Conservation of Arctic Flora and Fauna

**THE ARCTIC SPECIES TRENDS INDEX**
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## OVERALL

Overall, the ASTI includes data gathered from 323 species, or 37% of Arctic vertebrate species, a high amount of coverage for such an index. It is the most representative regional index of the global Living Planet Index.

Data additions and extensions have improved the ASTI, but the overall trend has not changed; Arctic fishes, birds and mammals, when lumped together increased from 1970-1990 then remain stable. However, when taken separately, fish, mammals and birds had different trajectories.

The high Arctic species index declined until the mid-1990s, while the low Arctic species index consistently increased over the same time period. The high Arctic species index appears to be recovering in recent years and the low Arctic index has stabilized since the mid-1990s. But this latest trend, since the mid-1990s, occurs over too short a time to interpret as an overall trend. It points to the importance of regular additions and analysis of the ASTI and the importance of long-term datasets.

In the sub Arctic, the ecozone most susceptible to direct human influence, species increased until the mid-1980s, but then declined steadily.

Arctic marine species have increased overall, driven by rising mammal and fish populations. However, increasing populations of species like the gray whale, Greenlandic walrus and commercially harvested Atlantic cod have not likely returned to historical levels.

Terrestrial species show a very different pattern; a steady decline starting in the 1990s to a level now below the 1970 baseline.

Terrestrial species´ decline is most prominent in the high Arctic, but this decline is moderated by dramatic increases in some populations, of geese for example, in the low and sub Arctic.

## MARINE

Marine analysis includes data up until 2005 and does not include the recently added data that updated the overall ASTI.

### Species

The ASTI marine index covers about 34% of Arctic marine vertebrate species, including 100% of mammals, 53% of birds and 27% of fishes. Bird populations account for the largest data holdings.

Arctic marine species included in the marine index have increased overall, driven by rising mammal and fish populations. Some mammals are recovering from historical over-exploitation, however, increasing populations of species like the gray whale, bowhead whale, Greenlandic walrus and commercially harvested Atlantic cod have not likely returned to historical levels.

The marine fish index increased dramatically, over two and a half times, in the 35 year data span and is largely driven by fish populations monitored in the Bering Sea. This increase in the marine fish index occurred until the 1990s then levelled off.

Trends in marine fish differed depending on ocean region. There is an unabated decline in the Atlantic.

Overall, marine mammals increased across all ocean regions, levelling off in the mid-1990s. Some populations are increasing dramatically, but are unlikely to have returned to historical highs.

Marine birds slowly increased until the mid-1980s, then in 1998, began a slow and steady decline. This may be related to changes in climate, sea ice and food availability, but the causes my vary depending on he species, thus caution in interpreting the results is needed.

The marine bird decline in recent years may be the beginning of a longer term decline. It will be important to monitor this over the coming years.

**Regions**

The Atlantic Ocean is experiencing an average decline in vertebrate abundance, thought to be driven, in part, by Arctic climate-driven regime shifts possibly operating in tandem with exploitation effects (commercial fishing).

The Atlantic Ocean is the smallest data set of the three oceans, and is largely driven by fish and bird population information. Therefore, caution is needed in interpreting this index.

The Arctic Ocean is experiencing a small average increase in vertebrate abundance, driven by increases in fish and mammals since 1988.

The Pacific Ocean experienced a dramatic increase in vertebrate abundance up until the early 1990s, likely driven by increases in recovering populations of mammals, and increases in pelagic fish strongly associated with changing marine conditions (warmer sea temperatures).

Environmental changes related to warmer sea temperatures are projected to lead to a shift in species composition from those living at the ocean bottom (benthic) to those living closer to the surface (pelagic), but there is no evidence that this shift is occurring at this time. However, there is a notable difference in the patterns between pelagic and benthic species, with pelagic species strongly linked to cyclical climate oscillations.

Three of the nine sea-ice associated species showed declines: ringed seal, beluga whale, and thick-billed guillemot. However, the data in the ASTI is not enough to calculate an overall trend index for sea-ice associated species. Given the lack of data, rapid changes in sea ice and concerning declining trends in some species, sea-ice associated species are a priority for targeted monitoring.

**Focus on the Bering Sea**

The Bering Sea and Aleutian Islands (BSAI) area of the Pacific Ocean is well studied and can provide more detail on marine trends.

Birds in the BSAI are declining but causes are not certain, as threats can vary across species. For example, red-legged kittiwake decline is due to a combination of industrial fishing, habitat disturbance and food-web disruptions.

