Research Report

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Forum: *Environment Commission*
Issue: *Sustainable aquaculture production of sea food*

Position: *Deputy Chair*

Introduction

28% of fish stocks worldwide are either overfished or nearing extinction and another 47% are near the limits of sustainability, according to the United Nations Food and Agricultural Organization (UNFAO). The availability of seafood decreases while the human population is growing, as well as the standards of living. The World Fish Center argues that the catch will have to be doubled by 2020 to keep up with demand. The greatest demand comes from developing nations in Asia. Western Europe is the second biggest consumer.
Aquaculture is one of the fastest growing global food production systems to fill the gap caused by overfishing of the wild stock. As these wild stocks decline, the demand for farmed marine fish is on the rise. Aquaculture provides almost half of the world's supply of seafood and it contributes over 13% of world animal-protein supply.
The downside is, however, that the rapid expansion of the seafood sector has caused various problems involving the environment and social impacts of aquaculture. When it is done responsibly, aquaculture's impact on wild fish populations, marine habitats, water quality and society can be significantly and measurably reduced. In order to realize a saver and healthier ocean, sustainable choices have to be made in the seafood sector.

Definition of Key Terms

Sustainable:
Conserving an ecological balance by avoiding depletion of natural resources.

Aquaculture:
Aquaculture is the cultivation of aquatic animals and plants in isolated water spaces or in public oceans or rivers. These products are produced artificially to reduce seafood shortages fit for human consumption and to overcome the problem involving endangered species.

Mariculture:
Mariculture is a specialized branch of aquaculture involving seafood farming in an enclosed section filled with seawater within an ocean or in separate tanks.

General Overview

Poor management, lack of knowledge and the race to make millions from fishing has unfortunately led to overfishing and too high a burden on other ocean inhabitants. The most common type of aquaculture is mariculture; the cultivation of marine organisms in the ocean or within an enclosed section of the ocean. The farmed seafood is held in open-net pens and cages which places the fish in direct contact with natural habitat of wild stock.

Infectious diseases are encountered in all food production. Especially fish and shellfish are more under threat from disease than other land animals or plants. Germs survive longer in water and they can spread more effectively there. A rapid treatment of bacterial and viral infection is therefore crucial in aquaculture. However, excessive use of chemicals, such as antibiotics and pesticides can have unintended consequences for marine organisms and indirectly human health.

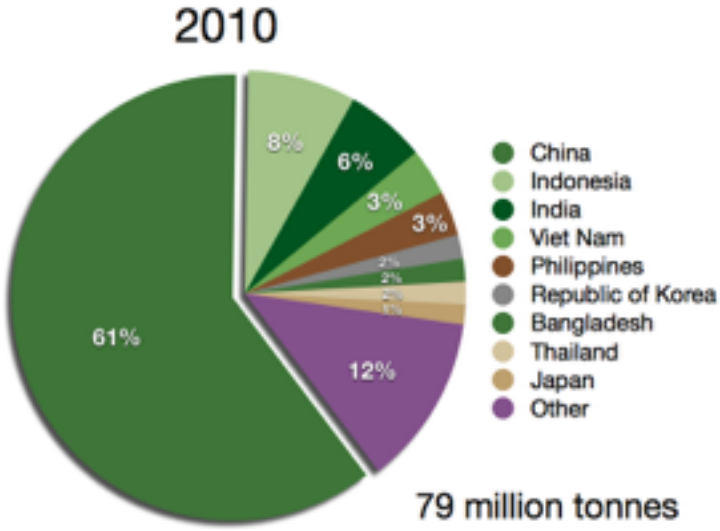
When fish are held in net pens in oceans, it is difficult to prevent them from escaping into the wild. Their escape can cause the farmed species to compete with wild fish for living space, breeding partners, food resources, spread disease, or interbreed with the wild stocks. Interbreeding of genetically engineered fish with wild fish can produce organisms with altered genes. The 'genetic pollution' will weaken the wild strain and reduce its ability to survive. Farmed fish and farm-wild offspring have a short life expectancy and a reduced survival chance in freshwater and at sea.

The use of food in farming fish sustainability is another major issue. The most wanted fish, tuna and salmon, are the top predatory fishes of the oceans. These fish have a diet based on fats. Other fish need to be caught from the ocean in order to sustain these fishes. This process counteracts the purpose of aquaculture: producing sustainable seafood and avoiding overfishing. Fish caught to make fishmeal and fish oil currently represent one-third of the global fish harvest.

When the fish are fed, their meals are thrown into the oceans. However, not all food can be caught by them. Excess food and fish waste increase the level of nutrients in the water and have the potential to lead to oxygen-deprived waters, which is stressful for both wild stock and farmed fishes. The waste can damage or even eliminate the existence of organisms living on the ocean floor. The waste can further endanger the life of wild stock as it decreases the level of oxygen ions in the ocean.

Major Parties Involved

Main aquaculture countries in 2010



WWF (World Wildlife Fund)
WWF actively supports producers in implementing responsible practices through Aquaculture Improvement Projects.

NOAA (National Oceanic and Atmospheric Administration)
NOAA is an American organisation within the United States Department of Commerce which has established the Fisheries Office of Aquaculture. It promotes and regulates the creation of sustainable aquaculture including safely produced seafood, the prevention of extinct marine species, the protection of wild stock habitats and the creation of career opportunities of local people.

