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Editorial

Shrimp Farming in India – Lessons and Challenges in Sustainable Development

Environmental issues have always been the point of debate in shrimp farm development. While the harvest from capture fisheries around the world has stagnated, aquaculture is viewed as a sound option to increase fish production, and play a vital role in providing food and nutritional security. However, the shrimp farming sector has been strongly opposed by environmental groups on many occasions, not only in India but in many other countries around the globe. Legal interventions have been sought to curtail shrimp culture, to preserve the coastal environment and the ecology. Though the polarisation of opinion on the adverse impact of aquaculture in the nineties was very strong, there are signs of more tolerance to accommodate diverse views and opinions lately and allow development of shrimp farming in an environment-friendly and sustainable manner.

In India, commercial shrimp farming started gaining roots only during the mid-eighties. It was a relatively late start in India; by this time, shrimp farming had reached peak in most of the neighbouring Asian countries, especially China and Taiwan; in some the disease and poor farm management practices had already taken a heavy toll. The boom period of commercial-scale shrimp culture in India started in 1990 and the bust came in 1995-96, with the outbreak of viral disease. The fact that most of the coastal States in India were new to commercial-scale shrimp farming, the general ignorance of good farming practices, and the lack of suitable extension services, led to a host of problems.

Sustainable Development of Shrimp Farming – Some Issues for Consideration

It must be accepted that the days of production-oriented shrimp farming are gone. Present day production has to take note of not only the markets but a host of technical issues as well as the concerns of the environment. The subject matter of sustainable shrimp farming is broad from farm level management practices to integration of shrimp farming into coastal area management, shrimp health management and policy, socio-economic and legal issues. In this analysis, I will discuss some of the most important issues that need to be addressed by the sector on a priority basis.

The White Spot Disease (WSD) has played havoc and its repeated occurrence has demoralised shrimp farmers in the country. Over the last couple of years, since the spread of the WSD, many research initiatives have produced protocols which can inhibit virus replication and also improve the resistance of shrimp to disease. The introduction of modern diagnostic tools such as Polymerase Chain Reaction (PCR) techniques to check the presence or absence of white spot virus in the shrimp post larvae prior to stocking has helped reduce the risk. Other protocols relating to pond chlorination, pond treatment and cleanliness, and bio-security are additional developments which considerably reduce the chances of WSD spread. In addition, new management techniques such as bio-remediation through various microorganisms, enzymes and probiotics added to the feed are also proving to be useful and their use is advocated.

Field laboratories with adequate facilities are essential to provide first hand diagnosis and need to be set up in the coastal States/Union Territories. Elaborate and comprehensive guidelines should



Paddy fields and coconut trees co-exist with shrimp ponds under sustainable farming practices

Y S YADAVA

be prepared on sustainable shrimp farming and translated in vernaculars so that the beneficiaries can be properly educated. This would help to mitigate the problems, especially those related to disease and health management.

The availability of quality seed is likely to be a major problem in the coming years, especially with respect to the availability of brood stock. Efforts have to be made to develop programme of broodstock development at the national level. Significant advances in domestication, selective breeding, and stock improvement in recent years have been made, especially in the Western Hemisphere, where several lines of domesticated shrimp are approaching 36th

generation in captivity. The domestication and selective breeding is slow in the Eastern Hemisphere, particularly in India where no significant move has been made so far in this direction.

As the economic benefits of bio-security and genetic improvement become more compelling, R & D in selective-breeding programme that rely on specific-pathogen-free (SPF) stock need to be taken up by the ICAR fisheries research institutions and also the industry to gain self-sufficiency in this critical area. This vital initiative will require dedication and cooperation from all concerned.

The development and use of compound feeds has been a major

The potential area available in the coastal region of the country for shrimp farming is estimated between 1.2 million to 1.4 million hectares. Presently, an area of about 157 000 ha is under farming with an average production of about 100 000 metric tonnes of shrimp per year. The average productivity has been estimated at 660 kg per hectare per year. Cultured shrimps contribute about 50 per cent of the total shrimp exports from India. The technology adopted ranges from traditional to improved traditional within the Coastal Regulation Zone (CRZ) and extensive shrimp farming outside the CRZ. About 91 per cent of the shrimp farmers in the country have a holding of less than 2 ha, 6 per cent between 2 to 5 ha and the remaining 3 per cent have an area of 5 ha and above.

There are around 260 shrimp hatcheries in the country with an installed production capacity of 11 billion post larvae (PL). About 200 hatcheries are in operation producing around 7 billion PL. There are about 33 feed mills with an annual installed production capacity of 150 000 metric tonnes. Shrimp farming provides direct employment to about 0.3 million people and ancillary units provide employment to 0.6 – 0.7 million people.

advancement in the successful expansion of shrimp farming. As in most animal-production enterprises, feed accounts for the largest operating cost (about 60-70 per cent) and proper feed management is crucial for profitability of shrimp farming. Feed management techniques are as important as feed quality in both improved traditional and extensive shrimp farming systems. The best shrimp feed will be at best an expensive fertilizer if not managed properly.

It is now generally agreed that good management practices can make shrimp farming highly sustainable and that procedures and methodologies for sustainable shrimp farming have been practiced in some countries with demonstrably effective results. These might include effective and holistic farm management practices; mandatory requirement for production of hatchery and disease resistant shrimp seed; domestication of brood stock; diversification including alternative candidate species; regulatory framework; community involvement; training and education; etc.

The shrimp farming sector has received criticism in recent years for excessive use of fishmeal in formulated feeds. While the use of fishmeal poses no present threat to the sustainability of marine fisheries, it is important to develop fishmeal substitutes over time. In India, where *Penaeus monodon* is the predominant cultured shrimp species, feed protein levels have not been significantly reduced. Today, the protein levels average around 38 per cent.

The number of shrimp farms and area under cultivation have expanded considerably during the last ten years. In many areas, shrimp farms have developed in close proximity to one another (in clusters) along the creeks and estuarine watercourses. The



Feed Management is crucial for sustainable shrimp farming

Kandaleru creek in Andhra Pradesh is an excellent example of farms set up in large-scale clusters. As sustained development of shrimp culture rely on good-quality source water, over-development of shrimp farms – either through management intensification or increased farm area – along a creek can impact estuarine water quality to levels unacceptable for shrimp farming. This fact brings to focus the urgent need for scientific investigations on carrying capacity which will address not only the physical area of shrimp farms, but also their density and geographical distribution along a watercourse. The orderly development of shrimp farms will, therefore, need considerable attention from the farmers as also from the planners and research establishments.

