A BETTER WAY TO FARM FISH
IN SECHELT INLET

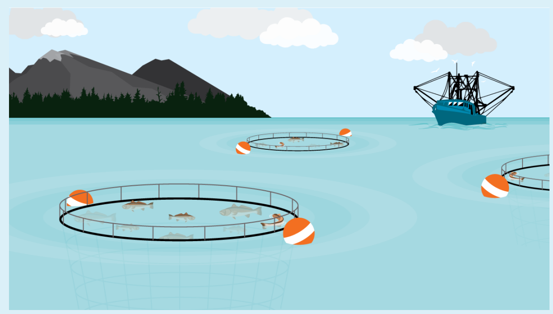
KEY POINTS

Current fish farms in Sechelt Inlet have negative implications on the surrounding environment

- Escapements of farmed Atlantic Salmon (invasive species) out-compete wild stock; excretion of fish and un-eaten feed smother bottom-dwelling organisms; excess by-product nutrients stimulate harmful algal blooms
- Sechelt Inlet has poor oceanographic conditions which do not efficiently support current monoculture farming
- To aid the sustainability of farmed finfish and support a fragile environment - an **integrated multi-trophic aquaculture (IMTA)** (polyculture) is proposed
- IMTAs mitigate the environmental effects of fish farming and capitalize on marketable filter and deposit feeders (eg. sea cucumbers, urchins, mussels)

WHAT IS AQUACULTURE?

Aquaculture is the rearing, breeding, and cultivation of aquatic plants and foods. Compared to wild capture, aquaculture production has grown to an impressive rate and has increased the quantity, affordability, and accessibility of fish globally. In Canada, aquaculture represents a 1/3 of the fisheries production and ~20% of total seafood production. The value of the industry has increased from $591 million in 2003 to $1.2 billion in 2017 (DFO, 2018).



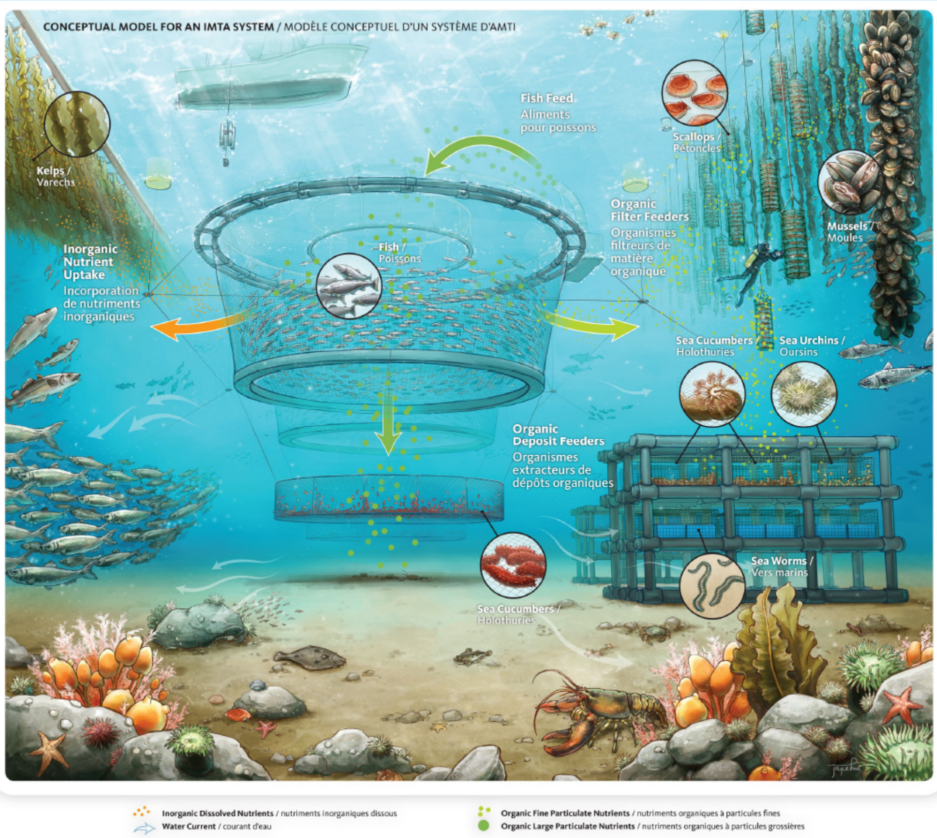
WHAT'S THE PROBLEM?

