INDICATOR #01

Polar bears

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Svalbard, Norway Pauline Mills/iStockphoto

Polar bears, *Ursus maritimus*, are distributed throughout the ice-covered waters of the circumpolar Arctic. This top-level predator is of interest because it is an iconic species of the Arctic and one that is particularly vulnerable to changes in sea ice. They are fundamentally dependent upon sea ice as a platform for hunting seals, travelling, finding mates, and breeding. Changes in the distribution, duration, and extent of sea-ice cover and in the patterns of freeze-up and break-up have the potential to significantly influence the population ecology of polar bears [1, 2].

As a species highly specialized for and dependent on the sea ice habitat, polar bears are particularly sensitive and vulnerable to changes in their environment [3]. Over the past several decades there have been a number of studies that have documented significant reductions in sea-ice cover in parts of the Arctic, thinning of multiyear ice in the polar basin and seasonal ice in Hudson Bay, and changes in the dates of break-up and freeze-up of the sea ice that are a consequence of climate warming [e.g.4, 5–11]. If climate warming in the Arctic continues as projected by the Intergovernmental Panel on Climate Change [12], diminished ice cover and extended ice-free seasons will have profound negative effects on the ability of polar bear subpopulations to sustain themselves, particularly those at the southern parts of their range [1, 2, 13].

Population/ecosystem status and trends

Polar bears occur in 19 relatively discrete subpopulations with an estimated worldwide abundance of 20,000–25,000 animals [14]. Our knowledge of the status and trend of each subpopulation varies due to availability, reliability, and age of data. Furthermore, for many subpopulations, there is limited or no data collected over a sufficient period of time to examine trends. Based on a 2009 review of the worldwide status of polar bears [14], one of 19 subpopulations appears to be increasing, three are stable, and eight are declining. For the remaining seven subpopulations, there is insufficient or no data to provide an assessment of status (Figure 1.1). In particular, there is a lack of data for the Russian subpopulations.

For six of the eight subpopulations in decline (Baffin Bay, Chukchi Sea, Davis Strait, Kane Basin, Lancaster Sound, and Norwegian Bay), harvesting appears to be the primary factor although in some, climate-induced effects are also suspected to play a role. Harvesting can be addressed through appropriate management actions. Four of these subpopulations are co-managed by two nations, creating special management challenges. In some cases, inter-jurisdictional agreements are in place or are under negotiation.

Figure 1.1: Distribution and current trend of polar bear subpopulations throughout the circumpolar Arctic [14].

For the Western Hudson Bay subpopulation, the decline is linked to the impacts of climate warming and loss of sea-ice habitat on body condition and demographic rates of polar bears [9, 13, 15].

Declines in the extent of summer sea ice in the Beaufort Sea have resulted in loss of optimal polar bear habitat [16]. Negative trends in body size and survival of certain age and sex classes of polar bears of the Southern Beaufort Sea subpopulation are associated with changes in habitat [17–19]. Although the previous [20] and current [17] point estimates, 1800 and 1526, respectively, suggest a decline in the abundance of the Southern Beaufort Sea subpopulation, it is not statistically significant because there has either been no change in numbers or insufficient precision in the estimates to detect a change [17].

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Concerns for the future

The increased fragmentation and loss of sea ice habitat, as a consequence of climate change, is the single most critical conservation concern for polar bears. Global warming has been amplified at high latitudes in the Northern Hemisphere [21, 22] and a number of studies have documented significant reductions in extent, duration, thickness, and age of sea ice [e.g., 4, 5, 9, 23, 24]. Recent predictions of continued climate warming [12] will result in unidirectional, negative changes to sea ice, although the timing and rate of change will not be uniform across the circumpolar Arctic. However, because of their dependence on sea-ice habitat, the impacts of continued climate change will increase the vulnerability and risk to the welfare of all polar bear subpopulations. Population and habitat modeling have projected substantial future declines in the distribution and abundance of polar bears [16, 25, 26]. A changing environment also increases the need for more frequent inventories because previous assumptions about the relative constancy of sea ice are no longer valid.

Pollutants that enter the Arctic via long-range transport on air and ocean currents, river systems, and runoff [27, 28] are also a cause for concern. Many persistent organic pollutants reach high levels in polar bears due to their high fat diet and high trophic position [29]. The effects of pollutants on polar bears at the individual and subpopulation levels are largely unknown. However, recent studies suggest that pollutants impact the endocrine system [30], immune system [31], and subsequent reproductive success of polar bears [32]. In addition, new pollutants in polar bear tissues have been documented [33–38]. Finally, McKinney *et al.* [38] documented increasing contaminant burdens in Western Hudson Bay polar bears as a consequence of dietary shifts due to climate-induced changes in sea ice.

Lastly, reductions in sea-ice extent, duration, and thickness will likely increase human presence and activities in the Arctic [39, 40]. Longer ice free seasons and reduced ice coverage could increase shipping activity and increase resource exploration, development, and production in areas used by polar bears. Potential effects of shipping on polar bears include pollution, noise, physical disturbance related to ice-breaking, and waste. The number and range of cruise ships moving further north into areas used by polar bears may also increase. Potential effects of increased tourism include pollution, disturbance, and increased risk of defense kills.