

Aquaculture and Environmental Pollution : A Review Work

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ABSTRACT

Aquaculture, the farming of aquatic organisms such as fish, mollusks, crustaceans, plants, in natural or controlled marine or freshwater environments. Aquaculture is a fast developing field in the developing world. In India and other such developing nations it has a dominating position in the gross domestic product. Aquaculture is continued to be one of the most viable methods to supply growing world population needs, but the challenge to maintain profitability and environmental compatibility is daunting. Aquaculture has had both positive and negative outcomes. Furthermore, aquaculture development represents a potential threat to greenhouse gas sinks and reservoirs, whilst aquaculture practices constitute a largely undefined source of greenhouse gas emissions. Tropical mangroves constitute a habitat critical to erosion prevention, coastal water quality, and the reproductive success of many marine organisms. Mangrove forests have also provided a sustainable and renewable resource of firewood, timber, pulp, and charcoal for local communities. To construct dike ponds for farming, these habitats are razed and restoration is extremely difficult. India is on second position in aquaculture. Farmed shrimp boost a developing country's foreign exchange earnings, but the loss of sensitive habitat is difficult to reconcile. According to the Forth Assessment Report of the Intergovernmental Panel on Climate Change, Working Group III (IPCC, 2007) making development more sustainable by changing development paths can make a major contribution to climate change mitigation. Already a number of countries have passed laws that protect mangrove habitats and restrict the development of shrimp farms, but enforcement is difficult in practice.

Keywords : Aquaculture, Climate, Pollution, Global Warming, Mitigation

I. INTRODUCTION

Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2007a) stated that 'Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased clearly as a result of human activities since 1750 and

now pre-industrial values determined from ice cores spanning many thousands of years' and that 'Most of the observed increase in global average temperatures since the mid-20th century is due to the observed increase in anthropogenic greenhouse gas concentrations.' There is an urgent need to properly manage important habitats the act as critical natural carbon sinks if we are to avoid future dangerous climate change (Loffoley *et al*, 2009) World population is predicted 6 billion by 2030, resulting in increasing global food needs. To maintain

this food supply for an increasing population will depend on the exploiting the effectively and sustainability of the production method that are expected adverse effect on climate (Johann,2010). Globally, aquaculture provides half of the fishes for human

II. METHODS AND MATERIAL

Consumption and good source of cash income for poor household. In addition it stimulates the local market economy and can be important source of foreign exchange. Additionally, even with growth of population enhance the production of aquaculture per capita increases from 0.7 kg in 1970 to 6.4 kg in 2002. Since 1970 total aquaculture output grew at an average of 8.9% per year until 2002, as compared with 2.8% for terrestrial livestock farming and 1.2% for capture fisheries over the same period (FAO, 2004). Aquaculture developments represent the probable threat

to greenhouse gas sinks. In the Indo-Western Pacific region alone, 1.2 million hectares of mangroves had been converted to aquaculture ponds by 1991 cultured food fish supplies currently account for nearly 50 percent of that consumed globally (FAO, 2008) and are targeted to increase to 60 percent by 2020. Working Group III concluded that 'There are still relevant gaps in currently available knowledge regarding some aspects of mitigation of climate change, especially in developing countries' and that 'Additional research addressing those gaps would further reduce uncertainties and thus facilitate decision-making. (IPCC, 2007).

State	Brackish water area (ha)
West Bengal	405,000
Orissa	31,600
Andhra Pradesh	150,000
Tamil Nadu	56,000
Kerala	65,000
Pondicherry	800
Karnataka	8,000
Goa	18,500
Maharashtra	80,000
Gujarat	376,000
Total	1,190,900

As far as brackish water aquaculture concern India has about 1.19 million ha (Table) area of which major area is under shrimp farming. Presently, brackish water shrimp culture is practiced on commercial scale on low lying fields which were once a part of back water and paddy field that converted into ponds. (Gupta *et al*, 2001). The following table gives the state-wise potential area available for shrimp in India. (Alagarswami, 1995) The negative impact mainly conversion of mangroves areas as well as agriculture land to construct dykes and also salination of surface water resource. (Gupta *et al*, 2001). There is an urgent need to regulate aquaculture activity in sustainable way. India has the acts and regulations to protect valuable environment. The rules on Coastal Regulation Zones would cover *inter alia* coastal aquaculture, but there are no specific rules and acts have been framed for aquaculture in Gujarat. Moreover further aquaculture development represents a potential threat to greenhouse gas sinks and reservoirs, whilst aquaculture practices constitute a largely undefined source³ of greenhouse gas emissions. The sources required for the aquaculture developments are fossil fuel for production activity, energy consumption,

conversion of important natural ecosystem to another, waste deposition, soil and water contamination due to chemicals.

