

## **Salmon Farming and the Environment**

**S**almon farming, like other food producing operations—whether for tomatoes, beef, wheat or any other commodity—impacts our environment. Thus, like these other agriculture production systems, it must stand up to rigorous evaluation of its environmental impact.

Evaluating the environmental impact of a food producing operation must consider not only what happens to the environment immediately surrounding the production site, but also how it impacts the worldwide ecosystem. As a relatively new and rapidly evolving form of food production, salmon farming and the rest of aquaculture have been the subject of intensive environmental assessments.

These assessments, when done with unbiased scientific scrutiny, consistently find that salmon farming poses a low risk to the environment, and the impacts that do occur are fully reversible through natural processes in a relatively short period of time. Salmon farming, like all of aquaculture, is extremely efficient in converting inputs into food, which has a positive impact far beyond local environmental effects.



## Local Impact

### Our Footprint

Salmon farming sites occupy a tiny portion of the coastal zone areas in which they are located. Aesthetics, navigation and a host of environmental considerations are taken into account when selecting sites. Issuing permits for each site is the responsibility of the local, regional and national jurisdictions and varies by locale. This process is rigorous; for example, in Maine, the process involves the review by over 15 authorities and typically takes 24 months to complete.

The actual area occupied by salmon sites is very small. Here are some examples:



**In Maine** the total area occupied is about 635 acres for all sites. This represents a very small percentage of the more than 2.5 million acres of fishable waters off Maine's coast which includes several hundred miles of shoreline. The actual salmon pens on these sites represent only about 30 percent of the 635 acres, the rest being open water. By comparison, pleasure boat marinas in Maine are estimated to occupy 1,275 acres of water space. And, of course, unlike salmon farm sites, these are all located on the most accessible shoreline.

**In Canada**, including operations in both British Columbia and the Bay of Fundy in the east, the total area is about 8,900 acres, which represents less than 1/10,000 (0.01%) of the coastal area in which these sites are placed.

**In Chile** it is estimated salmon farm sites occupy less than 1/50,000 (0.002%) of the available area.

### Our Impact on Water Quality

The primary waste products entering the water around salmon farming operations are salmon feces and uneaten feed that fall to the sea floor. While both are organic material and the salmon fecal matter is no different than that from wild fish, the concentrated area of the sites warrants an examination of these points.

One example from Maine is representative of what the total additional load placed on the environment is like: Based on a single-year class cycle (24 months) at a farm site that includes 18 cages with 500,000 salmon, on average, each day a total of 294 pounds (dry weight) of salmon byproduct are discharged. At this particular site, this is integrated into approximately 1.7 billion gallons of water. This is equivalent to 2 tablespoons of salmon byproduct being integrated into the amount of water found in 24 average-size, backyard in-ground swimming pools.

The first concern of salmon farmers and others is how this solid matter affects the areas under the sea cages. To a large degree, this depends on the tidal currents, which disperse the matter. As expected in

this highly variable environment, it differs by location.

When tides are not sufficient to disperse the daily load, salmon feces and uneaten feed fall to the bottom under a site faster than they can be consumed by marine animals. When this happens, these materials cause temporary oxygen reduction and chemical changes in ocean-floor sediments as they decompose. These effects are limited to the immediate area of the farm, and the sediments return to normal within several months after a farm is "fallowed" or moved to another site.

Studies and routine observations show that the abundance of bottom-dwelling animals along the edge of salmon farms is often significantly more than what would be there without the farm. Some species are not suited to the enriched conditions under a farm, and consequently there are temporarily fewer types of animals present in the sediments in the immediate area of a farm.

The area impacted by sites is quite small, usually within 100 feet of the pen. Any effects diminish rapidly as

### Doing Even Better

Ocean floor effects from salmon farms are being reduced in a number of ways. Most farms have underwater cameras or other equipment that allows them to stop feeding when the fish are full, reducing the amount of feed falling to the bottom.



Data from three Canadian provincial government studies reviewing the environmental impact of salmon farming waste in British Columbia show the results: The actual loss of wastes to the environment by today's industry is approximately one-third of what it was in the late 1980s. This, in spite of the fact that production levels at these sites have increased approximately three-fold.

one moves away from the pen, and there are no effects beyond 500 feet.

The effects on the ocean bottom begin to reverse naturally as soon as the fish are fully harvested from a site. Within several months, the sediments return to normal. The mix of fauna underneath the site returns to normal within two to three years, leaving no permanent impact.

## Our Impact on Other Marine Animals

### Predators

Seals and sea lions are the main predators that occasionally prey on farmed salmon. They are capable of biting fish through nets, and can kill hundreds of salmon in a single night. A common method to deter predators is to place a second net around the primary net containing the fish.

Salmon farmers can obtain permits from local authorities to destroy persistent individual predators, under specified conditions and when other deterrence measures have proved insufficient.

The populations of primary species that can be a problem for salmon farms—harbor seals and California sea lions—have been consistently increasing in both Maine and British Columbia waters for 25 years, and their populations are currently at historic highs.

### Wild Salmon

**In the Pacific:** There are two principal concerns about the impact of escaped farmed salmon on wild Pacific salmon: competition for food and habitat, and interbreeding between wild and farmed species. This is only a concern in British Columbia and the northwest region of the U.S., as wild Pacific salmon are not native to the east coast of Canada, the United States or Chile.