The fast pace of development in the shrimp farming sector has brought to focus the use of a wide variety of drugs, chemicals, antibiotics, hormones, etc by the fin and shellfish farmers. The use of such drugs and chemicals is indiscriminate and is mostly due to the lack of awareness amongst the farmers and a strong marketing strategy by the drugs and chemicals manufacturing companies. These products are sold to gullible farmers to enhance the productivity of the water bodies, increase the resistance in the fin/ shellfish, promote growth and also protect against diseases such as WSD, etc.

Chemicals and drugs used in aquaculture include those associated with structural material, soil and water treatment, antibacterial agents, therapeutants, pesticides, feed additives, anesthetics, immuno-stimulants and hormones. Chemicals and drugs presently in use, are mostly derived from agriculture/ veterinary and have never been tested/ evaluated specifically from the perspective of their effects on the aquatic environment. The use of many chemicals and drugs in aquaculture, if carried out properly, can be regarded as wholly beneficial with no attendant adverse environmental effects or increased risks to the health of farm workers. However, the indiscriminate use of chemicals and drugs, especially those which are banned may have a negative impact on the environment and also incur penalties to the shrimp farming sector, including:

- *International trade difficulties arising from drug residues*
- *The potential for loss of efficacy of prophylactics/ antibacterial agent*
- *Increased demand for and complexity of wastewater treatment*

Of the many good management practices that are currently in vogue and adopted by the farmers in the country, low stocking densities have proved to be successful in attaining sustainability.



Aerators help in maintaining ambient oxygen levels

The Aquaculture Authority permits stocking of post larvae up to 6 nos/ m² for farms within the CRZ and up to 10 nos/ m² outside the CRZ. It is now reported that high percentage of farms are embracing low stocking densities in the country – and enjoying a high success rate for doing so. In terms of economics also, the low stocking densities are working well. Adoption of low stocking densities will be one of the key elements of sustainability in the years to come and needs to be promoted among the shrimp farmers.

Role of coastal States/ Union Territories

The role of the State/ Union Territory(UT) is paramount in the development of sustainable shrimp farming. The State/UT Departments

of Fisheries have to develop a complete sense of engendering ownership of the development process and move ahead with the shrimp farmers in a participatory mode. Motivating the

Governments and shrimp farmers must ensure that shrimp culture practices become systematic, eco-friendly and socially responsible.

farmers on the use of good management practices and awareness building has been a herculean task for which the present extension paraphernalia in the States/ UTs has proved to be inadequate. This has also been compounded by the absence of qualified NGOs with experience of work in fisheries sector, especially in shrimp farming. To overcome



this lacuna, it is emphasised that shrimp farmers should organise into associations or 'self help groups'. The formation of 'aqua clubs' in some shrimp farming areas in Andhra Pradesh and Tamil Nadu is a significant step and the State Governments should promote and further this movement to encompass all the shrimp farmers.

Conclusion

Returns from shrimp farming continue to be rewarding, benefiting small-scale farmers and coastal communities, as well as entrepreneurs engaged in seed production, farming operations or ancillary activities. Sustainable utilisation of available areas and infrastructure can lead to the development of under exploited resources with the potential of generating a large number of jobs and enormous social and economic benefits to the coastal regions of the country.

— *Yugraj Singh Yadava*

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Aquaculture Authority – its structure, powers and functions



The Aquaculture Authority has been set up under Section 3 (3) of the Environment (Protection) Act, 1986 to perform the functions indicated in the Supreme Court judgement delivered on 11 December 1996 in Writ Petition No 561 (C) of 1994. Constituted vide Ministry of Environment and Forests' Notification No SO 88 (E) dated 6 February 1997, the Authority is functioning under the administrative control of the Government of India in the Ministry of Agriculture with its headquarters located at Chennai. The Authority is headed by Justice G Ramanujam, a retired Judge of Madras High Court with experts drawn from the fields of aquaculture, pollution control and environment protection and representatives from the Ministry of Agriculture, Ministry of Commerce and the Ministry of Environment and Forests as Members.

The Constitution and powers and functions of the Aquaculture Authority are as follows:

Powers and Functions of the Aquaculture Authority

The powers and functions of the Aquaculture Authority enshrined in the Notification No SO 88 (E) dated 6 February 1997 of the Ministry of Environment and Forests are as follows:

- (i) To exercise the powers under Section 5 of the Environment (Protection) Act, 1986 for issuing directions and for taking measures with respect to matters referred to in clauses (v), (vi), (vii), (viii), (ix) and (xiii) of subsection (2) of Section 3 of the said Act.
- (ii) To ensure that no shrimp culture pond can be constructed or set up within the Coastal Regulation Zone and up to 1 000 m of Chilka lake and Pulicat lake (including bird sanctuaries namely, Yadurapattu and Nelapattu).
- (iii) To ensure and give approval to the farmers who are operating traditional and improved traditional systems of aquaculture for adopting improved technology for increased production.
- (iv) To ensure that the agricultural lands, salt pan lands,



Justice G Ramanujam, Chairman, Aquaculture Authority

- mangroves, wet lands, forest lands, land for village common purposes and the land meant for public purposes shall not be used or converted for construction of shrimp culture ponds.
- (v) To implement the "Precautionary Principle" and the "Polluter Pays Principle" in coastal shrimp farming activities by adopting the procedure described in the Supreme Court Order dated 11 December 1996 passed in Writ Petition (Civil) No 561 of 1994.
- (vi) To regulate and give the necessary approvals/ authorisation for shrimp farming activities outside Coastal Regulation Zone areas and beyond 1 000 m from the Pulicat lake and Chilka lakes.
- (vii) To frame scheme/ schemes in consultation with expert bodies like National Environmental Engineering Research Institute, Central Pollution Control Board, respective State Pollution Control Boards for reversing the damage caused to the ecology and environment by pollution in coastal States/ Union Territories.

Constitution of the Authority

- | | |
|--|--------------------|
| 1) A retired Judge of High Court | - Chairman |
| 2) An expert in the field of Aquaculture | - Member |
| 3) An expert in the field of Pollution Control | - Member |
| 4) An expert in the field of Environment Protection | - Member |
| 5) A representative of the Ministry of Environment and Forests | - Member |
| 6) A representative of the Ministry of Agriculture | - Member |
| 7) A representative of the Ministry of Commerce | - Member |
| 8) (To be appointed by the Central Government) | - Member Secretary |

- (viii) To ensure the payment of compensation to the workmen employed in the shrimp culture industries as per the procedure laid down in the Supreme Court Order dated 11 December 1996 passed in Writ Petition (Civil) No 561 of 1994.
- (ix) To comply with the relevant orders issued by the concerned High Courts and Supreme Court from time to time.
- (x) To deal with any other relevant environment issues pertaining to coastal areas with respect to shrimp farming, including those which may be referred to it by the Central Government in the Ministry of Environment and Forests.



