

An Analysis and Comparison of the Sustainability of Ocean and Land-based Aquaculture Options

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MAIN FINDINGS

Aquaculture is a way for humans to shift away from fishing to and move to less impactful ways of generating food

It is better for the environment than raising other farm animals such as cattle and pigs

Out of the two methods considered: closed, land-based systems are more sustainable than ocean-based systems

From a comparison of aquaculture sites with similar output capacities, land-based systems have smaller footprints, are better for the environment, hire more people, provide better fish welfare, and deliver more consistent production.

Best practice examples from British Columbia show a shift away from open-net pen farms altogether and investment in land-based facilities (Seafood Source 2020)

With advancements in technology, it is expected that most aquaculture systems will move to land based operations



Photo source Salmon business

STUDY OVERVIEW

A global look into aquaculture practices while also looking into Canada's issues with finding a sustainable balance between ensuring food for everyone and protecting the environment for future generations.

Salmon in Canada are farmed in Newfoundland and Labrador, New Brunswick, British Columbia and Nova Scotia

Compiling together research in the form of peer reviewed articles and government-based reports and information from around the world.

BACKGROUND

Aquaculture, in its various forms, is an ever-growing industry worldwide. At its core aquaculture is the controlled process of cultivating aquatic organisms (Aquaculture Alliance, 2019) through breeding, raising, and harvesting for human consumption. Organisms included in this are fish, shellfish and to a lesser extent, aquatic plants. Aquaculture has been a long-standing practice in human history with evidence of its existence dating back to the Chou Dynasty (1112 bc – 221 bc) (Colin Nash 2010)

Research Questions:

- 1) Is aquaculture better for the environment than traditional fishing?
- 2) Between ocean based and land-based aquaculture systems, which is better for sustainability

As of the late 2010s aquaculture harvesting surpassed traditional fishing when it comes to total aquatic organisms caught for human consumption