III. RESULTS AND DISCUSSION

Shrimp farming is a profitable business for financial organizations, industries and governments as a path for developing countries to reach its targets and alleviate poverty. The main leading countries are Thailand, China, Indonesia, India, Vietnam, Philippines, Bangladesh, Mexico and Brazil. There are several laws and acts have been approved for sustainable shrimp farm development but uncertain to implement because it is a money making source for poor farmers and fisherman. Shrimp farming required less time, money and maintenance than the conventional farming.

A. Mangroves Destruction

Mangrove forest is most unique and dominant ecosystem in many tropical and sub-tropical coastline, but vanishing at alarming rate. The main cases of mangroves destruction is population growth, urbanization, industrialization, water diversion, aquaculture and salt pan construction. (Steve *et al*, 2009, Yisheng *et al*, 2009) Mangrove forest has been largely viewed as economically unproductive ecosystem hence destroyed for various economic activities. However, both ecological and economic significance are visible. (Indira *et al*, 2004)

According to the Food and Agriculture Organization (FAO, 2004) mangrove losses have been considerable and are continuing. Some 35,600 square kilometers were lost between 1980 and 2005. Recently, in many parts of Latin America and Asia, large swaths of coastal mangrove forests have been cut down and turned into shrimp farms. To overcome this problem in annual meeting of American Association for the Advancement of Science, Vancouver, Canada to get a handle on how much carbon dioxide is represented by shrimp, ecologist Boone Kauffman of Oregon State University in Corvallis made some estimates based on typical shrimp farms in Southeast Asia. (MAP, 284, 2012) The nations with the largest mangrove areas include Indonesia with 21 percent of global mangroves, Brazil with 9 percent, Australia 7 percent, Mexico 5 percent and Nigeria with 5 percent.

They are also recognized as an important greenbelt and carbon sink that protects coastal areas from natural disasters such as tsunamis, cyclones and erosion resulting from sea-level rise especially in small island countries. Trees were routinely felled and burned and the rich, organic soils which characterize mangrove areas excavated for pond construction; machines and labor for conversion make a further contribution to emissions (Valiela *et al*, 2001).

The average above-ground net primary production for a mangrove forest in Missionary Bay, northeast Australia equated to 14.8 t C ha⁻¹ y⁻¹ and that the standing stock of carbon in above-ground living biomass was 190 t C ha⁻¹. (Robertson *et al*, 1992) The report by the United Nations Environment Programme (UNEP, 2006) suggested that converting mangrove forests to aquaculture ponds resulted in limited net changes in terms of carbon sequestration. Assessing the conversion of mangroves to shrimp ponds in Thailand the report stated that 'The global benefits of carbon sequestration were considered to be similar in intact and degraded systems'. (Bunting *et al*, 2007)

Recently, 2012, In Ecuador The National Coordinator for Mangrove (C-Con Dem), organization works toward the protection, preservation and restoration of mangrove ecosystems to ensure their vitality and their people, says that the "legalization" of pools dedicated to shrimp production is "a license for impunity," (MAP, 287, 2012)

B. Pollution of Soil and Water

1) Physical Factor

i) Eutrophication

The most increasingly effect of the fish culture is eutrophication of water through receiving nutrients from the surroundings or rearing pens. Fish excretion combine with nutrients from the excess feed to increase the nutrition level and create healthy environment for the algal bloom. These algal blooms settle down at the bottom of the sea where they decompose and create the anxious condition and may produce toxins. In Scotland, an estimated 50,000 tons of untreated and contaminated waste generated from cage salmon farming goes directly into the sea, equivalent to the sewage waste of a population of up to three quarters of Scotland's

population. Certain species of the phytoplankton are lethal to other marine organism and human also. Cultured seafood with toxic algae is lethal for human.

2) Chemical factor

At present, there is no specific legislation to control the use of chemicals and drugs exist. (NALO, 2004). Pollution Control Board general regulations on effluent discharges include hazardous substances, but they are not specific to aquaculture. In some regions, there is indiscriminate use of chemicals and pesticides, particularly in shrimp farms (Alagarswami, 1995). There is no specific legislation for disease control within aquaculture facilities. However, a Compendium on Aquatic Medicines and Animal Health Management is under preparation within the Aquaculture Authority. Use of excess feed and antibiotics leads to death of organism and cause the microbial decomposition, which increases the anaerobic condition to the pond. A variety of chemicals are used to inhibit the growth of organisms which foul netting and other structures, reducing water flow through the cages.