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Paddy fields are prohibited from conversion to shrimp farms

Rules of Procedure

Within the framework of the directions given by the Apex Court, the Aquaculture Authority has framed its Rules of Procedure and asked the coastal States and Union Territories (UTs) to constitute State Level and District Level Committees for considering the application of shrimp farmers.

To enable the different categories of shrimp farmers to apply for approval/ authorisation, the Aquaculture Authority has prepared a set of application forms. Accordingly, the shrimp farmers operating traditional and improved traditional systems are required to apply in Form I for adopting

improved technology for increased production. Shrimp farmers who are already operating outside the Coastal Regulation Zone or those who want to set up a new farm are required to apply in Form III. Shrimp farmers seeking renewal of their licenses are required to use Form V. The approval/ authorisation is for a period of three years from the date of approval and the renewal is also for a similar period. The forms prescribed by the Authority can be procured from the respective Department of Fisheries of the coastal States/ UTs or from the Member Secretary of the District Level Committees set up for the purpose.

The primary objective of the Authority is to regulate shrimp farming in the coastal areas. To promote sustainable shrimp farming in the country, the

Authority has taken several steps, including publication of Guidelines for adopting improved technology for increasing production and productivity in traditional and improved traditional systems of shrimp farming and incorporation of effluent treatment systems in shrimp farms above 5 ha (see page 13). The Guidelines on “Precautionary Principle” and “Polluter Pays Principle” and “Good Management Practices” are under finalisation. The Authority has held twenty-eight meetings since its inception in February 1997 for effective implementation of the Supreme Court’s directives.

Aquaculture Authority News is a quarterly publication of the Aquaculture Authority, Ministry of Agriculture, Government of India. Readers are invited to send their views and experiences on development of sustainable shrimp farming. We also solicit scientific/popular articles on shrimp farming/ coastal area management. The articles should not exceed 4 – 5 typed pages and preferably with good illustrations/ colour photographs. The scientific articles will be subjected to peer review and edited before they are published. The publication will also be made available online on the Authority’s website. – *Editor*

Present composition of the Authority	
Justice G Ramanujam	- Chairman
Dr V Rajagopalan	- Member representing Ministry of Environment and Forests
Shri K Jose Cyriac	- Member representing Ministry of Commerce
Shri P K Pattanaik	- Member representing Ministry of Agriculture
Dr K R Ranganathan	- Member expert in the field of Environment Protection
Shri T Venugopal	- Member expert in the field of Pollution Control
Dr Y S Yadava	- Member Secretary

The Supreme Court's Judgement on Shrimp Farming and Subsequent Developments

The Supreme Court in its judgement dated 11 December 1996 regarding setting up of shrimp farms in coastal areas held that aquaculture is an industry and hence covered by the prohibition imposed in the Coastal Regulation Zone Notification, 1991*.

The salient features of the Supreme Court's judgement are:

- ◆ An Authority to be constituted under Environment (Protection) Act, 1986 to deal with the situation created by shrimp culture in the coastal areas;
 - ◆ No shrimp culture pond shall be constructed/ set up within the Coastal Regulation Zone (CRZ), except traditional and improved traditional types of ponds. This shall be applicable to all seas, bays, estuaries, creeks, rivers and backwaters;
 - ◆ No shrimp culture ponds shall be constructed/ set up within 1 000 meters of Chilka lake and Pulicat lake (including bird sanctuaries namely, Yadurapattu and Nelapattu)
 - ◆ All shrimp culture ponds operating/ set up in the CRZ as defined under the CRZ Notification, 1991 shall be demolished and removed from the said area.
 - ◆ Shrimp culture ponds, other than traditional and improved traditional can be constructed/ set up outside CRZ with prior approval of the Authority;
- ◆ Shrimp farmers who are operating traditional and improved traditional systems of aquaculture may adopt improved technology for increased production, productivity and returns with prior approval of the 'authority' constituted by this Order;
 - ◆ The agricultural lands, salt pan lands, mangroves, wet lands, forest lands, land for village common purpose and the land meant for public purposes shall not be used/ converted for construction of shrimp culture ponds;
 - ◆ The Authority so constituted by the Central Government shall implement the "Precautionary Principle" and the "Polluter Pays Principle"; and
 - ◆ The shrimp culture ponds which have been functioning/ operating within the CRZ as defined by the CRZ Notification and within 1 000 meters from Chilka and Pulicat lakes shall be liable to compensate the affected persons on the basis of the "Polluter Pays Principle".

A Review Petition was filed by the Ministry of Agriculture and others seeking review of the Supreme Court's judgement in January 1997. The Review Petition(s) came up for hearing on 21 March 1997 and initially a month's stay on implementation

of the judgement dated 11 December 1996 was granted. In the hearing held on 19 August 1997 the Apex Court directed that while the stay on demolition shall continue there will be no fresh stocking of seeds in the aquaculture farms within 500 m of the high tide line which were required to be demolished. The Petition was subsequently heard on 31 October 2000 when the Review Petition was admitted and the Court also directed the Aquaculture Authority to submit a comprehensive Environment Impact Assessment Report. The Report was submitted by the Authority to the Apex Court on 30 April 2001. The Report is presently under consideration of the Supreme Court.

**The Coastal Regulation Zone Notification issued by the Ministry of Environment & Forests in February 1991 under the Environment (Protection) Act, 1986 specifies that the coastal stretches influenced by tidal actions up to 500 m from the high tide line shall be treated as coastal regulation zone where setting up of new industries (except directly relating to water front) are prohibited. Hatcheries have been specifically excluded and drawal of ground water in 200 – 500 m zone is permitted when done manually through ordinary wells for drinking, horticulture, agriculture and fisheries purposes.*

The Aquaculture Authority in association with the Department of Fisheries, Government of Tamil Nadu organised an Expert Consultation on Development of Sustainable Shrimp Farming in India during 28 – 29 August 2002. Seventy



participants representing the coastal States/ Union Territories (UTs); Central Ministries and Departments concerned with coastal aquaculture; Fisheries Research Institutes under the Indian Council of Agricultural Research; Experts from India and abroad; Shrimp Farmers and Hatchery Operators; and Non-Governmental Organisations (NGOs) attended the two-day programme.

