Executive Summary

WHAT PRICE FARMED FISH:

A review of the environmental & social costs of farming carnivorous fish

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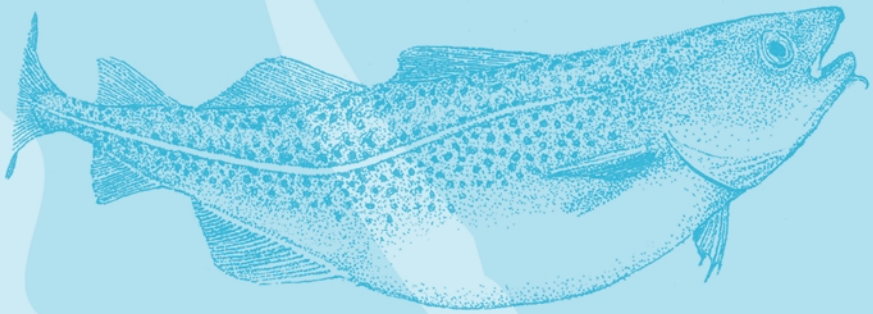

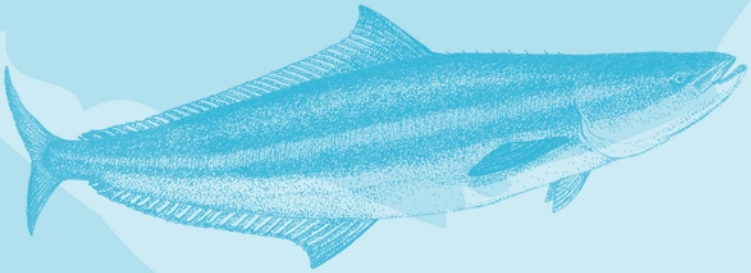

SeaWeb
Raising Awareness of the Living Ocean

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INTRODUCTION

The explosive growth of salmon farming in the 1990s raised concerns about its impacts on the environment and wild salmon populations; it also brought into question the wisdom of farming carnivorous fish. As profits from salmon farming declined, though, industry leaders shifted their attention toward farming other species of carnivorous fish. Neither government agencies nor industry players effectively applied the lessons learned from the unsustainable expansion of salmon farming to the development of new types of fish farming. Therefore, the same problems that resulted from salmon farming are expected to continue with other species.

This report provides a general overview of aquaculture and summarizes available literature on trends in aquaculture production, farming salmon and other carnivorous species, salient environmental and human health issues, and alternative methods and species for farming fish.

BACKGROUND

In the last decade, the supply of seafood and other aquatic products has grown steadily. While catches in capture fisheries have leveled off, reported production of aquaculture has grown dramatically. Between 1985 and 2000, global aquaculture production grew fourfold, to over 45 million metric tons (mt).

Consumption of seafood and other aquatic products varies from country to country. Overall, fish is the primary source of animal protein for one billion people.

Aquaculture has a pivotal role to play in meeting the need for growing human populations for high-quality protein. The capacity of aquaculture to fulfill this promise over the long term will depend upon the development of farming practices that do not compromise the sustainability of farming operations or the biological and social environment on which they depend.

OVERVIEW OF SALMON FARMING

Between 1985 and 2000, production of farmed salmon grew from 59,000 mt to more than 1,000,000 mt, and surpassed production from wild salmon fisheries. Norway and Chile produce nearly 70% of farmed salmon, followed by the United Kingdom, Canada, the Faeroe Islands and the United States, while the principal markets for farmed salmon are the United States, Japan and Western Europe. The United States imported $619 million of farmed salmon in 2000, nearly all coming from Canada and Chile. Ownership of the salmon farming industry has become highly concentrated in the last decade with 30 companies producing two-thirds of the world's farmed salmon and trout in 2001. Atlantic salmon has dominated farmed salmon production from the beginning,

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and accounts for approximately 90% of the total, followed by coho and chinook salmon.

Proponents often have promoted salmon farming, and other forms of aquaculture, as a means of generating socioeconomic benefits such as jobs and income for rural areas. However, as methods of farming salmon have evolved and become more intensive, employment opportunities have declined. Lower production and market prices also have contributed to financial instability in salmon fishing fleets and many fishermen have gone out of business, with dramatically negative effects on the economies of rural coastal communities.

ENVIRONMENTAL ISSUES

Like other forms of intensive food production, industrial-scale farming of salmon and other carnivorous fish generates environmental and social costs. The extent of these costs depends on such factors as the scale, intensity and duration of a farming operation, the biological and oceanographic setting, and other past or existing activities in an area. These costs are rarely evaluated before farming begins or expands.

