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Is there a Bottom Line in the Wild Salmon - Farmed Salmon Debate?

- A Technical Opinion -

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Introduction

Despite early attempts to farm salmon in British Columbia's marine environment, the industry did not take hold until some 20 years ago. Many looked upon this new industry as a gold mine and a near gold-rush mentality prevailed as floating net-cage farms popped up along the BC coastline. Initially, the industry largely concentrated on raising coho and chinook salmon in their ocean feed lots. Pacific salmon did not take well to 'domestication' and the industry largely switched to Atlantic salmon production in keeping with operations in Norway, Scotland and Ireland. Although the industry had now introduced a foreign species to Canada's West Coast, the federal government approved the move, blurring the lines of authority and responsibility between fish farmers and government regulators, who some believed were acting more like industry promoters. It is notable that the United Nations has declared the introduction of foreign or exotic species as the greatest threat to global biodiversity after habitat loss. Fishermen, environmental groups, and the concerned public became outraged at this relationship between government and industry, and thus began an acrimonious rapport between all of the interests. In the early 1990s, the industry, which then was run mostly by small BC companies, ran into difficulties and some farms disappeared. As a result of this, several large, multinational corporations (mostly from Norway) consolidated farms along the coast and they now dominate the industry in BC (Keller and Leslie 1996, EAO 1997).

As the salmon-farming industry has developed here, there has been an obvious lack of meaningful government control and regulation. In fact, the provincial and federal governments have promoted the industry at a cost to the environment. The federal Department of Fisheries and Oceans (DFO) has a particularly clear terms of reference, but it has been less than diligent in enforcing its legal mandate - the protection and conservation of wild fish and their habitat.

The introduction of Atlantic salmon to this coast is a prime example of DFO favouring industry over environmental protection. Such decisions were politically led because in the early 1990s, the Fisheries Director of the-then provincial Ministry of Environment, Lands and Parks and the DFO Regional Director General did not support the introduction of Atlantic salmon to BC's coast. Government bureaucrats were given a political directive to allow the introduction with the provision that it be done so as to protect wild salmon (D. Narver, 1995). From the outset, the industry was prone to countless violations of the federal *Fisheries Act*. This has included the escape of hundreds of thousands of fish including Atlantic salmon, harmful alteration of habitat including the smothering of the benthos under the net pens with fish wastes, unapproved facilities that interfere with navigation, and illegal deposit of deleterious substances. Despite this, government agencies did not put this industry on an even playing field with other industries that would be held responsible for similar actions.

Concerns related to Salmon Farming

1. Open net cages: The use of net-pen technology floating in the ocean is the root cause of many environmental problems and the issue that most requires resolution (Staniford 2002). The problem with this technology is that what is put into the sea pen will, in certain quantities, eventually spread beyond the pen and settle on the ocean bottom. Farmed salmon are also susceptible to disease and predators from the marine environment outside of the cage. To control predation, the government will issue farms predator-control permits that allow marine mammals like seals and sea lions to be shot.

2. Disease: One of the greatest threats to wild salmon is the introduction and/or the enhancement of disease (i.e. amount and strains) and the spread of disease from salmon farms. Of special concern is the fact that a monoculture of salmon crowded into a net pen is a prime candidate for disease epidemics, particularly the enhancement of sea lice populations that can harm wild fish populations. The use of Atlantic salmon further exacerbates this problem as they can have less resistance to natural diseases or parasites indigenous to the Pacific coast. Studies indicate that sea lice emanating from salmon farms in the Broughton Archipelago, off the northeast coast of Vancouver Island, were the most probable cause of a large loss of juvenile wild pink salmon in 2001. This was a major contributor to the catastrophic collapse of returning adults in the fall of 2002 (PFRCC 2002).

3. Waste Discharges: An obvious impact of a net-cage salmon farm is the deposition of fish feces and excess food products on the ocean bottom. This impact is local in scope and can smother the benthic environment. Reducing food waste and fallowing sites (i.e. removing the fish and leaving the pen empty for a period of time) has been applied to mitigate these impacts. Unfortunately, the problem still exists and provincial Ministry of Agriculture, Food and Fisheries regulations, which specify the sampling and testing for sulfide generation, are overly simplistic and will not adequately protect the benthic life under a fish farm (Levings et al 2002). DFO has indeed disagreed with this approach but has yet to define what is a harmful alteration of the ocean bottom habitat, as is required, if the federal *Fisheries Act* is to be fully applied as a regulatory tool.

4. Escape of Farmed Fish: Many people are very concerned about the escape of Atlantic salmon and their possible colonization of West Coast habitats and competition with Pacific salmon. While this is a legitimate concern, the escape of farmed Pacific salmon may be as great or a greater threat to the health of wild salmon stocks (Volpe 2001). Farmed Pacific species, which include coho and chinook, are most often hybridized and will readily cross with local salmon, thereby altering their genetic makeup.

5. Predator Control: Fish farmers can obtain a DFO Predator License to kill seals and sea lions that threaten their farmed fish. Such licensing has been abused, and control over the killing and the mandatory reporting provisions have not been enforced. Although it is believed that the kill rate has been greatly reduced in recent years, reporting provisions continue to be largely ignored. In 2002, DFO did not receive a single sample from killed pinnepids as is required under their permits. DFO has argued that seal and sea lion populations are healthy (Morgan 2003), but they seem to have forgotten about the Stellar sea lion whose populations are red-listed under provincial species at risk policy (Cannings 1999) .

