



Fjord Estuary Ecosystem

The fjord estuary ecosystem is one of the richest assemblages of life on earth, but not one of the most well known. Found only in six locations around the planet (Chile, Norway, New Zealand, Alaska, Greenland, and Antarctica), fjord estuaries require just the right combination of events for their construction.

About 27-32,000 years ago, this precise mixture began in Alaska during the Wisconsin glacial period. Snow piling up for years and years, compressing into ice underneath its own weight, spread across the Kenai Peninsula as the Cordilleran ice sheet. Here in the Kenai Fjords, ice covered the mountains and carved the valleys. The ice etched out a landscape of U-shaped valleys with jagged ridges, known as arêtes, in between. Many of these valleys extended 600-1000 feet below what would become sea level once the warming progressed. Once filled with seawater, these long deep arms of the sea are called fjords; other glacially carved valleys were elevated on mountainsides and appear today as what we call “hanging valleys.”

About 10,000 years ago as the ice began to melt, the valleys filled with seawater. Some of the lower glacial features drowned and became beautiful half moon bays. Now, even as they melt, glaciers continue to move downhill under the force of gravity, eroding the bedrock beneath them. The meeting of this fresh water with the ocean creates an estuary. When the contribution of fresh water is from glaciers, a fjord estuary ecosystem is the result. Glacial run-off colors the saltwater grey with the rock flour it carries. In the park, this sediment accumulates as much as a foot a year at the bottom of the 600- to 1000-foot deep bays. The fresh meltwater provides calcium, iron, magnesium, potassium, and trace elements to the ecosystem.

Essential Parts of the Whole

All ecosystems consist of biotic (living) and abiotic (non-living) elements. The non-living elements drive the richness of the living elements in Kenai Fjords National Park. Beginning with the spring season, long days of sunlight, fresh water influx, cold, oxygen-rich seawater, and local nutrient availability conspire with tides, strong winds, and currents to assemble a new crop of biotic elements in the ecosystem. Each spring



McCarthy Glacier.

USGS photograph by Bruce Molnia

Keystone Species

In most ecosystems there is a “keystone species,” one that has a role linking the whole ecosystem. The sea otter holds that role for the fjord estuary ecosystems of Alaska. Feeding on a variety of shellfish but always keeping the sea urchin population in check. Sea urchins have been known to create “urchin barrens” eliminating giant stands of kelp if there is not a local predator to keep their numbers down. The sea otter inadvertently keeps the macro-algae community healthy by being a voracious predator of sea urchins. This affords many other creatures a place to hide from large prey. If the sea otter population is healthy then one can conclude that the ecosystem it lives in is healthy.

is a little bit different based on the timing of the abiotic elements. However, each year the fjords can count on a great spring bloom in the phytoplankton community sometime between early April and early June.

Phytoplankton is “plant plankton,” the primary producer and the key ingredient of the complex fjord food web. Primary producers all use the sun’s energy to convert carbon dioxide and nutrients into carbohydrates supporting the growth of the creatures that feed on them. In Kenai Fjords National Park, the presence of phytoplankton is evidenced by the deep green color of the water. The phytoplankton is the food source for many of the zooplankton, or “animal plankton.” An abundance of phytoplankton gives rise to an abundance of zooplankton. Some zooplankton and invertebrates are grazers feeding strictly on phytoplankton or algae. The presence of great numbers of phyto and zooplankton bring the larger consumers to the fjords to feed. Consumers eat other animals and in some food webs are referred to as predators or carnivores. They come in all shapes and sizes from the zooplankton to creatures like the humpback whale that travel 2,700 miles from their winter breeding grounds to take advantage of the rich waters of this ecosystem.

Some of these consumers come in such great numbers that scientists call them “indicator species.” The common murre is one example of an indicator species. It is a diving seabird feeding on small oily fish like sand lance and capelin. Its local colonies can easily be 10,000 strong in Kenai Fjords. If a shortage or delay of their prey fish occurs, scientists are easily alerted by a sudden die-off in the population.

With all of this feeding going on there is also a lot of waste and decay. Detritivores, like crab, are the garbage men of the ocean, feeding on the waste and decay of other creatures and recycling the system nutrients.

The Perfect Mixture

From the primary producers to the garbage men of the sea, the fjord estuary ecosystem is a varied and rich network. The complex web of life flourishes here because of the unique physical setting created where the glacial streams meet the sea. Understanding the links between the abiotic and biotic elements found in the fjords helps us appreciate this unique ecosystem and understand our own role to play as visitor and steward.



Dinglstadt Glacier.

USGS photograph by Bruce Molnia



Pederson Glacier.

USGS photograph by Bruce Molnia