Fish in the BSAI increased on average until 1993. Furthermore, studies showed that those fish had increased biomass, in the 1970s and 1980s. Favourable environmental conditions are likely responsible for those increases. After 1993, fish began to decline, likely due to low productivity in the region´s groundfish, but then stabilized.

Mammals in the BSAI have increased, but not consistently. Mammal abundance peaked in 1988 and has declined since, although remaining above the 1970 baseline. This constant decline is reflected in the beluga, Steller sea lion, harbour seal, sea otter, northern fur seal and gray whale. Declines have occurred for various reasons including increased predation, loss of sea ice and reduced food availability.

**SPATIAL**

In addition to knowing how species trends have changed over time, it is important to indicate how they change from place to place. This type of spatial analysis at this scale hasn´t been widely applied in biodiversity monitoring, but is featured in some prominent projects including CAFF´s Bering Sea Sub-Network (BSSN) and the WWF´s Rapid Assessment of Circumarctic Ecosystem Resilience project (RACER).

ASTI spatial analysis helps identify gaps in monitoring data (time-series length and quality) and set priorities for biodiversity monitoring programs.

The benefit of spatial analysis comes when associations can be made, location by location, between species trends and drivers of observed changes, such as climate change. This round of ASTI analysis tested a model that explored biodiversity´s relationship to air temperature, human density and land cover. Those variables were found to only explain a small amount of change (5-11%), which indicates that analysis of other variables is needed to explain trends in Arctic vertebrate abundance.

**Locations of monitoring**

The ASTI includes data from 366 sites across the Arctic. Data was collected on 200 to 600 populations per year since 1970.

Northern Scandinavia, Iceland and the Bering Sea and Aleutian Islands have had more monitoring coverage, while northern Russia, northern Greenland and the islands in the Canadian High Arctic have had relatively sparse monitoring coverage since the 1950s. However, this discrepancy could be due to an inability to secure data from some regions, rather than an accurate account of monitoring coverage.

**Length of monitoring**

Time series data is much more equally spread across the Arctic, with 20 or more years of data collection concentrated in the Bering Sea, Iceland, northern Scandinavia and the Kamchatka Peninsula. Canada and the Aleutian Islands have less complete annual datasets. However, this discrepancy could be due to an inability to secure the data from some regions, rather than an accurate account of monitoring coverage.

Monitoring data increased until 2000 then declined. This indicates either a lag in reporting time or, reductions in biodiversity monitoring efforts, or a combination of both. It results in insufficient data to report on years past 2005 for the marine analysis, and 2007 for the overall analysis.

Monitoring increased substantially in the 1970s, especially across northern Canada and Russia. There are recent gaps in data availability from northern Canada, particularly from populations that reported declines, however this does not necessarily mean that monitoring has stopped in that location.

**Species and locations**

When data are combined for all locations, the proportion of locations with increasing or stable populations has declined since the 1950s. This could reflect a changing emphasis in monitoring programs to focus on declining species for conservation purposes, or reflects an increase in the number of Arctic vertebrate populations in decline in recent decades.

When examined at regional scales, spatial analysis can identify clusters of population growth and decline. For instance fish in the Labrador Sea are declining rapidly, but increasing in the Bering Sea. But in the Bering Sea, mammals and birds are not doing as well as fish.

**RECOMMENDATIONS/LOOKING AHEAD**

New data collection efforts should focus on areas where data is currently sparse, especially where there are declining trends.

Sites that monitor single species should expand to focus on multiple species when feasible. This will be able to help identify whether trends are common across species and populations.

Monitoring efforts for vertebrate species should also include monitoring of non-biological measures to help improve understanding of the drivers of vertebrate species trends.

Areas that are more sporadically monitored, especially where there are declining populations, should be more frequently monitored, which will help quickly distinguish between naturally occurring changes and actual population reductions.

Extensive and complete regional data, from areas like the Bering Sea and northern Scandinavia, improve understanding of local factors that exert pressures on biodiversity. This data should be further analysed.

Measures to encourage consistent and timely reporting of monitoring results improve the capacity of ASTI to provide up-to-date information and detect emerging changes.

Work is needed to define key drivers behind biodiversity change, such as habitat fragmentation, impacts of climate change on habitats, and harvest, and to develop and access data sets for these drivers. This will help the ASTI better construct predictive models that explore relationships between biodiversity and these potential drivers.