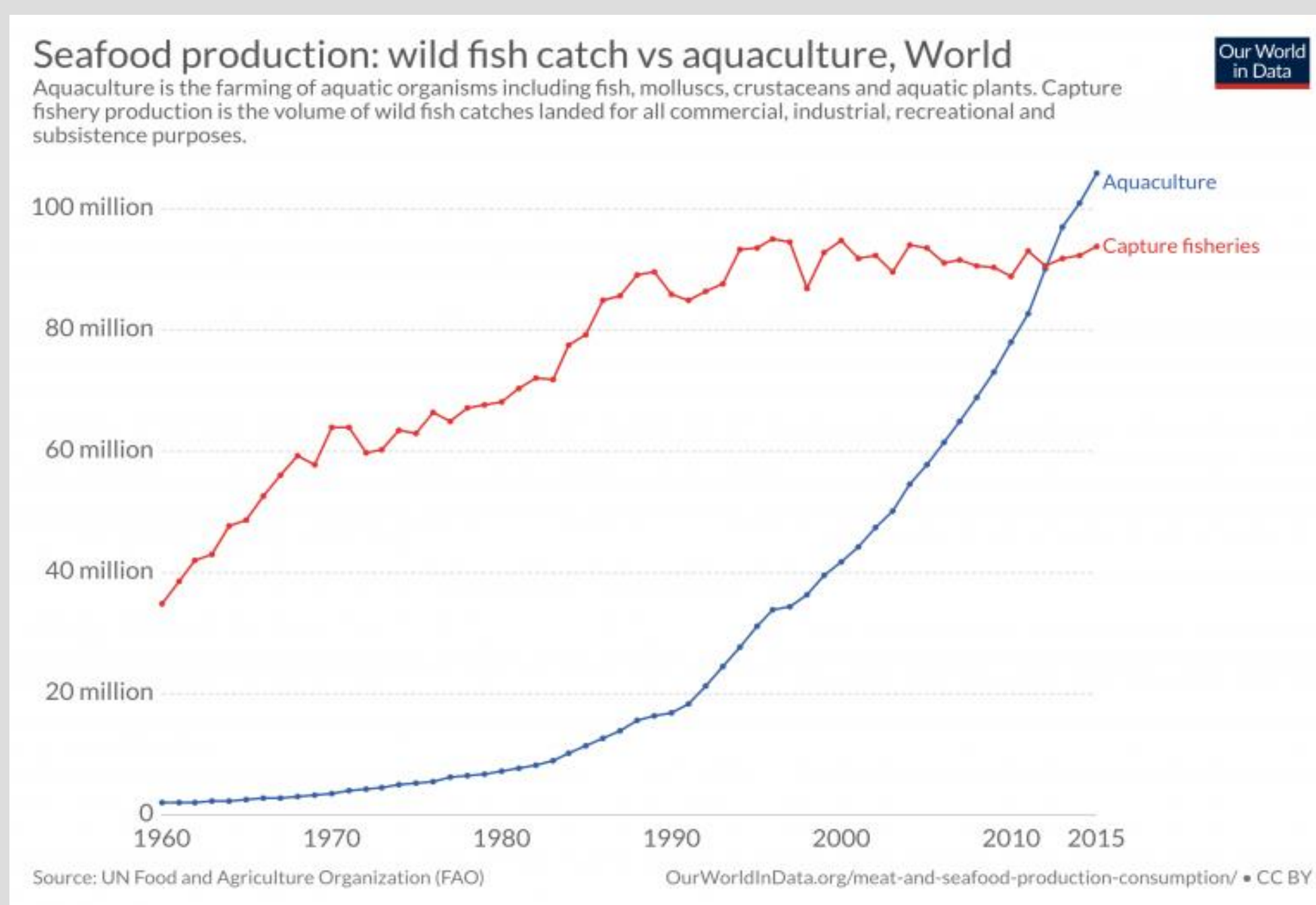


Figure 1: Wild caught vs Aquaculture farmed totals up until 2015

OCEAN-BASED AQUACULTURE

I will mainly focus on salmon farming because of the environmental risks it creates compared to other aquaculture organisms. Operations begin on land for the hatching and as the fish grow, they are moved into the pens in the ocean.

Pros:

- Reduces reliance on wild fish stocks,
- Can provide jobs to coastal communities
- Takes less time to get fish to harvestable size than waiting on wild stocks.

Cons:

- Frequent escapes of farmed fish
- Free exchange of diseases, pesticides, parasites and fish waste into ocean water
- Act as lures to predators who can get caught in netting and die(mostly by drowning)
- Cannot control water temperature(when this happens fish congregate leading to a lack of oxygen and resulting in die-offs

BY THE NUMBERS COMPARISON

	Ocean-based	Land-based
Start- up costs	\$12.3 million USD	\$32 million USD
Total area	463 000m2	68000 m2
Yearly harvest	~5600 metric tons	~5500 metric tons
Price per kilo	~\$5.66 USD	~\$5.66 – 7.63 USD
Profit over 10 years before interest and taxes	~\$5.47 million USD	~\$11.16 USD
Best case scenario for both methods		(Source The conservation fund)

CLOSED LAND BASED SYSTEM

Operations start and stay on land for entire growth cycle of the fish. Growth cycle is the same as open-net fish, only the final holding pens are different.

Pros:

- Reduces reliance on wild fish stocks,
- Can provide jobs to coastal communities
- Takes less time to get fish to harvestable size than wild stocks
- Virtually impossible to have escapees
- No free exchange of pollutants
- Cheaper to run
- More consistent harvest amounts
- Uses less feed
- Water temperatures controlled

Cons:

- More expensive to setup
- Takes up land
- Requires more electricity

SIGNIFICANCE OF THE STUDY

- Seafood is the most consumed animal protein in the world
- Traditional wild fishing has proven unsustainable in its current form
- Open net pen aquaculture is nearly as harmful to the environment as traditional fishing
- Many people rely on fishing to support themselves and their communities
- Switching to a more sustainable land-based system has been shown to reduce farming impacts