The following problems have arisen in the farming of salmon and will likely arise in the farming of other carnivorous species:

Displacement of wild populations: Large numbers of farmed fish regularly escape from netpens each year. Once escaped, farmed fish can reduce the viability of wild populations, particularly those that have always been small or that have been reduced by overfishing, habitat loss or other causes. If genetically modified fish are approved for commercial production in netpens, their expected escape will pose an additional threat to vulnerable wild populations.

Genetic impacts: Once they have escaped from netpens, farmed fish may breed with wild fish, thereby introducing their farm-adapted genetic make-up into wild populations whose own genetic make-up reflects adaptations to environmental conditions over millennia.

Parasites and diseases: In the crowded conditions of netpens, pathogenic organisms that occur at low levels in the wild, or not at all, may reach epidemic proportions. In addition to killing tens of thousands of farmed salmon each year, disease and parasites can be transferred to wild fish populations.

Effects on other wildlife: Confining large numbers of fish in coastal netpens attracts marine wildlife that can become entangled in protective nets. Lethal and other measures to deter wildlife from netpens often have direct and indirect negative effects on local wildlife populations.

Aquaculture wastes: Much of the feed used in farming salmon and other carnivorous species enters surrounding waters as uneaten feed or feces. Depending upon oceanographic conditions, these wastes can pollute bottom habitats and organisms.

Chemicals and antibiotics: Like other aquaculturists, salmon farmers use pesticides and other chemicals as well as antibiotics

whose environmental and ecological effects are poorly understood. Government controls and reporting requirements regarding the use of chemicals and antibiotics remain spotty.

Feeds and feed conversion ratios: Farming carnivorous fish results in a net loss of fish protein. Unlike farmed herbivorous and omnivorous fish, such as carp, catfish and tilapia, which consume a plant-based diet, farming carnivores requires a diet containing large amounts of fishmeal and fish oil. Even with improvements in feed and breeding, three pounds or more of wild fish are still required to produce one pound of farmed salmon or other carnivorous fish.

HUMAN HEALTH ISSUES

Nutritionists often urge the consumption of marine fish because omega-3 fatty acids in the tissue of many types of marine fish provide unique and significant health benefits. Recent tests have found that unlike their wild counterparts, farmed Atlantic salmon have low levels of omega-3 fatty acids and relatively high levels of omega-6 fatty acids, which can be problematic.

Limited studies have found surprisingly high levels of toxic chemicals such as polychlorinated biphenyls (PCBs) and dioxins in farmed salmon fed fishmeal and fish oil.

Key concerns regarding the use of antibiotics in aquaculture have to do with the development of resistance to antibiotics and the presence of antibiotics in wild fish and shellfish harvested from areas surrounding fish farms. These impacts have received little study.

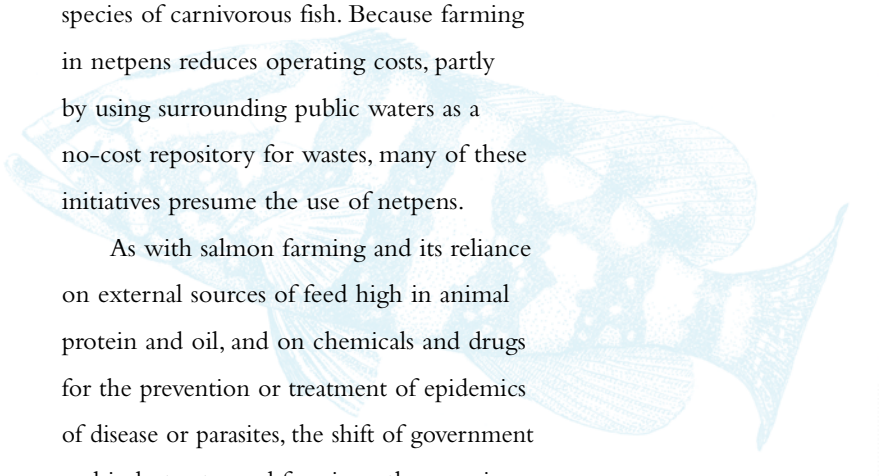
THE FARMING OF OTHER CARNIVOROUS SPECIES

As markets for salmon become glutted and prices continue to decline, many multinational corporations involved in aquaculture are diversifying their operations by adapting methods of farming salmon to other species of carnivorous fish. Because farming in netpens reduces operating costs, partly by using surrounding public waters as a no-cost repository for wastes, many of these initiatives presume the use of netpens.

As with salmon farming and its reliance on external sources of feed high in animal protein and oil, and on chemicals and drugs for the prevention or treatment of epidemics of disease or parasites, the shift of government and industry toward farming other carnivorous species will likely generate many of the same environmental, human health and social problems.

Generally, neither government agencies nor the industry have devoted nearly as much effort to identifying and addressing such problems beforehand as they have to developing techniques for farming additional species in coastal waters.