China
Aquaculture is an important economic activity in China. In 2005, China accounted for 70% of world production. Most shrimp aquaculture takes place in China and it has generated substantial income in these developing countries.
The disease outbreaks in shrimp aquaculture in China, Thailand and Vietnam and in salmon farming in Chile illustrate some of the industry's challenges. But the growth of aquaculture also presents countries with the opportunity to expand and improve fish farming so that it is sustainable and environmentally-responsible.

Norway
Norway is one of the largest producers and exporters of salmon and other seafoods cultivated through aquaculture activities. 95% of its production is exported to the European Union and it contributes to Norway's economy for a substantial amount. In 2003, the export of seafood from Norway to the European Union offered the country a

profit of 1,350 million US dollars. It is a major challenge to maintain a profitable aquaculture and to produce in a sustainable manner at the same time.

The Farm Animal Welfare Council
The Farm Animal Welfare Council offers guidelines for a fundamental animal welfare. The animal's welfare should be examined in their mental and physical state under the conditions they define:

- Freedom from hunger and thirst;
- Freedom from discomfort;
- Freedom from pain, disease, or injury;
- Freedom to express normal behaviour;
- Freedom from fear and distress.

One can argue that these freedoms are violated in unsustainable aquaculture of seafood.

Timeline of Events

3500 BC	Cultivation of carp begins in China using freshwater ponds and rice paddies.
1900-1700 BC	This period witnessed worldwide expansion of aquaculture. The cultivated Asiatic carps and the Indian major carps were induced to spawn under controlled conditions.
Early 1990s	The Irish sea trout fishery collapses because of sea lice infestations believed to be caused by salmon farms. Shrimp farming industries in many parts of the world collapse due to outbreaks of disease.
2002	Traces of illegal antibiotics are detected in farmed shrimp imported from Asia.
2003	Salmon farmers in Maine are found in violation of the Clean Water Act and ordered to fallow their sites for two to three years and cease the use of European strains of fish at their farms.
2009	The WWF established a certification program which examines whether seafood farmers follow the standards set out by the Aquaculture Stewardship Council (ASC) to limit the unsustainable aquaculture activities.

Previous Attempts to solve the issue

In an attempt to alleviate the environmental impact of fish farming, some forward thinking aquaculturists have turned to closed-contained systems, either solid-wall systems that float on the water or tank systems that operate entirely on land and by perfecting their methods by successfully growing fish that are herbivores. By separating farmed species from native populations, both systems protect the environment from accidental fish escapes, limit the spread and transmission of disease and parasites between local and farmed fish, and decrease the amount of fish feed and waste excreted into the local ecosystem.

Since May 2012, Vietnam has been working with the World Bank to help fishing communities adopt good fish farming practices to better manage disease and improve waste management. Sustainable aquaculture is also being developed in Ghana, which has begun to establish fish farms in the Volta Lake region.

16 countries worldwide now use geothermal energy to sustain aquaculture in other areas than the ocean, including China, Israel, and the United States. For example, in California 15 fish farms produce catfish, bass, and tilapia with warm water from underground. The warmer water makes sure that these fish grow during the whole year and mature quicker.

The impacts of diseases are limited through the use of single bay management and single generation sites. For example, some seafood farmers have shifted to a male or female only aquaculture. This would eliminate genetic pollution of the genetically manipulated fishes with wild stocks.

Possible Solutions

An environmentally sustainable aquaculture industry, which minimizes risks to the marine environment and biological diversity, is essential for long-term growth and development. In order to decrease the impact of negative consequences of the aquaculture governments should encourage farming of species lower on the food web; fish with herbivorous or omnivorous diets or filter feeders such as oysters. We need to improve food management and efficiency in industrial aquaculture systems and develop substitutes for fish-derived food ingredients. Additionally, developing integrated fish farming systems that use multiple species reduces costs and wastes while increasing productivity.

Governments have a key role in developing regulations to protect coastal ecosystems and in re-examining subsidies for unsustainable marine fisheries. If the regulations, the subsidies are implemented correctly, the present unsustainable trends can be reversed and aquaculture can make an increasingly positive contribution to global fish supplies.

Appendix/Appendices

- http://www.nmfs.noaa.gov/aquaculture/faqs/faq_aq_101.html
- http://www.greenpeace.org/international/en/campaigns/oceans/sustainable-aquaculture/
- http://www.davidsuzuki.org/issues/oceans/science/sustainable-fisheries-and-aquaculture/what-is-sustainable-seafood/
- http://www.sciencedaily.com/releases/2013/09/130905142719.htm
- http://www.oxforddictionaries.com/definition/english/sustainable
- http://www.worldwildlife.org/industries/farmed-seafood
- http://www.nmfs.noaa.gov/aquaculture/faqs/faq_aq_101.html
- http://www.fisheries.no/aquaculture/Aquaculture/#.VejBozSsWSo
- http://www.worldbank.org/en/news/feature/2014/02/05/raising-more-fish-to-meet-rising-demand
- http://www.marineconservation.org.au/pages/sustainable-seafood.html
- http://www.oceanfutures.org/news/blog/future-sustainable-fish-farming
- http://www.aces.edu/dept/fisheries/education/documents/General_Aquaculture_Timeline.pdf
- http://www.imr.no/genimpact/filarkiv/2007/07/genetic_impact_of_aquaculture.pdf/en
- http://www.fao.org/fishery/countrysector/naso_norway/en