Prof. M. Koteswara Rao
Dr. K. Swarupa Rani

Development of Aquaculture in India

Challenges and Opportunities

At a Global Level aquaculture is one of the fastest growing food production sectors. The spread of aquaculture as a dynamic economic activity is witnessed across the world. Aquaculture is one of the major foreign exchange earners for India. Andhra Pradesh is the leading state in the country in production as well as exports of aqua products. The aquaculture sector, though acclaimed for its profits and protein-rich food supply, has its own problems which need to be addressed for achieving sustainability in the business.

The present book manifested itself with a repository of many chapters of different scholars focuses on the development of fisheries and aquaculture in India as well as in Andhra Pradesh and the challenges and opportunities in this field. A comprehensive range of articles on important issues in this areas of research such as growth of fisheries, status of fishermen in the country, problems of aqua farmers, production and exports trends of aqua products, linkages to aqua industry, women in the processing industry, employment opportunities, sustainability of the sector, environmental issues, processing and marketing of fish products etc. This book is produced specifically for the benefit of students of aquaculture, zoology, agricultural economics, applied economics, researchers, academicians, aqua farmers and policy makers. Every chapter in this book is reviewed and updated with reference to new developments and initiatives.

Prof. M. Koteswara Rao is a Professor of Economics having put up three and half decades teaching and research experience published very widely in National and International Journals of repute and presented papers in National and International Conferences. Guided 28 Ph.D's and 26 M.Phil's so far for the award of Research Degrees. Specialized in the areas of Urban Development and Labour Economics. Carried out 6 Research Projects sponsored by UGC and other Agencies. Prof. Rao is currently the Dean of Faculty of Social Sciences, Dean, College Development Council and Vice-Principal, University College of Arts, Commerce & Law, Acharya Nagarjuna University, Nagarjuna Nagar, Guntur District.

Dr. K. Swarupa Rani is currently working as an Assistant Professor in the Dept. of Economics at RRDS Govt. Degree College, Bhimavaram, West Godavari District, Andhra Pradesh. She has more than fifteen years of experience in teaching Economics at various levels. Besides an M. A. in Economics, she is qualified in both NET and SET in 2012. She did her Ph. D. on Economics of Shrimp Culture under the supervision of Prof. M. Koteswara Rao from Acharya Nagarjuna University, Guntur. She presented more than fifteen papers in national and international seminars and published three Research articles in scholarly journals.

CITY PUBLICATION

1/9944, UG/Floor, Street No. 3A,
West Gorakh Park, Shahdara,
Delhi- 110032, Mob: 8368465258
E-mail: citypublication2001@gmail.com

₹950.00

ISBN : 978-93-8911-720-2

CHAPTER 20

Environmental Issues in Aquaculture

P. Aravind Swamy and B. Narayanarao

India is the world's second largest producer of farmed fish, and the state of Andhra Pradesh (AP) is by far the most important producer of farmed fish in India. Andhra Pradesh has a coast line of 970 km with vast scope for production of fish, prawn and other sea products. Freshwater aquaculture has boomed in AP since the late 1970s, first with carps, then pangasius catfish. Andhra Pradesh is achieving rapid progress in aquaculture with vast potential for the development of fish and prawn cultivation and sea food production. A.P. ranks No. 1 in the country in total fish and prawn production and produces over 70% of cultured shrimp in India. During 2016-17, out of total export earnings of Rs. 37,000 crores from India, the share of A.P. was about Rs. 17,000 crores. The State ranks third in global shrimp production (0.3 million tonnes) and sixth in aquaculture production (1.57 million tonnes).

The fish and prawn production has 6.4 per cent share in the Gross State Domestic Production (GSDP) and providing livelihood to 14.5 lakh population. Up to December 2017, the fish and prawn production achieved 27.49 lakh tonnes with GVA of Rs. 34,041 crores (constant prices). During the year 2017-18, the State government had set the target of producing 33.84 lakh tonnes of fish and prawns with GVA of Rs. 42,110 crores with growth rate of 22.35 per cent on production and 35.65 per cent on GVA. Andhra Pradesh has lion's share in the sea food exports from our country with 45 per cent share in the year 2016-17. Sea food worth Rs. 17,000 crores were exported from the state in the year 2016-17 against the total exports of worth Rs. 37,871 crores from India.