Speaking at the inauguration of the Expert Consultation, Shri M Radhakrishnan, Hon'ble Minister for Fisheries, Government of Tamil Nadu, and the Chief Guest at the function, said that the principles of sustainability and social equity should be fully incorporated in all the programmes aimed at development of coastal areas for shrimp farming. Earlier Justice G Ramanujam, Chairman, Aquaculture Authority in his

Experts Meet to Discuss Shrimp Farming

address stated that there are few economic activities which have witnessed high growth rates as shrimp farming in coastal areas of a large number of countries, during the last decade. This rapid development has brought in many controversies, resulting in a more closer look at the environmental and socio-economic impacts of shrimp culture. To ensure that aquaculture develops sustainably, it is essential to address the potential social and environmental issues.

The inaugural session of the Expert Consultation also saw the formal launching of the website of the Aquaculture Authority (<http://aquaculture.tn.nic.in>) by the Hon'ble Minister and release of a set of four awareness posters by the Chairman, Aquaculture Authority.

Recommendations

The Aquaculture Authority should consider streamlining the procedure for application/ granting of approval/ authorisation, and to find ways for better networking/ coordination. Massive efforts are required from the District and State Level Committees set up in the coastal States/ Union Territories to motivate the shrimp farmers to apply for the approval/ authorisation of their shrimp farms/ ponds by the Aquaculture Authority.

The Aquaculture Authority should explore the option of issuing approval/ authorisation to shrimp farms within the context of coastal zone development plans and zoning of sites for aquaculture, particularly in areas where there are large numbers of small-scale shrimp farms.

There should be a coordinated research and development program to support long-term development of domesticated stocks of *Penaeus monodon* and other relevant species, involving cooperation among government agencies and industry. As domestication will take time, short to medium-term research support should aim for better screening of wild caught stocks and production of quality seed.

The establishment of a *P monodon* broodstock bank to assist in improving quality of nauplii/ post-larvae should be expedited.

Baseline survey of broodstock should be initiated to provide advice on available resources and practices to be used in their collection and distribution. Only small shrimp hatcheries should be promoted in States that do not have hatcheries or need more hatcheries to meet the demand.

Research on shrimp genetics should be taken up towards development of disease resistant stocks. Research on other

economically important shrimp species should be undertaken to assess the options and make recommendations on their suitability for commercial-scale farming.

Macro-level planning including base studies as required, should be undertaken to understand the inter-sectoral interactions, including socio-economics, and to incorporate aquaculture into Integrated Coastal Zone Management Plans (ICZMPs). Active involvement of the Departments of Fisheries, Central fisheries institutions/ agencies and other aquaculture/ fisheries stakeholders would be essential in preparation and finalisation of ICZMPs.

Micro-level planning should be carried out, including carrying capacity studies, clustering of farms and aquaculture estates. Research on carrying capacity should be taken up in priority at 2 – 3 sites for development of models for wider application in coastal areas. Carrying capacity studies should also consider effects of nutrient load and other polluting elements from different economic activities in coastal zones and contiguous upstream areas.

Environmental assessment and monitoring programs should be taken up in important farming areas to monitor and advise on the cluster design and practices, to ensure that the carrying capacity of the ecosystem is not exceeded and also to advise on the changing environmental conditions in the estuarine/ coastal profiles.

The Guidelines on Good Management Practices (GMPs) should be comprehensive to include environmental protection needs, labeling of chemical products used and disposal techniques for aquaculture wastes. Shrimp farmers/ self-help groups/ associations and NGOs as applicable should be actively involved in the preparation of the GMPs.

Discuss Sustainable Shrimp Farming in India – A Report

The technical sessions during the first day of the programme included Keynote presentations by Shri K Jose Cyriac, Chairman, Marine Products Export Development Authority, Kochi (*Status of Shrimp Farming in India*); Shri P K Pattanaik, Joint Secretary (Fisheries), Ministry of Agriculture, New Delhi (*Policy Perspectives and Future Thrust Areas*); Dr P Ravichandran, Principal Scientist, Central Institute of Brackishwater Aquaculture, Chennai (*Good Management Practices in Shrimp Farming*) and presentation of status papers by the representatives of the coastal States/ UTs present at the Expert Consultation.

Keynote presentations by Dr (Ms) Indrani Karunasagar, Associate

Professor, College of Fisheries, Mangalore (*Shrimp Health Management*); Dr Michael J Phillips, Network of Aquaculture Centres in Asia-Pacific, Bangkok (*Sustainable Development of Shrimp Farming – A Regional Perspectives*) and Dr Y S Yadava, Member Secretary, Aquaculture Authority, Chennai (*Aquaculture Authority and its Role in Development of Sustainable Shrimp Farming*) were made on the second day of the Consultation. The presentations were followed by panel discussion covering topics such as Good Management Practices, Licensing and Regulations, Planning and Governance, Information Networking, Training, Extension and Education and the Role of Financial Institutions.

The full proceedings of the Expert Consultation will be published shortly as a Report of the Aquaculture Authority – Editor

The Expert Consultation with a broad-based participation successfully adopted a set of recommendations (see box below) which on implementation will enable development of shrimp farming on a sustainable basis in the country.



The Ministry of Agriculture, with the technical assistance of ICAR Fisheries Institutions and Agriculture Universities should assist the States/ UTs in setting up of laboratories for shrimp health management units and common effluent treatment systems in areas where farms have been set up/ to be set up in clusters.

States should improve shrimp health management facilities (including surveillance, contingency planning, mobile laboratories, etc) and networking to provide early warning on disease and other problems and dissemination of relevant information to shrimp farmers.

The National Bank for Agriculture and Rural Development (NABARD) should review its funding/ credit policy with respect to shrimp farming, and if necessary call for an interaction meeting with the concerned Ministries/ Aquaculture Authority and the State Governments and investors. This would ensure improved access to banking and financing mechanisms to support GMPs at farm level.

The Ministry of Agriculture should initiate dialogue with the General Insurance Companies for insurance coverage of the shrimp farms/ hatcheries.

The Ministry of Agriculture should prepare a model aquaculture bill, which *inter alia* should include regulation on hatcheries, certification of seed and feed quality also following shrimp health management protocols and disease reporting. The involvement of the industry and other stakeholders should be ensured in its formulation.

More extension effort is required to support implementation of GMPs at farm level. The relevant extension material should be translated into local languages and electronic media, such

as television should be extensively used for dissemination of success stories and information on aquaculture. Shrimp farmers/ self-help groups/ associations should be provided with improved access to market information to get better remuneration of their produce.

Extension mechanisms, such as “agri/ aqua-clinics” should be promoted. State/ UT Governments should ensure that aquaculture is integrated in the “agri-clinics” scheme. More trained personnel in health management at district and village level should be provided.