Recently, report by global times, china encountered that some shrimps origination in Tianjin, China have been injected with gelatin to make them heavier and plumper, posing threat to public health. (MAP, 283, 2012)

Sediment management in pond base aquaculture has important affect on the accumulation of carbon and release of greenhouse gases. Accumulation of organic carbon in the pond increases the anaerobic conditions leading to the evolution of toxic microbial metabolites and disruption to benthic communities. To overcome this problem ponds are periodically drained with accumulated sediments left exposed to the atmosphere to promote organic matter mineralization, tilling is also sometimes employed to promote more rapid oxidation, and lime is routinely applied to increase pH and disinfect the pond (Xinglong *et al*, 2006).

C. Water pollution

In aquaculture practice due to fermentation process, lack of oxygen, use of drugs, excess feed, fish excreta produce an effluent discharge to the water. To control the water quality in aquaculture is a prime factor. Mainly, fish excretion is high in ammonia, nitrate and nitrite.

D. Impact on Natural Stock

Feeding fish to fish directly impact on natural stock and environment. All the brackish water culture is directly depended on the natural fishery although more and more hatcheries are constructed to provide food to the pond culture. For larva culture collection of wild fish to stock are very common and in some case culture of different species required destruction of other larva stocks. When fish are removed from the natural stock for fish meal, less food is available for commercially important species such as seal and seabird and this will alter the entire food web. (Handisdyde *et al*, 2006)

E. Salinization

Salinization of land around the pond area is common observable fact. In Tamil Nadu and Andhra Pradesh complaint that some of the shrimp farms operators provide drinking water to the affected villages by pipeline from their own fresh water source where ever available. Due to pond culture activity adjoining agriculture farms are also affected. In some semi-arid saline region people practiced brackish water to develop brackish water aquaculture which may cause the saline top soil. (De Silva *et al*, 2009)

F. Introduction of Alien species

Introduction of exotics to the pond has high adverse impacts. They may alter the already existing communities of the receiving ecosystem through completion for food, space, habitat etc. Some of the countries prevents the alien species because loss of genetic adaptation to local species as well as potential susceptibility to diseases. Marine environment and preservation of the marine biodiversity does not only concern developing countries but more so than ever concerns the industrialized countries which have lost much of theirs. Genetically modified organisms including microorganisms have adverse effects on humans and animals as well as disruption of ecological processes. Currently, there are no effective regulations of control.

G. Policy and Regulations

Aquaculture process has both positive and negative impact. Growth of aquaculture is initiated by

governments and they are eager only for economic growth but now, governments have started to implement strict regulatory guidelines addressing environmental and social issues to ensure sustainability. No. of countries have passed laws that can protect mangrove and marine ecosystem but enforcement is difficult in practice because it is most essential alternative for coastal communities. In India, India Fishery act, 1987, Coastal Aquaculture Authority act,2005 developed for sustainable aquaculture.(NALO, 2004) In the United States some adaptive measures are taken by the Environmental Protection Agency, Food and Drug Administration, the National Marine Fisheries Service, the United States Department of Agriculture and numerous state environmental agencies and local groups. Canada has also developed stringent guidelines to maintain the health of the environment, and Brazil, Malaysia, Sri Lanka and others have all made progress in the establishment of legal and regulatory frameworks which are starting to have a positive effect on aquaculture development.

Presently The Brazilian Institute of Environment and Renewable Natural Resources (Ibama) and the Army carried out an unpublished decision of Justice to destroy a shrimp bed in Tibau do Sul (Rio Grande do Norte) because it worked irregularly to stop the mangrove destruction. (MAP, 277, 2011)

H. Promote better practices

New technologies are available for lessening the impact of aquaculture on the surrounding environment, but many countries cannot take advantage of these expensive innovations. To accomplish population demand food production will remain an overriding priority, and aquaculture will continue to grow. We should develop or adapt some needs and capacity of developing countries. Government organizations, society, aquaculture federation should adopt best practice. Lower energy consumption, reduction in carbon tax, potential market premiers etc. will help to promote good practices. Using our intelligence and ingenuity, the human species can preserve biodiversity and unique places for future generations, without compromising the quality of life for present populations.

IV. CONCLUSION

Aquaculture is a fast developing field in the developing world. In India and other such developing nations it has a dominating position in the gross domestic product. Aquaculture is continued to be one of the most viable methods to supply growing world population needs, but the challenge to maintain profitability and environmental compatibility is daunting.

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