Aquaculture has grown rapidly in the recent years and has promise for further potential growth. This rapid expansion was possibly because of the growing demand for aquatic products and the failure of the global capture fishery, which has been exploited, to or beyond its potential. When the global catch statistics remains standstill between 80-100 million metric tons per year, the

global aquaculture production is registering an overwhelming annual growth of 8-14% producing between 20-25 million tons per year. Of the aquaculture practices, coastal shrimp farming has registered the maximum growth of about 400% in the last decade. The two factors resulting to its boom were the increasing demand for Indian shrimp and the improved farming techniques.

Traditional aquaculture has a long history in the Indian states of West Bengal, Kerala, and Karnataka. In the lands adjoining the sea, rice is cultivated for several months and shrimp and some species of fish for the rest of year. The two types of cultivation complemented each other, bringing yields to both farming and fishing communities. The same cannot be said for modern shrimp aquaculture, which was introduced into India only in the last ten or five years and is having serious environmental and social consequences in Andhra Pradesh and Tamilnadu, where 77,000 hectares are already under shrimp cultivation.

Impacts of Coastal Aquaculture

Some forms of coastal and inland aquaculture have imposed costs on the environment, on fish and human health, and on biodiversity. Intensive farming in ponds, pens, or cages produces organic matter that settles to the bottom of the pond or pen, or below the cages. Some of the suspended waste matter from excessive artificial feeding, fish excreta, and the application of chemicals is flushed out of the enclosures and pollutes adjacent waterways. The aquaculture subsector itself has suffered from such pollution. The decline of intensive shrimp farming in Taipei, China, has been attributed to massive mortality from the reuse of polluted water discharged from ponds. Intensive shrimp farming has also had significant negative environmental impacts in PRC, India, Indonesia, Thailand, and Vietnam. In some instances, aquaculture has affected biodiversity through competition between indigenous species and introduced species that have escaped into the wild and produced self-sustaining populations

Environmental Impact -Aquaculture, which is often regarded as the 'under water agriculture', has been accused of causing many negative environmental and social impacts. Destruction of wet lands, mangrove forests, large scale conversion of agricultural land to aquaculture ponds, water pollution, biodiversity reduction, salination of fresh waters, displacement of poor artisanal fishermen and loss of access to fishing grounds by the artisanal fishermen and colleagues. The unscientific shrimp culture practices were the main culprits, which led to the above said problems. Apart from its effects on the local economy unregulated intensive shrimp culture is contributing to serious environmental degradation in Tamilnadu and Andhra Pradesh with implications for both agriculturists and fish workers. A major problem is the salinisations of drinking water. Excessive pumping of ground water, which is needed for mixing with sea water to maintain the correct salinity for growing shrimps, has led to the penetration of sea water

into the water table, while the storage of saline water in ponds for several months at a time results in seepage underground. This affects not only ground water, but also water stored intents. There is also the contamination created by shrimp form effluents being discharged from the ponds.

Pollution: The oceans and all bodies of water are the global sinks for many pollutants from both land-based (e.g., mine tailings, untreated domestic effluents, and sediments from soil erosion) and water-based (e.g., oil spills and waste from shipping) industries. Almost all forms of water pollutants diminish the capacity of water bodies to support aquatic life if they reduce the amount of dissolved oxygen. Chemicals in polluted waters also affect fish populations adversely. Some river systems in major urban centres in some DMCs have been declared biologically dead. The contamination of aquatic species with pollutants, primarily with sewage and toxic substances, and the occurrence of toxic algal blooms have also rendered them unfit for human consumption.

The untreated effluents discharged from shrimp farms directly or indirectly have polluted coastal waters, estuaries, creeks and back waters. Residual chemicals, drugs, antibiotics, decomposed and unused artificial feeds contributed to toxic nature of the effluents. The heavy nutrient load in the water lead to hyper eutrophication developing massive algal blooms and reduction of oxygen, over accumulation of detritus at pond bottom and poor quality of water leading to profusion of ciliates and other protozoan which cause respiratory and gill diseases in shrimps.

Destruction of mangroves: Despite the growing awareness and concern, coastal and other aquatic ecosystems continue to be degraded by pollution and unsound forms of utilization. These negatively impact on fisheries as shallow-water fish habitats such as mangroves, sea grass beds, coral reefs, estuaries, bays, rivers, lakes, and swamps are biologically the most productive and the most ecologically diverse aquatic environments. These are important fish breeding and nursery grounds, where many species reproduce. The loss of mangroves has ecological, economic, and social consequences. Their removal has several implications on the sustainability of many coastal activities. The major effects are the coastal erosion, changes in pattern of sedimentation and shoreline configuration making coastal zones more vulnerable for storm erosion, salinity intrusion, loss of breeding and nursery grounds of fishes and crustaceans, decline of availability of larvae and post larvae, decline in traditional fish catches, reduction of fishery recruitment to sea, loss of filtration capacity of soil, changes in physico-chemical properties of water, reduction of biodiversity and disturbances in the ecological balance.

