Annual Patterns, Seasonal Shifts, and Modeled Trends in Polar Bear Observations in the Prudhoe Bay Industrial Footprint

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Declining Arctic sea ice is rapidly altering polar bear habitat and increasing interactions with human activities. This study investigated how sea-ice loss influences polar bear movement and encounter risk at the industrial footprint in Prudhoe Bay, Alaska. Using 20 years (2000–2019) of sea-ice concentration data and industrial observation records, I analyzed the relationship between open-water conditions and annual polar bear encounters. Sea-ice metrics describing the duration of open water and marginal ice were evaluated using generalized linear models. Because the data were overdispersed, a negative binomial regression model was selected based on AIC criteria and diagnostic tests. Results show that polar bear encounters are strongly seasonal and have increased significantly over time ($P < 0.001$), rising by approximately 7.4% per year. The first annual sightings have shifted significantly earlier ($P = 0.0029$), indicating earlier movement onto land, while departure timing has not changed. Notably, sea-ice conditions from the previous year were strong predictors of current-year encounter risk. These findings suggest that sea-ice decline is driving earlier and longer land use by polar bears, increasing overlap with human activities. As Arctic sea ice continues to retreat, this study demonstrates that long-term monitoring can predict high-risk encounter seasons, providing a valuable tool for Arctic wildlife management and industrial safety.

Awards Won:

Fourth Award of $600

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