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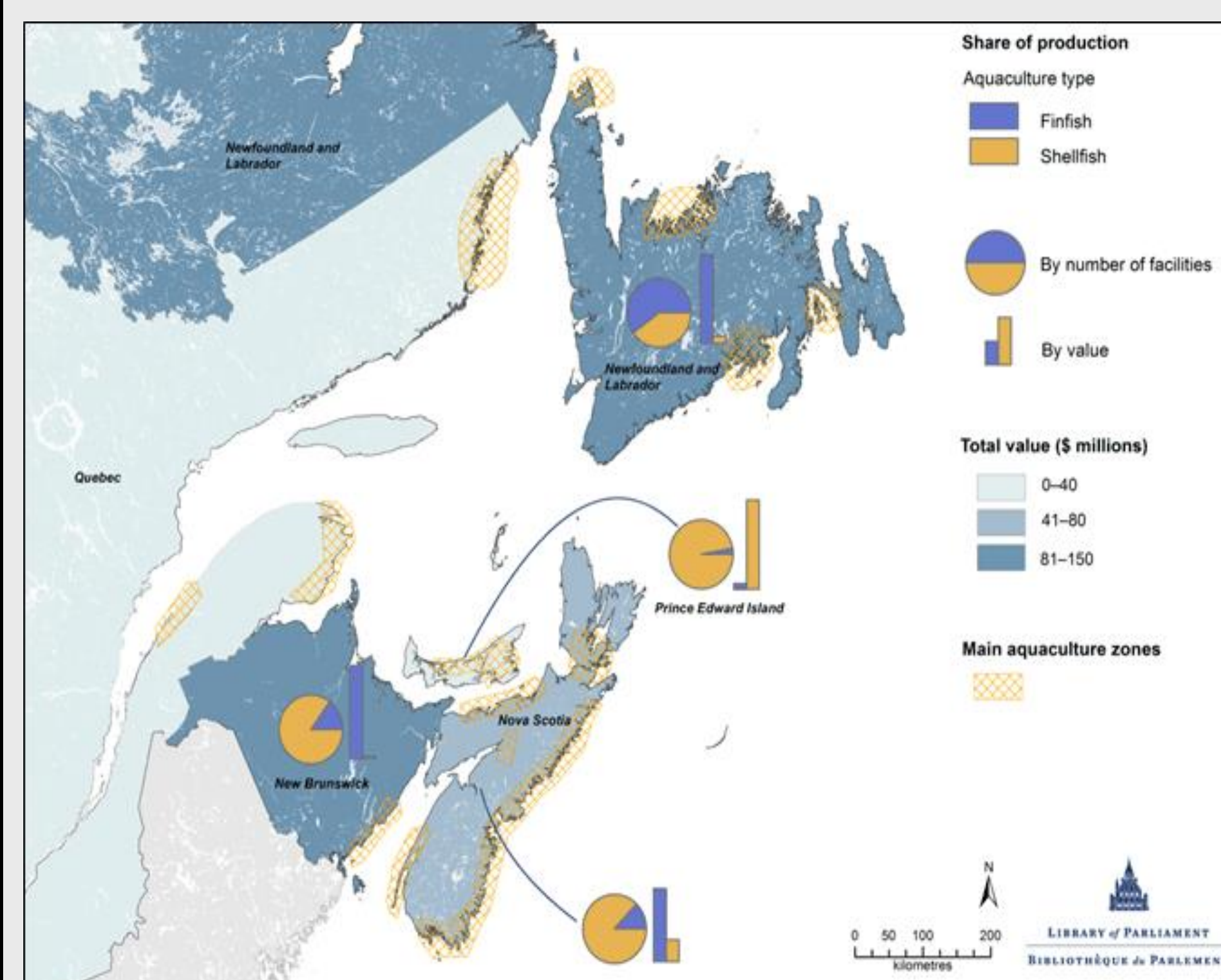