Self-help farmer groups/ associations/ village clubs as one way to improve management practices (GMPs), information exchange and extension as well as to facilitate timely supplies of quality inputs, including credit and possibly also crop insurance cover and product sale, should be encouraged. Priority attention to building capacity of self-help farmer groups to improve local management of aquaculture should be given and subsidy/ grant schemes that provide training, facilities and guidance and support development of sustainable village level clubs should be considered for implementation.

Colleges of Fisheries under the State Agricultural Universities should upgrade their curriculum to include training in responsible use of chemicals and shrimp health management.

The Aquaculture Authority’s website should be developed as a means of gathering and dissemination of information on sustainable shrimp farming. National centres should also be linked to regional information sources such as Network of Aquaculture Centres in Asia-Pacific (NACA), Bangkok, for the benefit of sharing the experiences of the shrimp farmers in the region.

Status of Shrimp Farming in West Bengal

West Bengal stretches from the Himalayas in the north to the Bay of Bengal in the south. It has boundaries with Sikkim and Bhutan on the north, Assam and Bangladesh in the east, the Bay of Bengal in the south and Orissa, Bihar and Nepal on the west. Covering an area of 88 853 sq km, the State has 19 districts. The State has a coastline of 158 km and a continental shelf of 17 000 sq km.

In view of the existence of productive agro-climatic and soil-morphological conditions and with a dynamic estuarine river system, a unique network of productive fishery resources including brackishwater fisheries has emerged in West Bengal. The total fish production in the State during 1999-2000 was estimated at 1045 700 metric tonnes, of which 180 000 (17.2 per cent) metric tonnes came from the marine sector.

West Bengal is endowed with the highest potential resources of brackishwater aquaculture (27 per cent of the country's potential) among all the maritime States. The State's share of the saline soil is about 0.08 million hectare (mha) out of 2.10 mha in the country. The total potential culturable area is estimated at about 0.21 mha and presently 48 000 ha of water area has been brought under brackishwater farming.

Excepting for 4 678 ha under improved traditional shrimp farming, the remaining area falls in the category of traditional type with trap and culture, locally known as *bheries*. According to the estimates provided by the Government of West Bengal, 18 479 ha of the total

Table 1. District-wise potential area of Brackishwater in West Bengal

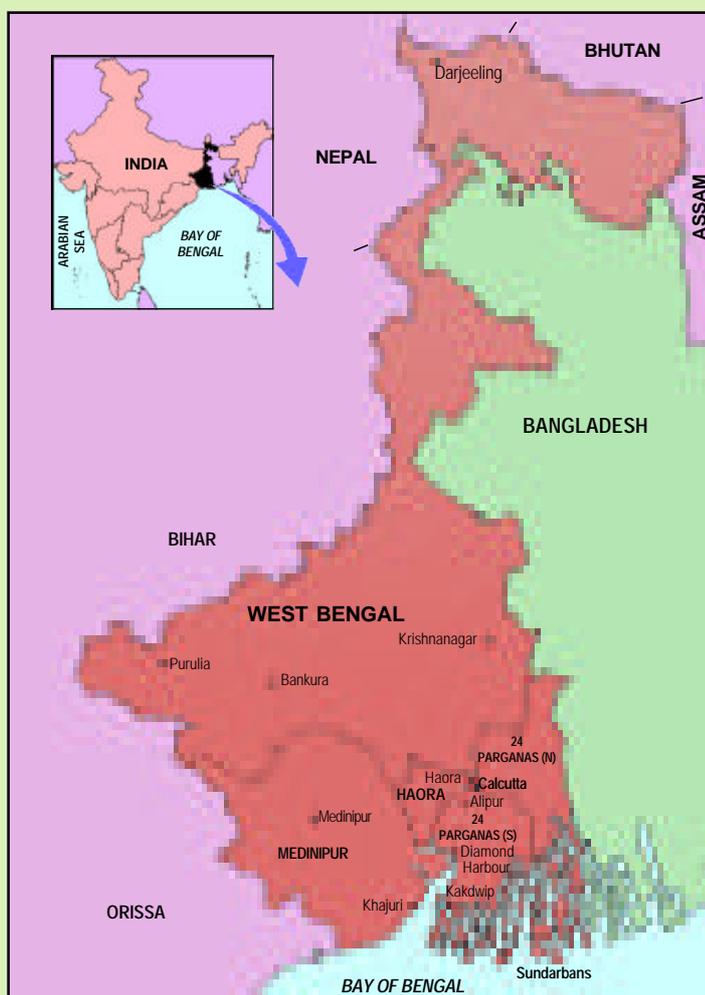
District	Potential area (in ha)	Area under culture (in ha)
North 24 – Parganas	1 10 000	33 000
South 24 – Parganas	70 000	12 000
Midnapore	30 000	3 000

area was in farm holdings of less than 2.0 ha; 4 237 ha under 2.0 – 5.0 ha and the remaining 25 728 ha in farms of above 5.0 ha. All the shrimp farms are creek-based and are located within the Coastal Regulation Zone.

The brackishwater fisheries development is high in West Bengal particularly because of the extensive saline soil-water resource, human resource,

favourable agro-climatic conditions, productive estuarine ecosystem including the Sundarbans and also abundance of prawns and other brackishwater finfishes.

Based on the management practices *viz.* traditional, improved traditional/ extensive methods of culture systems are in vogue in the State. The traditional shrimp farming practices are also commonly known as “*Bhasa Badha*” fishery.



Beginning with this issue, we plan to bring out the status of shrimp farming in the other coastal States/ Union Territories in the subsequent issues of the Aquaculture Authority News.

In West Bengal about 80 per cent of the fisheries belong to the traditional type of farming where large areas are enclosed and tidal water is allowed to enter along with the natural seed of shrimp and fish. No supplementary feed is given. After a considerable period, the fishes and shrimps are harvested. The average productivity of such systems lies between 500 kg to 900 kg/ ha/ year of which about 30 per cent is constituted by prawns/ shrimps and 70 per cent by mullets. These fisheries are mainly located in the districts of North

24 – Paraganas, South 24 – Paraganas and Midnapore. The district-wise potential area of brackishwater is given in Table 1. With the advent of scientific farming in the early seventies, the traditional farmers have also resorted to selective stocking with improvement in production levels.

The extensive farming is commonly known as improved traditional farming in the State. This system involves construction of peripheral canals/ ponds of size ranging from 1 – 5 ha. Shrimp seed at the rate of 15 000 – 20 000/ ha are stocked. Water management is done by tidal effect. The average yield is 1 500 – 1 700 kg/ ha, including mullets.

Though shrimp farming was in vogue in West Bengal much before it started in other States, the development has been slow as compared to other States. Presently, the average production from the State is about 436 kg/ ha .

