

The Ocean — Glacier Bay National Park and Preserve

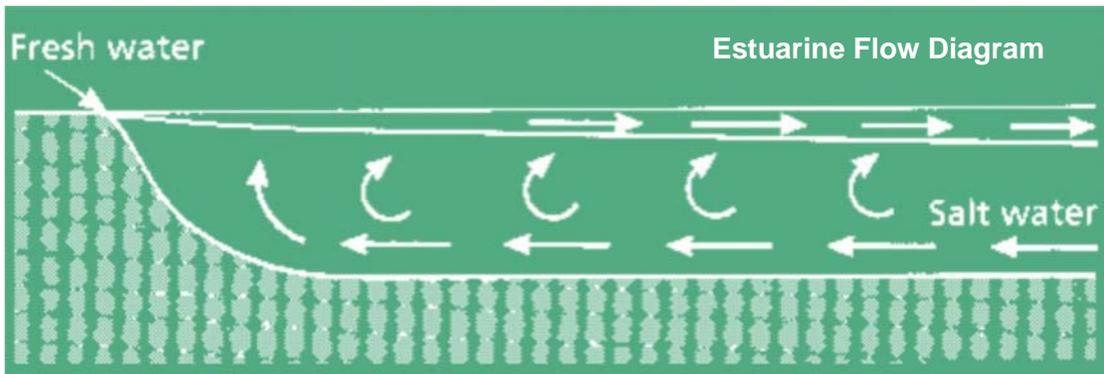


Directions: Below, read about Glacier Bay's ocean environments.

Recent studies show that Glacier Bay contains a very complicated **oceanographic** system within a relatively small area. This complexity is one of the reasons why such an unusual variety of marine life is found here. As the glaciers retreated, the ocean's invasion created a wide array of underwater environments with biological communities that often overlap.

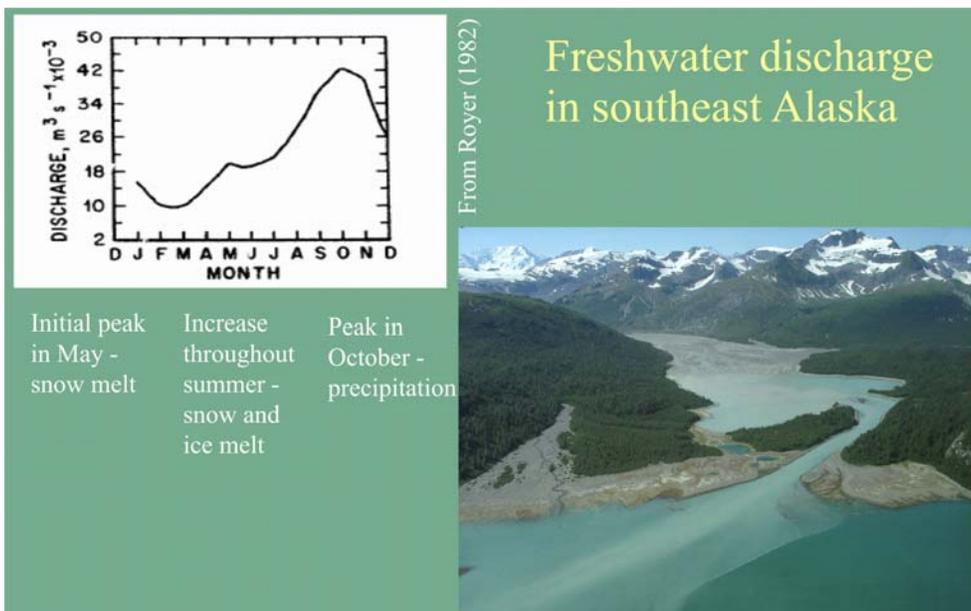
Oceanographers classify Glacier Bay as a "*recently **deglaciated**, tidally mixed, **fjord estuarine** system with [many] **underwater sills**."* This means that the bay is a network of large U-shaped valleys that once were filled by glaciers but are now flooded by the ocean and fed by streams and rivers.

At the glaciated faces of the system there is a more or less continual supply of fresh water. Fresh water floats on salt water because it is less dense. This fresh water forms an upper layer of water a few meters thick that flows toward the sea, picking up some salt water from below and carrying it along on its current. A layer of salt water from the ocean balances the outward flow. This salt water is denser and very cold; it sinks below the less dense, fresh water. This current flows into the bay in an exchange of fresh water and salt water known as an **estuarine circulation**.



Underwater sills are piles of rock debris on the ocean bottom that are the remains of the **terminal moraines** left behind by glaciers that paused during their retreat. Sills tend to be at or near the mouths of inlets and other areas where the faces of tidewater glaciers once stood still for a time. Like speed bumps, sills partially obstruct the bay's strong underwater currents, causing **upwellings** and **tide rips** similar to rapids in a river. A very large sill, formed when Glacier Bay was completely filled by ice, extends across the mouth of the entire bay. Another sill acts together with a natural **constriction** in the bay's shape to form the extreme tide rips observed in Sitakaday Narrows.

These sills are usually backed by very deep basins with 12 tidewater glaciers at their heads and many streams flowing into them from the surrounding mountains. As a result, there is a large amount of fresh water flowing into the bay from streams, precipitation, snowmelt, and melting glacial ice. This freshwater runoff and glacial melt make the ocean waters extremely cold and full of oxygen, while also delivering many **nutrients** to the sea.



Because of the big tides and strong currents, mixing and upwelling of the deep waters in the deep bays occur at the sills and constricted areas. At these locations the waters coming into and going out of the bay are well mixed. This constant mixing of oxygen-saturated, nutrient-rich waters results in a marine system that is especially "biologically productive" or able to support a great deal of living organisms.

The bulk of this marine productivity is driven by countless billions of tiny plant-like creatures, called **phytoplankton**, that float suspended in a shallow band of water mainly in the Middle Bay where sunlight can penetrate. Phytoplankton are too small to be seen with the naked eye. Glacier Bay supports incredibly dense populations of phytoplankton that last throughout the spring, summer, and fall.

Phytoplankton can **photosynthesize** — that is, they can harness the sun's energy and turn it into organic material with the aid of **chlorophyll**. Each spring, when there is enough light, **water column stability** and high nutrient levels in the surface waters, phytoplankton begin to reproduce, or **bloom**, in great numbers. This "bloom" creates rich feeding for **zooplankton**, tiny animals that also live suspended in the water column. Schools of fishes prey on the zooplankton and, in turn, they attract a diverse host of migratory predators such as whales, seals and sea lions, seabirds, halibut, and adult salmon.