Figure 2: Aquaculture locations on the East Coast

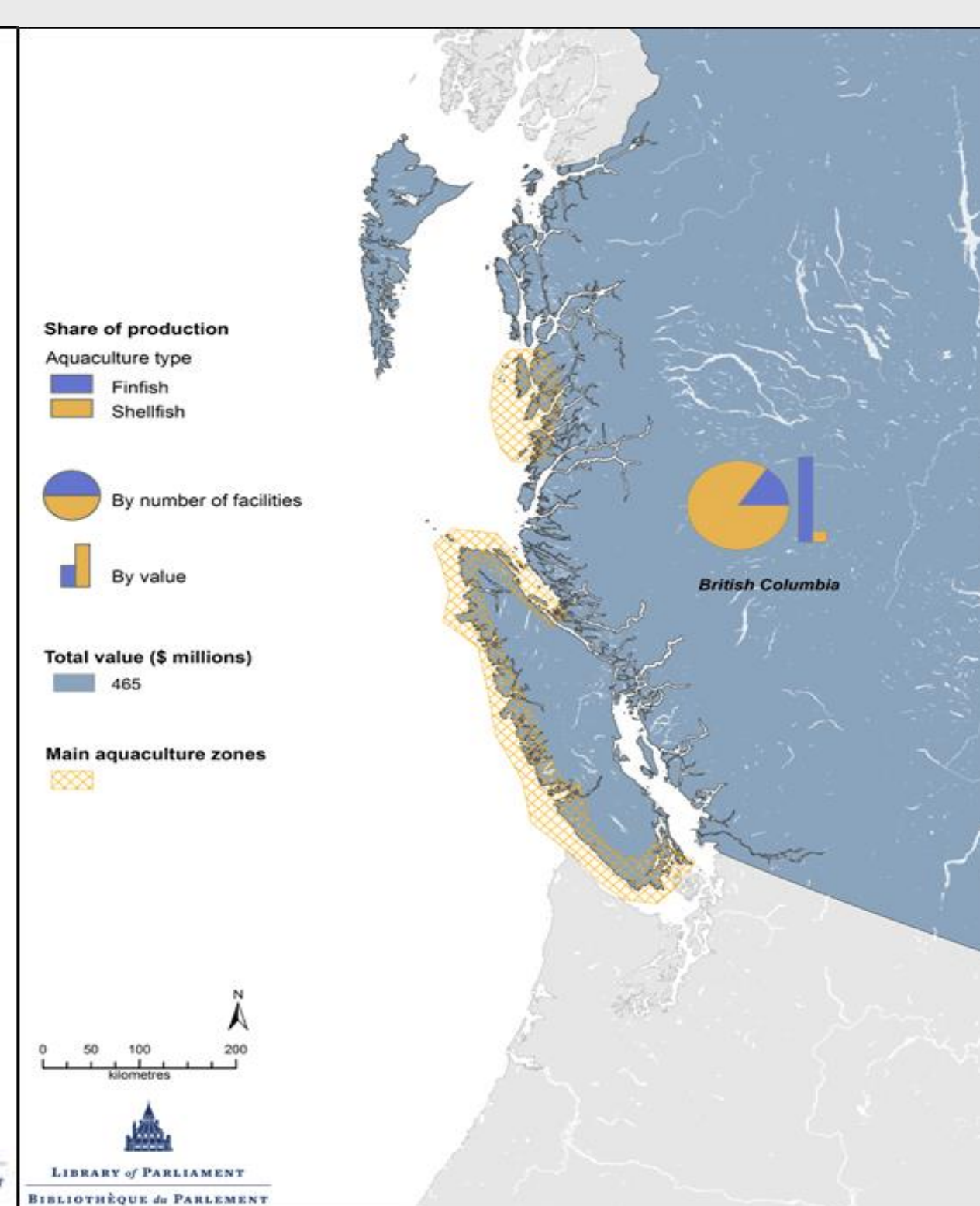


Figure 3: Aquaculture