The report provides brief descriptions of farming activities for Atlantic cod, cobia, barramundi, grouper, halibut, red drum, seabass, seabream, turbot and other species.



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AQUACULTURE ALTERNATIVES

In thinking about alternative farming practices, it is useful to step back from the industrial model of food production to which we have become accustomed, and to survey the world for other possible models that may better reflect sustainable principles. Small-scale agriculture in Asia, for instance, often integrates the production of vegetables, livestock, poultry and fish. Wastes of one activity become inputs to another, thereby optimizing the use of resources and reducing pollution. Fish play a unique role in such systems by converting low-grade feed and wastes into high-quality protein that can be harvested at will.

Given increased wastes from intensive production of poultry and livestock in both developed and developing countries, waste-fed aquaculture may provide a means for significantly reducing pollution of lakes, streams and coastal waters. However, such uses of aquaculture have attracted little research and development in the United States or elsewhere.

Most research and development now focuses on incremental improvements of industrial-scale open systems of aquaculture that require the import of food, energy and chemicals and the discharge of wastes into the environment. Compared to open systems including coastal netpens, a closed, recirculating system on land provides the farmer with greater control over the environment of the fish and over exposures to disease, parasites, and predators. However, recirculating systems are currently feasible only in high-value niche markets. Farming fish in netpens in the open ocean rather than coastal waters is expanding, but many questions remain unanswered, including environmental and biological impacts and economic feasibility.

While some progress is being made in reducing the reliance of carnivorous fish on relatively high levels of animal protein and fish oil in their feed, fish farmed in coastal netpens will continue to rely on external sources of food. Pilot projects have demonstrated some promise for recapturing the nutrients in feces and uneaten feed by cultivating seaweeds or raising mussels or oysters near netpens.

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CONCLUSIONS AND RECOMMENDATIONS

Industrialized aquaculture of salmon and other species that requires intensive use of resources and exports problems to the surrounding environment is overdue for reform. As attention shifts to farming other species of carnivorous fish, government and industry have an opportunity to do things differently and to develop new forms of aquaculture in ways that do not create the same kinds of problems associated with salmon farming.

- Farming fish in netpen systems pollutes the environment through discharges of feed, feces and chemicals, and threatens wild fish populations through escapes of farmed fish and the transfer of diseases and parasites. To eliminate these risks, the future expansion of the finfish aquaculture

industry should be based on closed systems, total containment of fish, and recovery/reuse of wastes.

- While transitioning to closed containment systems, a number of measures should be taken to protect wild fish populations and coastal ecosystems, including mandatory reporting of escapes, tagging of farmed fish, and use of reproductively sterile stock. Non-native and genetically modified strains and species of fish should be prohibited from farming systems in which the potential for escape of fish is greater than zero.
- Expected expansion of farming of carnivorous fish will significantly increase demands on world supplies of fishmeal and fish oil, increasing pressure to maintain these supplies possibly at the expense of long-term sustainability of fisheries. Government policy should foster reduced use of fishmeal and fish oil, partly by promoting the farming of low trophic level species that do not require significant amounts of animal protein or oil in their feed.
- In most countries, fish farmers are not required to report the volumes or types of feed, chemicals and drugs that they use. This information is critical to determine trends and to evaluate impacts. Before expansion of any type of farming proceeds, effective mechanisms for reporting and monitoring the use of feeds, chemicals and drugs should be in place.
- The impacts of chemicals used in fish farming on other species and on the healthfulness of farmed seafood has received little attention, although many of these chemicals are problematic. Unless farms are required to capture and treat their wastes, they should be required to provide regular monitoring of water quality and of nearby animal and plant communities. Additionally, government agencies should screen both domestically produced and imported farmed fish for chemical residues.
- In setting priorities for policy and funding, government agencies should take into account the collateral and cumulative impacts of expanded farming of high-value carnivorous species so that small-scale operators and those that use environmentally preferable methods do not have to operate at a considerable disadvantage. Government agencies also should embrace adaptive management in structuring their programs of research, technical assistance and regulation. Fish farming activities should expand only at a pace that insures sufficient information is available to evaluate possible impacts and that does not risk irremediable environmental damage.

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SeaWeb's mission is to promote conservation of the ocean and the web of life it supports. Raising awareness of the living ocean and its fragile state is a key underpinning to saving it. To achieve our mission, we collect and communicate information anchored in science about the importance and condition of the ocean to decision makers and individual citizens.

Since 1998, the SeaWeb Aquaculture Clearinghouse has been raising awareness of the environmental and social issues related to aquaculture and generating involvement from all stakeholders, including the public, in order to encourage its sustainable development. We strive to maintain and promote healthy and productive coastal waters and watersheds through development of responsible aquaculture that is either integrated into the natural ecosystem or developed in closed systems, is diverse on local and regional scales, and is beneficial to local communities.

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