



Species Shifts

What They Mean for Alaskans, and How We Can Adapt

Alaska's environment is changing, in part due to global climate forces, and the mix of species that inhabit our seas and lands is changing along with it. Some changes are advantageous to people who live here, and others are detrimental. A few species shifts already are occurring and have been noted by scientists and by the rural people who live and work closest to nature.

What species shifts are anticipated?

Endemic (naturally occurring) species can change in **abundance** or **distribution**. That means there may be more or fewer of them, and they can extend their range into areas where they were not previously common or were entirely absent.

A warming climate may allow a species to become more abundant because of **greater food availability**, **less winter-kill**, or other biological factors. Examples are salmon and the bears that feed on them, both of which have increased in abundance with an oceanic warming trend that began in the mid-1970s. However, there can be too much of a good thing, and sometimes a population explosion can have detrimental results, such as when toxic algae **bloom** or jellyfish numbers increase to the point that they clog fishermen's nets and decimate larvae of commercially valuable species.

A stock that is at the southern fringe of the species' preferred habitat, or is sensitive to consequences of temperature changes, can become less abundant. While a warming sea has boosted cod and pollock numbers, for example, it has had disastrous consequences for crab and shrimp, in part due to **predation** by cod and pollock.

A major consequence of changing temperature regimes is the arrival of non-native or **invasive species**, which can arrive in at least three ways. They can:

- **spread naturally** through the environment by walking, flying on their own wings, or drifting with the currents;
- **"hitchhike"** in ballast water, on boat hulls, on the soles of wading boots, in vehicles, or as seeds clinging to hiking boots and outdoor clothing; or
- be **intentionally introduced** (transported) by people who want them for sport fishing or hunting, natural pest control, or aesthetic addition to the landscape.

The climate link is not in how invasives arrive, it's whether they survive and

flourish. If an invasive encounters a hostile environment it will soon perish, but if conditions are good it can soon breed an invasive population. Some invasives, like certain songbirds, seem benign, but even so the newly arrived species likely is competing with and possibly displacing a previously existing one. Others, like the European green crab, could be disastrous for Alaska's shellfish industries if they become established.

What are Alaskans observing?

Increasing abundance: salmon, cod, pollock, yellowfin sole, arrowtooth flounder, and many other fishes became more abundant following an oceanic "regime shift" in the late 1970s that warmed the ocean by about one degree. Many terrestrial animals, including bears, beavers, caribou, and moose likewise experienced



A warming sea has boosted pollock numbers in Alaska.

population increases due to more food, less winterkill, or other factors.

Decreasing abundance: shrimp, crabs, and several species of pelagic forage fish and the seabirds that depended on them went into decline, as did the Steller sea lion in western Alaska waters.

Note: the oceanic regime shift of the late 1970s was not global warming, but it was the warm phase of a multi-decadal cycle, called the Pacific Decadal Oscillation. However, the slightly elevated sea temperatures it brought are indicative of the effects of a warming climate. A long-term trend of increasing air and sea temperatures is masked by regime shifts.

Range extension: Many fish species appear to be extending their range northward during warm years, including salmon, pollock, and some crabs. Tuna and other subtropical fish species show up more frequently in Alaska waters. Beavers are moving north, causing public health concerns and depriving residents of access to traditional skiff travel routes due to their dams. Moose are moving north, becoming a new food resource in some remote western and northern Alaska communities where they had been unavailable. Woody shrubs are advancing to the north and higher up mountain slopes, providing food for moose but displacing vegetation required by caribou. Various songbirds are showing up in Alaska where they previously were rare or entirely unknown.

Other changes in range or abundance: walrus, several kinds of seals, and polar bears have shown changes in location, and in some cases abundance, related to climate-induced decreases in sea ice.

Invasive species: Several species of invasive tunicates (marine invertebrates known as sea squirts) have been identified in southeast Alaska and Prince William Sound. If they spread they could foul aquaculture gear. More than 160

For more information or assistance

Climate Change Adaptation, Alaska Sea Grant Marine Advisory Program
<http://www.marineadvisory.org/climate>

Alaska Center for Climate Assessment and Policy (ACCAP)
http://ine.uaf.edu/accap/alaska_arctic.html

Ecological Impacts of Climate Change – National Academies Press
www.nap.edu/catalog/12491.html

Protecting Alaska's Valuable Natural Resources from Marine Invaders
www.alaskasealife.org/New/research/mis_documents/Brochures/AK_Marine_Invaders.pdf

Invasive Species in Alaska – Defenders of Wildlife
www.defenders.org/resources/publications/invasives/alaska.pdf

Smithsonian scientists to help identify and eradicate invasive species in Alaska waters
<http://smithsonianscience.org/2010/12/smithsonian-scientists-help-identify-and-eradicate-marine-invasive-species-in-Alaska>

Invasive Species: state resources – Alaska
www.invasivespeciesinfo.gov/unitedstates/ak.shtml

species of invasive plants have taken root in the state, including purple loosestrife, yellow toadflax, and orange hawkweed. If they add color to the Alaska landscape, they also displace native plants, and some are toxic to native wildlife. Atlantic salmon, escaped from net-pens in Washington or British Columbia, are caught in Alaska. Northern pike, which decimate trout and salmon populations, have taken hold in several southcentral Alaska water systems, probably purposefully and illegally introduced by anglers. While none of these are a direct result of climate change itself, a more agreeable marine and aquatic environment allows some Alaska waters to support introduced populations.

How can Alaskans adapt to species shifts?

- Fishermen (commercial, sport, subsistence, and personal use) may have to adjust their harvesting expectations to account for decreased (or increased) availability. Hunters may find they have more moose and fewer caribou to harvest. Harvesters of all kinds may have to travel farther or shift their focus on different target species. Each species is a different story and the key is to be adaptive.
- Support research on species shifts and invasive species. Never release a non-native species into the wild. Participate in local monitoring programs. Support adaptive management policies.

This Alaska Sea Grant Marine Advisory Program (MAP) project is supported by the Alaska Center for Climate Assessment and Policy (ACCAP). MAP is a statewide outreach and technical assistance program that helps Alaskans sustain economic development, traditional cultural uses, and conservation

of marine and coastal resources. ACCAP's mission is to assess the socioeconomic and biophysical impacts of climate variability in Alaska, make this information available to local and regional decision-makers, and improve the ability of Alaskans to adapt to a changing climate.