6. Fish Food: As long as 10 years ago, warnings were issued that fish farms were consuming more and more of the world's diminishing fish meal resources (Rumsey 1993). The fish meal fishery has long over-exploited global fish stocks (Naylor 2000). The practice of taking fish from a protein-poor Third World country's fishery to produce salmon for wealthy North American and European consumers raises not only concerns for ecosystem integrity, but also significant ethical issues.

7. Salmon Quality: Much controversy is associated with the quality of farmed salmon. The farmed product is generally softer in texture and is an unappetizing grey colour. The latter problem is overcome by the addition of pigment to the food in order to colour the flesh a more-appealing red tone. Although some indicate the addition of such pigments is not a concern in farmed salmon, high doses of these colorants can harm the human retina (Baker 2001). The European Union has recommended the reduction of the pigment Canthaxanthin in fish food from 80 mg/kg to 25 mg\kg (SCAN 2003).

The proportion of beneficial omega-3 to omega-6 fatty acids is reduced in farmed salmon when compared to wild salmon, and many health experts consider this a health issue (Bell and Paone 2002). However, of greater concern to human health is that most farmed fish have up to 10 times the levels of persistent organic compounds such as PCBs in their tissue over that found in wild fish (Easton, 2001).

8. Price Impacts: Some argue that farming salmon will take the pressure off wild salmon and allow diminished wild populations to recover. This is misleading, however, as globally, salmon farming now out produces the wild fishery. This has resulted in a glut of salmon on the world market and depressed prices for salmon. Wild salmon prices are approximately 20 percent of what they were 10 years ago, and farmed salmon prices have also declined, reducing industry profits. Fishermen can no longer make a living because they cannot compete with cheap farmed Atlantic salmon that is available year-round. Where fishing is possible, this has put more pressure on fishermen to increase their catch. In BC, government agencies are now putting less effort into conserving wild salmon as they believe it is no longer an economic driver. Unfortunately, the greater ecological value of salmon in ecosystem functioning is not considered. This leads to a heightened downward spiral for the future of wild salmon and those that depend upon salmon for their livelihood. Of course, this dependence also includes aquatic and terrestrial ecosystems (Grende et al 2002).

Discussion

Most jurisdictions where salmon farming exists, other than Chile, boast that they have the most-stringent regulations in the world. British Columbia is no exception (Van Dongen 2002). Despite the mandates of a multitude of government agencies (including the provincial ministries of Water, Land and Air Protection and Agriculture, Food and Fisheries, DFO and the federal Environment Department), government promotion of this industry exceeds the necessary research, regulations, and enforcement necessary for salmon farmers to adopt environmentally sustainable techniques and operating procedures. This was recently confirmed in studies by the Pacific Fisheries Resource Conservation Council (PFRCC), an independent body appointed by the federal government (2003).

There has been little objective assessment of the environmental impacts caused by salmon farming or how government manages the industry. Day-to-day decisions by government agencies have been inequitable in that they insist that fish farms cause little or no risk to the environment. Available research, however, simply does not support such a politically motivated agenda. This conclusion is confirmed by one of the most recent and objective reviews conducted to date: that of the federal Office of the Auditor General in 2000 (Gardner and Robertson 2003, PFRCC 2003). The provincial government has concluded that the recent PFRCC report did not conclusively indicate that sea lice are a threat to the wild fishery, and the provincial Fisheries Minister has indicated his department will continue to operate as they have in the past (van Dongen 2003). This is distressing to say the least and demonstrates the need for a change in short-term thinking so that the precautionary principle will not continue to be violated and ecosystem health undermined.

Government and industry have been very reluctant to objectively review most of the problems outlined above. Indeed, as time passes and more information becomes available, many of the issues that biologists and environmentalists have predicted have indeed come true. The industry claimed that escapes of Atlantic salmon were not an issue. If they escaped they would not survive. If they survived they would not migrate into our rivers and spawn (McMullan, 2000, 2001). They have indeed done exactly that (Volpe 2001, Gardner and Robertson 2003). Also, the impacts of the 2002 sea lice epidemic in the Broughton Archipelago were totally dismissed despite solid European research that indicated salmon farms greatly enhance sea lice populations. There is high probability that the 2002 pink salmon runs in the Broughton Archipelago collapsed due to the extreme level of infestation of the ocean-bound juvenile pink salmon as they migrated past the numerous salmon farms in that area.

Conclusions

Salmon farming based on net-cage technology is a definite threat to the marine environment, ecosystem functioning and wild salmon populations. The risk to wild salmon and marine habitat varies depending upon the threats posed by the location of specific fish farms on the local environment. Currently, impacts from sea lice due to a propagation of natural sea lice levels because of fish farms has reached a crisis level of concern in the Broughton Archipelago. Unfortunately, government agencies (i.e. DFO and the provincial Fisheries Ministry) have been less than diligent in protecting the natural environment and associated wild species. Government agencies, in cooperation with industry, have promoted salmon farming while not conducting the necessary research, regulation development and enforcement to protect natural ecosystems and the vital legacy of wild salmon on Canada's West Coast. The lifting of the moratorium in April 2002 by the provincial government to allow salmon farm expansion along the BC coast was premature because it was not supported by solid science based on a risk-adverse approach. If politicians and government agencies believe that the protection of wild salmon and the wild salmon fishery is truly important then a much more objective approach to fish farming must be implemented in order to sustain the natural environment. Although there has been some positive dialogue between the protagonists, the controversy over wild versus farmed salmon is alive and well in British Columbia, and for now, it appears there is no foreseeable bottom line in this debate.

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