Availability of hatchery raised seed is still a constraint in West Bengal.



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Casting net to harvest shrimp crop

Although harvesting of wild seed is banned by the State Government, some collections in remote estuarine areas of the State still continue. To meet the growing demand of the shrimp farms, there is an urgent need to set up shrimp hatcheries and facilities for testing of the seed in the State.

To develop new areas/ existing areas for shrimp farming, Brackishwater Fish Farmers Development Agencies (BFDAs) have been operating in the coastal districts of Midnapore, North and South 24 – Paraganas. Up to 2001-2002, an area of 4 235. 90 ha has been developed under this programme. Shrimp farmers under BFDAs have adopted improved traditional methods of culture so that no environmental hazards are posed. In most of the farms, shrimps along with other brackishwater fish species are being cultured.

In accordance with the guidelines of the Aquaculture Authority of the Government of India, State Level Committee and District Level Committees have been constituted for the purpose of ensuring and processing of applications of shrimp farmers and recommending them to the Aquaculture Authority for approval.

With an aim to increase production of farmed shrimps in the State, an Integrated Brackishwater Aquaculture Development Project with the assistance of National Cooperative Development Corporation (NCDC) is being implemented by the “Benfish” at Nayachar Island (Meen Dwip) in North Midnapore district. Under this project, 175 ha of area has been developed. Moreover, 451.73 ha water area has been developed under the World Bank aided Shrimp Culture Project in Canning and Dighirpar of South 24 – Parganas and Digha and

Table 2. Area Covered under BFDA

Year	Area (in ha)
1997 – 1998	327.47
1998 – 1999	495.79
1999 – 2000	529.88
2000 – 2001	499.39
2001 – 2002	460.45

Table 3. Shrimp Production in West Bengal (1978 – 2002)

(In metric tonnes)

Year	Inland		Marine		Total
	Penaeid	Non-Penaeid	Penaeid	Non-Penaeid	
1997 – 1998	17 373	8 161	10 727	3 239	39 500
1998 – 1999	18 357	6 442	11 319	3 947	40 065
1999 – 2000	17 049	6 178	11 599	5 924	40 750
2000 – 2001	16 610	6 075	11 320	6 015	40 020
2001 – 2002	18 200	4 250	11 615	6 130	40 195

Table 4. Export of Fin and Shellfish from West Bengal through Kolkata Port

Year	Quantity (in mt)	Value (Rs in millions)
1997 – 1998	16 111	4204.4
1998 – 1999	14 450	4166.0
1999 – 2000	15 060	4579.1
2000 – 2001	16 348	5117.0
2001 – 2002	18 420	6309.0



Y S YADAVA

Healthy environment, healthy shrimp

2001-2002, 18 420 tonnes of marine products worth Rs 63090.0 million have been exported, of which 90 per cent was contributed by shrimps.

Dadanpatrabar of North Midnapore districts.

As a diversified programme, brackishwater crab (Mud crab) culture and fattening in selected areas is under adaptive trial of the Research Wing of the Fisheries Directorate to explore its potentiality. For ensuring

sustainable development in brackishwater fisheries in an eco-friendly manner, West Bengal Fish Producers' Licensing Order, 1994 has also been promulgated in the State.

West Bengal is one of the pioneer State for export of shrimps to different countries. During the year

Compendium on "Aquaculture Medicines and Aquatic Animal Health Management"

The Aquaculture Authority has initiated work on preparation of a Compendium on "Aquaculture Medicines and Aquatic Animal Health Management" through the Centre for Fish Disease Diagnosis and Management of the Cochin University of Science and Technology, Kochi. The objectives of bringing out a Compendium are to make available a handy source of reference for the use of scientists, policy makers, development agencies and the grassroot practitioners of aquaculture in the country on the safe and responsible use of aquaculture chemicals, drugs, etc. The Compendium will include chapters on antimicrobials (antibacterial, antifungal, and antiviral); antiprotozoal/antimetazoal/antihelminthes compounds; general management chemicals; anesthetics; hormones; probiotics and immuno-stimulants; vaccines; HACCP in aquaculture; and diagnostics.

The Compendium is expected to be ready by November 2002.

Guidelines on Good Management Practices in Shrimp Farming

In exercise of the powers conferred by sub-section (3) of Section 3 of the Environment (Protection) Act, 1986 the Aquaculture Authority has been *inter alia* mandated to implement the "Precautionary Principle" and ensure orderly and sustainable development of shrimp farming in the country. To fulfil the above function and to enhance the positive contributions that shrimp farming can make to the economic growth and poverty alleviation in the coastal areas, the Authority has constituted an Expert Group to prepare Guidelines on "Good Management Practices in Shrimp Farming" under the chairmanship of Dr M N Kutty, former FAO/UNDP Consultant.

The terms of reference of the Expert Group are to (i) review the contemporary

developments in small-scale shrimp farming in India and abroad, and to (ii) formulate Guidelines on Good Management Practices for shrimp farming operations taking into considerations the directives of the Supreme Court in its judgement dated 11 December 1996 (WP (Civil) No 561 of 1994) and other interim orders issued from time to time. The Guidelines will cover topics such as site selection; design and construction; general pond operations; feeds and feed use; animal health management; safe and responsible use of therapeutic agents and other chemicals; effluents and solid wastes and their treatment; community participation and food safety.

The Guidelines are expected to be ready by October 2002.

The Aquaculture Authority's website was launched on 28 August 2002. To visit the website, please log on to <http://aquaculture.tn.nic.in>. Your views/ suggestions are invited to make the site more informative and user-friendly.

Aquaculture Authority — Publications

Guidelines – Adopting Improved Technology for Increasing Production and Productivity in Traditional and Improved Traditional Systems of Shrimp Farming

The Supreme Court in its judgement dated 11 December 1996 on shrimp farming *inter alia* permitted farmers practicing traditional and improved traditional systems of shrimp farming to adopt improved technology for increased production, productivity and returns with the prior approval of the Aquaculture Authority. The Guidelines for adopting improved technology have been formulated with the objective of optimising yield levels in traditional and improved traditional systems on sustainable basis. These Guidelines bring out simple procedures and lay down parameters which aim at improving the management of shrimp farms under traditional and improved traditional systems to ensure long-term sustainability of the farming practices.

Guidelines – Effluent Treatment System in Shrimp Farms

Shrimp farm wastewater comprises both living and dead plankton, feed waste, faecal matter and other excretory products of shrimps. Though all these nutrients and organic wastes are biodegradable, beyond a reasonable limit they can result in nutrient enrichment in the open waters (creek, estuary or the sea) where the farm wastes are generally released. The Guideline provides a prototype of the Effluent Treatment System (ETS) which can be integrated with the shrimp farm and assist the farmer to improve the wastewater quality before it is released into the open waters. In view of the variety of coastal

aquaculture practices and the diversity of their environmental settings, it is likely that some of the issues addressed in the Guidelines would require field-level alterations to meet the site-specific requirements of shrimp farmers.

