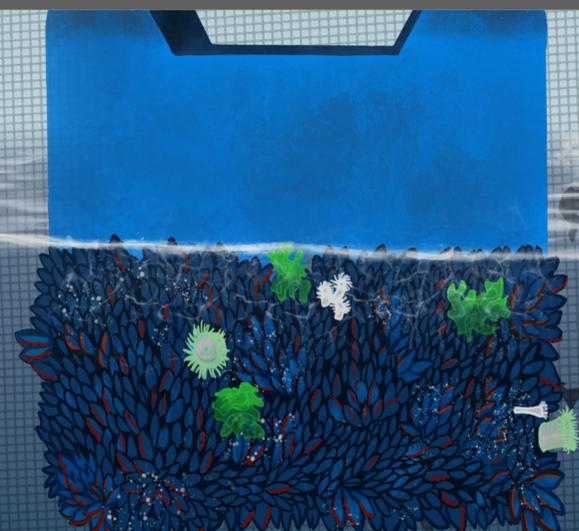
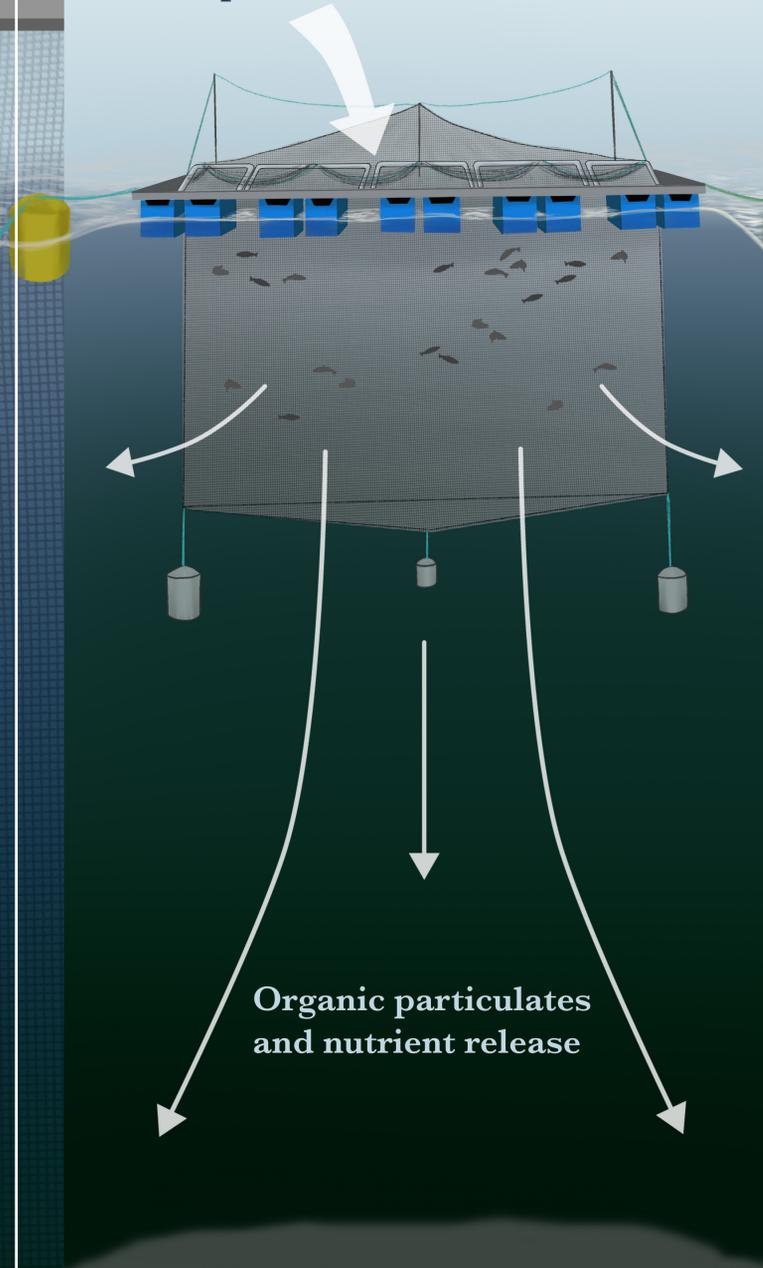


The Salmon Farm: A Floating Ecosystem

Biofouling community structure is dictated by local water conditions:

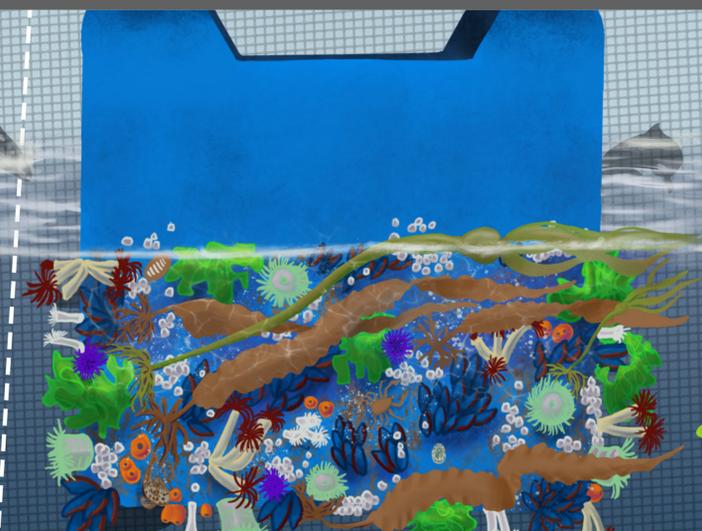
Feed input



Areas of Freshwater Influence

At some salmon farms, a layer of freshwater at the surface is common in the spring and summer when snow-melt runoff enters the ocean. In these areas of freshwater influence, the biofouling community is often dominated by mussels, which can withstand these dramatic fluctuations in salinity.