locations on the West Coast

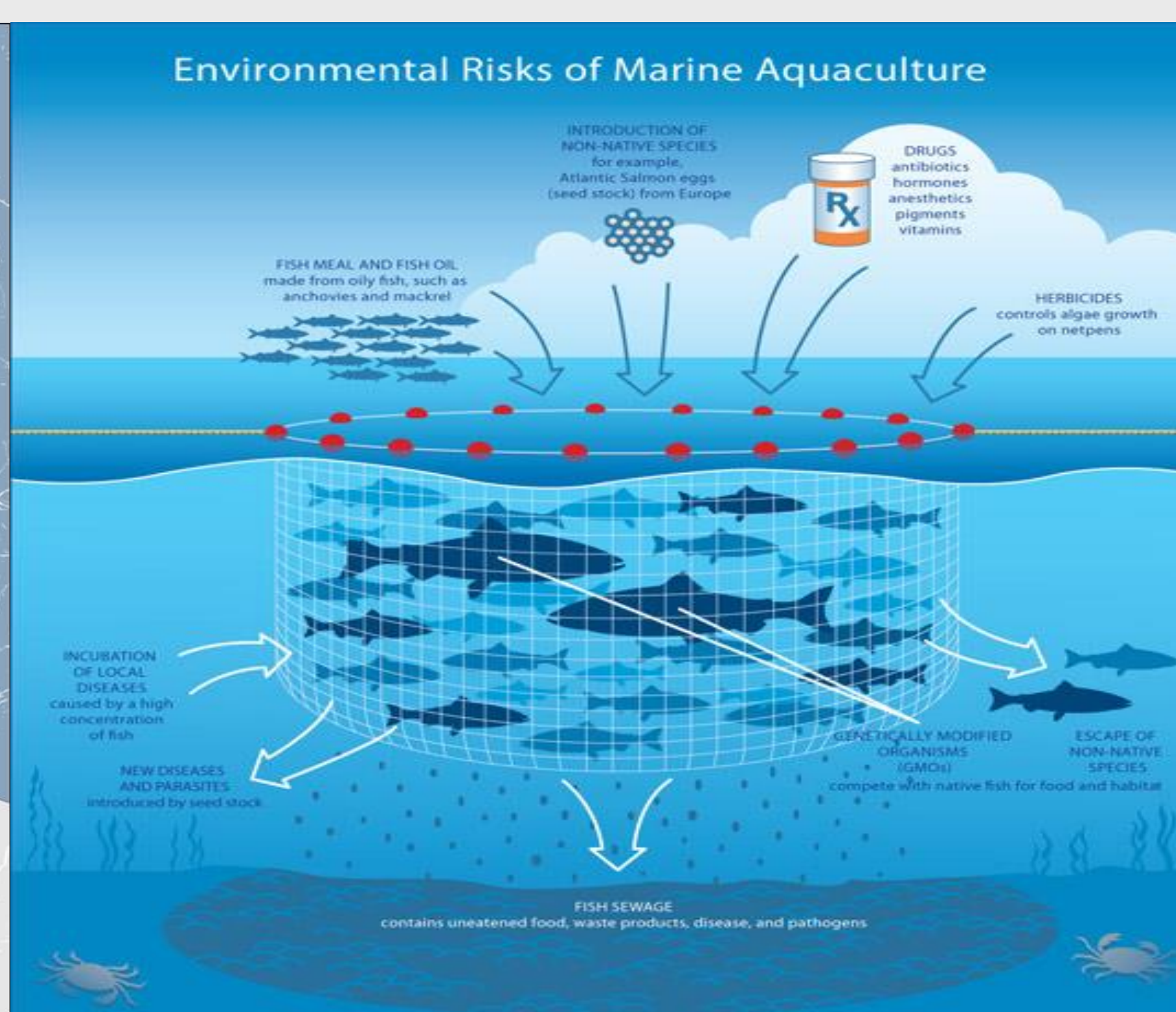


Figure 4: Example of an ocean-based pen from GSA