Impact on coastal land use: While development of shrimp culture increased the efficiency of utilization of coastal land (unutilized agricultural lands, derelict salt pans, deltaic regions, lake areas, mud flats traditional shrimp

farms etc) leading to higher income generation. But the mass scale conversion of coastal agricultural lands to shrimp farms lead to the salinisation of soil and ground water leading to the desertification of adjacent productive lands. The casuarinas and coconut plantations have been affected. Construction of pond lead to accelerated soil erosion.

Nutrient enrichment: Eutrophication of coastal waters due to nutrient rich effluent discharge often results in nuisance algal blooms, which reduces species diversity especially in ecologically flimsy areas like the coral reefs. Phosphate enrichment of coastal reef waters may directly inhibit hard coral growth through phosphate inhibition of calcium carbonate deposition, which is an essential process of healthy coral reef growth. Sea grass and mangroves are less susceptible to such eutrophicated waters as they have a capacity to absorb high levels of nutrients. Nevertheless, high organic loading in these systems may cause anoxia and increase in turbidity levels where resilience and diversity of these systems is adversely affected.

Shading and night illumination: Floating structures like pontoons, cages or aeration equipments can shade significant areas of bottom, which may seriously affect the ecology of areas like coral reefs or sea grass beds. Most of the corals and associated fishes have photosensitive feeding behaviour. In contrast to shading, shoreline night lighting or illuminated floating structures may influence the movement of light sensitive species including fish, squid and hatchlings of turtles, resulting in an inland movement rather than their natural movement towards sea.

Introduction of exotic species: Movement of or bringing in of species outside its present geographical area for aquaculture may seriously affect the native fauna. The worldwide transplantation of Tilapia is a vivid example for this. The recent nuisance created by the introduction of *Clarius garipenaeus* (African catfish) is also causing concern in the Indian waters. In addition to altering or improving the natural biodiversity of the ecosystem, through competition and inbreeding, it may cause the transfer of a new disease causing agents to native waters. Unfortunately, the ecological impact assessment studies due to the introduction of exotic species are not carried out in developing countries like India. This new sector of Biological impact assay (BIA) needs to be considered at least at these late hours.

Indiscriminate use of antibiotic drugs: The recent outburst of many bacterial and viral diseases led to the indiscriminate use of many broad-spectrum antibiotics. These are only therapeutic agents and are not prophylactic in nature. The environmental changes associated with the use of chemotherapeutics in aquaculture are as follows:

1. Quantitative and qualitative changes in the soil and water microflora.
2. Toxic effects on wild organisms living in a particular area.

3. Development of antibiotic resistance in fish pathogens (AntibiotiC resistant strains)
4. Transfer of antibiotic resistance to human pathogens.

Environmental assessments and monitoring must be undertaken in order to minimize adverse ecological changes and socio-economic consequences arising from water extraction, land use, discharge of effluents, use of drugs and chemicals, and other aquaculture activities. Once the problem like pollution, salination and disease problems are not curbed, the future of aquaculture seems to be meagre. It is high time realize that success cannot be achieved simply by dumping money Prevention is always better than cure.

References

Shyam S.Sslim and S.N.Ojha (2002), Environmental and Social issues in Costal Aquaculture

Emerson Kagoo and N. Rajalakshmi (2002), Environmental and Social Conflicts of Aquaculture in Tamilnadu and Andhra Pradesh

Bailey, C. (1988). The Social Consequences of Tropical Shrimp Mariculture Development, *Ocean and Shoreline Management*, 11: 31–44.

Berkes, F. (1985). The Common Property Resource Problem and the Creation of Limited Property Rights, *Human Ecology*, 13: 187–208.

Folke, C., and Kautsky, N. (1989). The Role of Ecosystems for a Sustainable Development of Aquaculture, *Ambio,* 18: 234–43.

Goodland, R., and G. Ledec (1987). Neoclassical Economics and Principles of Sustainable Development, *Ecological Modelling*, 38:19–46