When farmed Pacific salmon escape they do not compete well in the wild, and do not have a high survival rate. Of the low number of escaped fish that survive, over 94 percent have empty stomachs when caught, indicating that their competition with wild salmon for food is insignificant.

Very few farmed Pacific salmon have been found in river systems and farmed fish have been shown to have a significant competitive and reproductive disadvantage compared to wild salmon. Competition for spawning locations between wild and farmed salmon is negligible.

Escaped Atlantic salmon farmed in Pacific waters survive even more poorly than farmed Pacific salmon and because they are a distinct species from Pacific salmon they *cannot* interbreed. Over the years, numerous attempts to introduce Atlantic salmon into Pacific

habitats have failed in spite of intensive stocking programs involving stocking tens of millions of fish.

**In the Atlantic:** There is concern in the Atlantic that escaped farmed salmon will interbreed with wild salmon. Some experts feel that this would be beneficial to the recovery of wild populations by improving the gene pool. Others disagree, and want the wild salmon to remain “pure.” The industry is addressing these concerns.

### Fish Health

There is no evidence that farmed salmon spread disease to wild salmon, or that the small amounts of antibiotics used in salmon feed from time-to-time affect the environment.

Preventive health measures are good business. This business consideration also benefits the environment by ensuring healthy fish go in the water and minimize any treatment required. The fish health program is as comprehensive as any in the sea farming operation:

- Inspection of fish before they are moved to the sea farm, meaning fish placed in the farm are healthy.
- Vaccination of fish before they are placed in the farm, so the natural immune system is fully activated and disease resistance is increased.
- In Canada, less than three percent of the feed fed to salmon is medicated. When antibiotics are used, they are administered in the feed and under the direction of a licensed veterinarian.

### Production Efficiency

Salmon farming produces about one pound of salmon for every one and a half pounds of feed consumed. When compared to other farmed animals, salmon farming is very efficient in terms of feed conversion ratios per pound of edible food. For instance, the current ratio for beef is 10 to 1 and for pork is 5 to 1.

As a comparison with wild salmon production efficiency, farmed salmon efficiencies represent a significant ecological advantage because it takes between 10 and 15 pounds of wild forage fish to produce one pound of wild salmon compared to under 3 pounds for farmed salmon.

Wild Pacific and Atlantic salmon in the lower 48 states and Canada have seen significant declines over the last several decades, starting long before salmon farming operations occurred. All the evidence points to the fact that the declines were caused by a combination of climate change, over-fishing and freshwater-habitat destruction.

The evidence shows salmon farming has not had a significant impact and poses a low risk to Pacific salmon. On the east coast of the United States, wild Atlantic salmon are an endangered species. While farmed Atlantic salmon do not impact on their decline, there is concern about interbreeding between wild and escaped farmed salmon. This is being addressed by the industry.

### Fishmeal and Forage Fish

Fishmeal used in salmon farming represents about 30 percent of the salmon feed consumed and this accounts for about 9 percent of the world consumption of fish meal. The bulk of the fishmeal used worldwide goes into livestock and poultry feeds and for fertilizer.

The fishmeal used in salmon farming feed is composed primarily of fish, commonly called forage fish, that are fast-growing, short-lived, and not generally used for human consumption. The Food & Agricultural Organization (FAO) of the United Nations has stated that the forage fish sources for fishmeal are not over-fished or depleted.

### How Forage Fish Are Wasted

As a comparison to the total amount of forage fish used by all sources, of which salmon farming represents 9 percent, consider that the amount of by-catch killed and discarded annually is estimated to be between 18 and 40 million tons. By-catch is the unwanted fish that are caught in nets used for other species and discarded. This represents approximately the total amount of fish currently harvested for fishmeal production.

### Aquaculture and Farmed Salmon Production as Part of the Global Environmentally Sustainable Solution to More Food

There are three reasons for the development and growth of farm-raised salmon.

1. People want more salmon than can be caught. In a peak catch year, wild salmon can supply about one-third of the worldwide demand for salmon. And that's at today's demand, which is growing as people find the tasty solution to a healthy diet in salmon.

Wild salmon fisheries are carefully managed to avoid the perils of over-fishing that have led to the depletion and near extinction of some important ocean fish species, such as cod. But this stewardship means supplies of salmon caught in the wild are limited and cannot increase.

2. Fresh fish is what people want to eat most of all and only the year-round supply of farmed salmon can provide that.
3. The third reason is much more basic than preference for fresh salmon. It has to do with the worldwide demand for protein and how we will face this

challenge. Farmed salmon, as other farm-raised aquaculture species like shrimp, tilapia, and catfish, to name just a few, represent one very important way to feed the world in the 21st century and beyond. Consider the facts:

- There is not enough unused available land to bring into production to fill long-term demand for food.
- Water for irrigation is diminishing at an alarming rate, which means irrigated lands that now produce abundantly will no longer do so.
- Fisheries are at the limit of their catch worldwide. Harvesting could mean extinction for many species of fish.
- More than a billion people depend on fish as their main protein source.
- Population growth is ever expanding.

We need to farm fish to feed people. Farm-raised salmon is now part of the answer to preventing hunger.

#### SALMON OF THE AMERICAS



#### Our Mission

Make salmon the dietary protein source of choice by informing the North American public about its nutritional value, wholesomeness and the environmentally sound practices associated with production of this sustainable natural resource.

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