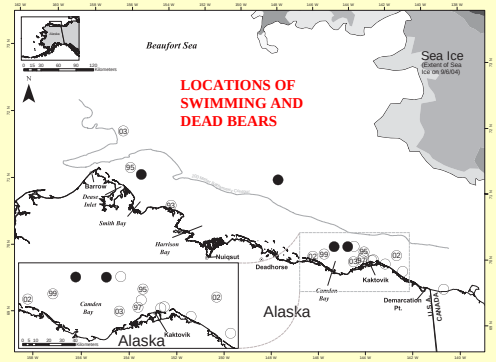
THE DISTRIBUTION OF POLAR BEARS HAS CHANGED.

During the first half of this study, polar bears tended to be distributed relatively uniformly across the sea ice of the Beaufort Sea OCS during September-October. During more recent surveys, bears were highly concentrated on shore. From 1979-91, polar bears observed near Barrow (survey block 12) accounted for roughly 27% of the total compared to only 4% of the total observed in this same block from 1992-04. During the same interval, there has been a 10-fold increase in number of bears observed near Kaktovik (survey blocks 4 and 5).

The net result of these changes is that since 1992, the average latitude of sightings is 62 km further south and the average longitude is 130 km further east than in previous years.



The reason for the concentration of bears near Kaktovik is unproven, but is probably related to: 1) bears being stranded on land due to diminished September sea ice and, 2) the presence of bowhead carcasses left near the village from subsistence whaling.



Distribution of polar bears observed during September aerial surveys in the Beaufort Sea, 1987-2004. Closed circles represent dead bears observed in 2004. Open circles without numbers represent live bears that were observed swimming in 2004, and for other open circles numbers indicate year in which the observation occurred.

SWIMMING IS ASSOCIATED WITH EXTENSIVE OPEN WATER & MAY LEAD TO DEATHS

During September 2004 an unusual number of bears were seen swimming offshore (10 of 51(20%) versus 12 of 315 (4%) in 1986-2003). Following an abrupt windstorm (below), 4 dead bears were seen floating far offshore (versus 0 in all previous years). Those bears are believed to have drowned as a result of the storm. The survey has about 10% coverage so it is likely that many other bears also drowned but were not seen.