Shrimp Aquaculture and the Environment – An Environment Impact Assessment Report

The Supreme Court – while considering the Review Petitions filed by the Government of India and other interested groups against its judgement of 11 December 1996 in Writ Petition No 561 (C) of 1994 – urged that an Environment Impact Assessment Report be obtained from an independent authority about the effect on the environment of the shrimp culture industry/ shrimp ponds/ shrimp farms and in that process felt appropriate to get the assessment done by the Aquaculture Authority.

This Report, “Shrimp Aquaculture and the Environment – An Environment Impact Assessment Report” brings out an objective assessment of the shrimp farming

sector and its impact – both positive and negative on the environment. The Report has been presented in nine chapters. The first chapter, an Introduction, traces the genesis of the Hon’ble Supreme Court’s judgement on shrimp farming. The second and third chapters outline the present status of shrimp farming in India and other major shrimp farming countries. The fourth chapter describes the existing legislation on environment protection and the Coastal Regulation Zone. Chapters five and six focus on the coastal environment protection and the interactions of shrimp farming with the coastal ecosystem, including the impacts. Chapter seven deals with mitigation measures. Chapter eight briefly describes the role of Government agencies in the development of shrimp farming in the country.

In chapter nine which is also the concluding chapter, a future plan of action has been suggested for consideration of the Apex Court.



Copies of the Guidelines and the EIA Report can be obtained from the Aquaculture Authority

Use of Antibiotics, Drugs and Chemicals in Shrimp Farming and Steps for their Regulation - A Report

The Aquaculture Authority convened a meeting to discuss the modalities to regulate the use of antibiotics, drugs and chemicals in shrimp culture and make shrimp farming practices sustainable and environment- friendly. The meeting convened on 18 May 2002 at Chennai was chaired by Justice G Ramanujam, Chairman, Aquaculture Authority and attended by 12 Experts representing different agencies, including the shrimp farming sector.

Justice Ramanujam in his introductory remarks stressed on the need for sustainability in shrimp farming. He stated that the unscientific use of antibiotics, drugs and other pharmacologically active compounds can have adverse impact on human health and also the environment. Most of the countries importing marine products from India do not permit any residue level of banned antibiotics and chemicals. Therefore, from the export angle also we must ensure that the shrimp farmers do not use antibiotics, etc. which have the potential to harm human health and adversely impact the environment.

The various chemicals and pharmacologically active compounds used in grow-out ponds and hatcheries in both freshwater and coastal aquaculture in India can be classified into the following broad categories: water/ soil treatment products, disinfectants, piscicides, herbicides, organic and inorganic fertilizers, feed additives, therapeutants and anesthetics.

It was informed that the Marine Products Export Development Authority(MPEDA) had prepared a list of drugs, chemicals and other



DOF, Tamil Nadu

pharmacologically active compounds presently in use in shrimp farming in India. MPEDA had also prepared a detailed monitoring plan for testing antibiotic and chemical residues in farmed shrimp. The monitoring plan envisages collection of samples from shrimp farms and processing units directly by MPEDA and testing them for pesticide and antibiotic residues.

The Expert Group noted that several 'aqua shops' in Andhra Pradesh and Tamil Nadu sell antibiotics, drugs and chemicals and other medical formulations unauthorisedly for shrimp culture, disregarding the ban on several of such products. Most of the products marketed are without label and any description of their composition/ usage. It was also noted that under the pretext of probiotics, there are several preparations marketed which contain antibiotics. Probiotics is a big business today worth 300-400 crores and most of them are imported.

It was opined that the distress harvest of shrimps should not go for either domestic marketing or exports and suggested that the marketing of shrimp seed and feed should be regulated for ensuring quality sustainability.

The need for further research to standardise prophylactic and control measures in shrimp culture is real, since commercial-scale farming practices are of recent origin. Research needs to be strengthened and focussed to develop safer and biodegradable chemicals for use in aquaculture.

Based on the discussions held in the meeting of the Expert Group, the following recommendations were made:

- (i) A list of 20 antibiotics, drugs and pharmacologically active substances and four antibiotics for which a certain level of residue is permissible in the finished product was considered by the Expert Group. It was recommended that Aquaculture Authority might consider including a provision in the approval given to shrimp farmers prohibiting use of banned antibiotics/ pharmacologically active substances* during the shrimp culture operations. This condition will enable the Aquaculture Authority to regulate the use of banned antibiotics, chemicals, etc and to cancel the approval if the ban is violated by the farmers. The Expert Group also noted that this ban would in no way hamper the farming practices, as there were several safe alternative compounds

**** The Aquaculture Authority approved the recommendations of the Expert Group in its 27th Meeting held at Chennai on 31 May 2002. The list of 20 banned antibiotics and pharmacologically active substances (see box) now form a part of the approval given by the Authority to shrimp farmers.***

available to be used by the shrimp farmers during crisis.

- (ii) As creation of awareness is vital for achieving the objectives of regulating the use of antibiotics, drugs, chemicals, etc in shrimp farming, a comprehensive programme is necessary to educate the shrimp farmers and those associated with the manufacture, supply and marketing of such chemicals, etc. MPEDA was requested to consider chalking out a programme and also preparing necessary awareness material in consultation with the Aquaculture Authority. This programme would be implemented with the active cooperation of the coastal States/ Union Territories.
- (iii) To assist shrimp farmers in management of animal health and water quality in farms, it was recommended to set up mobile laboratories in the coastal States/ Union



DOF, Tamil Nadu

Use of lime helps in maintenance of water and soil quality

Territories. It was also recommended to establish modern laboratories accessible to the processing centres for testing antibiotic residues in farmed shrimp at selected places. The Expert Group suggested that this recommendation might be considered by the Ministry of Agriculture and the coastal States/ Union Territories while preparing their schemes for the Tenth Five Year Plan.