The function of such a community is largely filtration. On one salmon farm, the filter-feeding biomass may reach 20 metric tonnes, filtering more than 10 million litres of seawater per day.

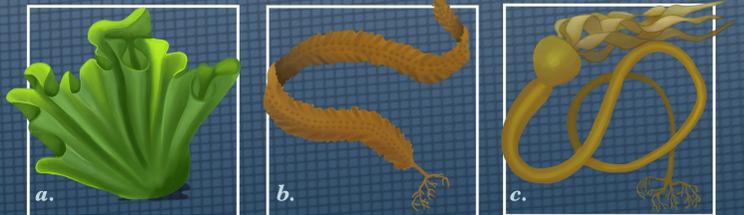


Highly-Mixed Areas

Salmon farms located in highly-mixed areas rarely experience a freshwater layer. This high salinity and high nutrient environment supports a more diverse biofouling community (>50 species), with a much wider functionality. In addition to filtration, community functions include photosynthesis and dissolved nutrient absorption by macroalgae, and the recycling of organic material by deposit-feeders. The physical structure of the community also serves as habitat for local fishes, who will take up residence or may be transient in nature—all of these fish will prey on the small invertebrates of the biofouling community.

Macroalgae

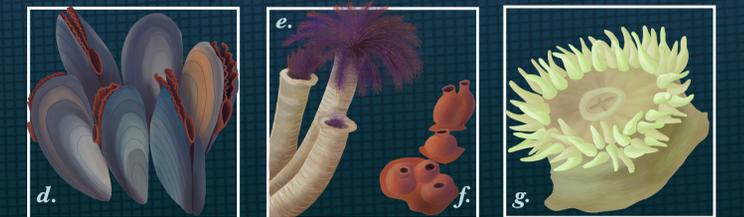
Macroalgae, or "seaweeds", use energy from sunlight and nutrients from seawater to grow. The presence of kelp—large brown macroalgae species in the order Laminariales—near the surface is a good indicator of high salinity and usually well-mixed conditions. These optimal conditions, with additional nutrients released from the fish, will also support other species such as the brilliant green algae, *Ulva lactuca* (the sea lettuce).



a: sea lettuce, *Ulva lactuca*; b: sugar kelp, *Saccharina latissima*; c: bull kelp, *Nereocystis luetkeana*

Sessile Species

These animals settle on the farm infrastructure as tiny larvae. Once attached, they are sessile—meaning they cannot move—and feed by capturing food out of the water using filtration or other techniques.



d: mussels, *Mytilus* sp.; e: feather duster worm, *Eudistylia vancouveri*; f: Pacific sea peach, *Halocynthia aurantium*; g: sea anemone, *Anthopleura* sp.

Mobile Species

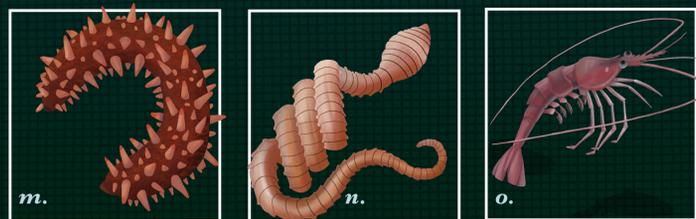
A variety of mobile invertebrate and fish species live on or in association with the salmon farm biofouling community. The attraction of mobile species to the farm may be driven by their need for food, shelter, or a surface for laying eggs.



h: owl limpet, *Lottia* sp.; i: chiton, *Mopalia* sp.; j: decorator crab, *Oregonia gracilis*; k: sculpin, *Artedius fenestralis*; l: sea urchin, *Strongylocentrotus* sp.

Benthic Species

Organic material from the salmon farm that settles on the ocean floor will influence the biodiversity and abundance of benthic species—organisms that live on or near the ocean floor. Biodiversity is typically the lowest directly beneath the farm, where the most organic material accumulates, and only select, opportunistic species can tolerate this environment—the marine worm complex *Capitella capitata* is the most common. However, moderate organic enrichment surrounding the salmon farm can also be a valuable food source, and this usually results in higher biodiversity and/or abundance of benthic species—an enrichment effect.



m: sea cucumber, *Parastichopus californicus*; n: polychaete worm, *Capitella capitata*; o: shrimp, *Pandalus* sp.



Cross, SF and A. Byrne. 2017-18. Structure and Function of the Salmon Farm Reef. North Island College Research funded by the BC Salmon Farmers Association Marine Environmental Research Program.

Reference: Callier, M. D. et al. Attraction and repulsion of mobile wild organisms to finfish and shellfish aquaculture: a review. *Rev. Aquac.* 1–26 (2017).

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