Aquaculture of finfish causes high amounts of waste for their surrounding environments. Although certain bodies of water may be better able to cope with managing farm waste, basins like Sechelt Inlet are not biophysically capable of efficiently supporting these farming practices. This semi-enclosed body of water is prone to reaching high temperatures (<20°C) in the summer and has an increased frequency of seasonal nutrient loading (Arber, 1993). These oceanographic properties contribute to the stimulation of harmful algal blooms which deplete the dissolved oxygen in the water and the sediments. Anoxic sediments release gases (hydrogen sulphide, ammonia, and methane) into the water and create localized toxic zones for fish. The unbalanced inputs and outputs of the 'old' system are causing economic and ecological loss. In addition, current fish farm nets are too close to the surface and kill sea birds. Despite this, six farms are still operational and harvesting Atlantic Salmon in Sechelt Inlet (DFO, 2018). In an effort to restore the balance and improve the production of the farms, a new integrated multi-trophic aquaculture (IMTA) system is proposed for Sechelt Inlet (DFO, 2013). The aim of the IMTA is to increase the long-term sustainability and profitable cultivation by allowing the wastes from one crop to fertilize another crop. IMTA practices incorporate species of *different* trophic levels in *one* system. Multiple trophic levels reduce energy and nutrient loss in the water. In Sechelt Inlet, the normal monoculture farms have species from the same trophic level co-existing (eg. only fishes). The fishes have the same ecosystem function and thus, wastes and excess feed are not recycled. Since this new system incorporates species with different ecosystem functions (eg. deposit and filter feeders), the overall production of the IMTA is much greater. Farmers are able to capitalize on harvestable crops of other plants and animals while using the same amount of feed.

PROBLEM	SOLUTION
Excess particulate organic nutrients from finfish feed and finfish waste smothering bottom feeding organisms	Deposit feeders (eg. sea urchins, sea cucumbers, worms) are able to sift through the sediments to feed on particulate organic matter. They are used to recycle larger particles that settle beneath the farm site.
Excess dissolved inorganic nutrients	Seaweeds (eg. kelp) extract the dissolved inorganic nutrients – specifically, the nitrate and phosphates that are produced by other farmed species.
Excess fine organic nutrients	Filter feeding bivalves (eg. blue mussel, Japanese scallop, pacific oyster) filter through the water feeding on micro-algae and small zooplankton. They reduce the fine organic particles that result from the feed and excrement components of the IMTA.
Entanglement of bird species in nets	Pens are lowered deeper into the water column to reduce the interaction with birds feeding on the farmed fish. This also reduces escapement by preventing nets from being compromised.
Low productivity of monoculture fish farming practices	Polyculture is economically beneficial for farmers because the IMTA farmed species can be harvested for commercial value alongside the farmed fish (eg. the Asian sea cucumber market is increasing in demand) (DFO, 2013)

MODEL FOR IMTA SYSTEM

The integrative multi-trophic model illustrates the use of finfish farms to generate high-quality organic and inorganic wastes to support shellfish and marine plants. The organic particulate nutrients from finfish food and finfish byproducts flow to the sea cucumbers (deposit feeders) and blue mussels (filter feeders) who ingest and convert the nutrients. The blue mussels and the fish nutrients are extracted by the sea cucumber. The inorganic dissolved nutrients from the finfish are taken up by the kelp (seaweed component). Within BC, Sea Vision has been ecologically and economically successful in implementing the IMTA approach to their commercial fishery (DFO, 2013). See video: http://www.dfo-mpo.gc.ca/videos/imta-amti-eng.html



@EugenieJacobsen

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CONTACT LIST

Nicholas Simmons
MLA Powell River – Sunshine Coast
nicholas.simons.MLA@leg.bc.ca

Pamela Goldsmith-Jones
MP – West Vancouver – Sunshine Coast – Sea to Sky Country
pam.goldsmith-jones@parl.gc.ca

Henry Warren Paull
Chief of the Sechelt Nation
wpaull@secheltnation.net

Darnelda Siegers
Mayor of Sechelt
siegers@sechelt.ca