List of Antibiotics and other Pharmacologically Active Substances Banned by Aquaculture Authority

S No	Antibiotics and other Pharmacologically Active Substances	Maximum Permissible Residual Level (in ppm)
1.	Chloramphenicol	Nil
2.	Nitrofurans including: Furaltadone, Furazolidone, Furylfuramide, Nifuratel, Nifuroxime, Nifurprazine, Nitrofurantoin, Nitrofurazone	Nil
3.	Neomycin	Nil
4.	Nalidixic acid	Nil
5.	Sulphamethoxazole	Nil
6.	Aristolochia spp and preparations thereof	Nil
7.	Chloroform	Nil
8.	Chlorpromazine	Nil
9.	Colchicine	Nil
10.	Dapsone	Nil
11.	Dimetridazole	Nil
12.	Metronidazole	Nil
13.	Ronidazole	Nil
14.	Ipronidazole	Nil
15.	Other nitroimidazoles	Nil
16.	Clenbuterol	Nil
17.	Diethylstilbestrol (DES)	Nil
18.	Sulfonamide drugs (except approved Sulfadimethoxine, Sulfabromomethazine and Sulfaethoxyipyridazine)	Nil
19.	Fluroquinolones	Nil
20.	Glycopeptides	Nil

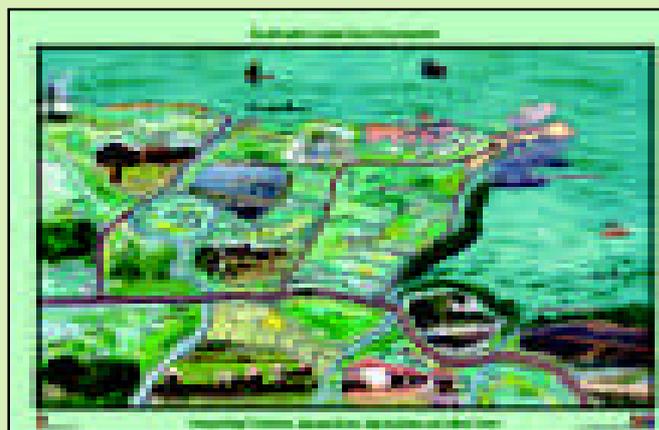
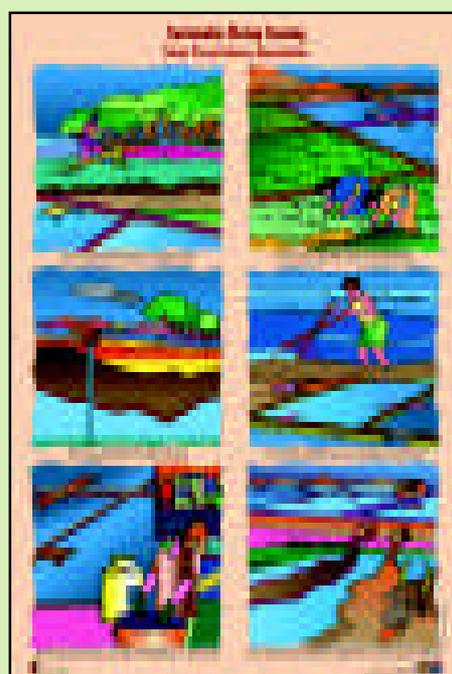
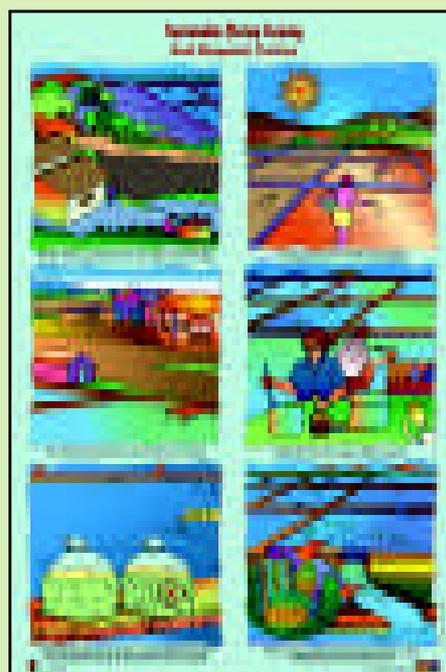
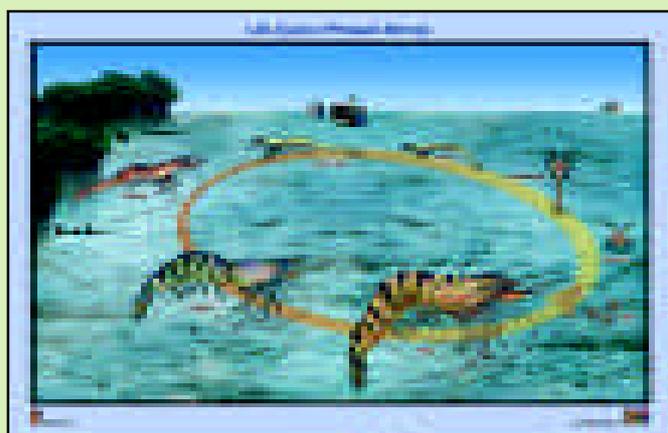
- (iv) The Expert Group recommended amendments to the Livestock Importation Act to regulate the import of shrimp and other aquatic animal feed and suggested that the list of antibiotics and other pharmacologically active substances approved in the meeting might be considered for inclusion in the said Act. The promulgation of a Feed and Seed Act was also recommended, the modalities of which could be discussed by the Aquaculture Authority in its next meeting.

- (v) The Ministry of Agriculture, Department of Animal Husbandry & Dairying may consider regulating the use of probiotics as they contain live organisms and probiotics of foreign origin may have the potential to introduce exotic species, the impact of which may not be known. It was also informed that guidelines for manufacturing, import and marketing of probiotics will be detailed in the proposed Compendium on Aquaculture Medicines and Aquatic Animal Health Management.

- (vi) The Ministry of Agriculture, Department of Animal Husbandry & Dairying may consider issuing Executive Orders to the State Governments/ UTs on imposing effective ban on the use of drugs, chemicals, etc for aquaculture. The Ministry of Agriculture may also consider requesting the Ministry of Health and Family Welfare (office of the Drug Controller) to issue directives to the drug manufacturers to label the bottles/ packets of veterinary grade drugs with '**Not for use in Shrimp Culture**'. This would help in checking the rampant use of veterinary grade drugs in shrimp farming.

— P Pakshirajan

Posters on Sustainable Shrimp Farming



Posters play an important role in communication and Aquaculture Authority has effectively utilised this media to propagate the elements of sustainable and environment-friendly shrimp farming.

A set of four posters in bright and beautiful colours was released during the recently concluded Expert Consultation on Development of Sustainable Shrimp Farming in India. These posters depict some good management practices and the precautionary approach to sustainable shrimp farming, the life cycle of penaid shrimps and integration of fisheries, aquaculture, agriculture and other uses in sustainable coastal zone development. Those interested in the posters can write to Aquaculture Authority for free copies.



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