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EMPLOYMENT GENERATION IN TRIBAL AREAS THROUGH AQUACULTURE TECHNOLOGIES & FISHERY ESTATES

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The fisheries development policies adopted so far have not produced the desired results in the country. Inspite of the extensive aquatic resources supporting a lucrative fishery, the fishermen community continues to be poor and backward. Lack of technological training and inadequate administrative, financial and extension support have been identified as key limiting factors. This paper discusses suitable technologies for adoption in tribal areas.

Introduction

The fishery resources of India consist of 2.02 million sq. kms of EEZ, 29 000 kms of rivers, 3.0 million ha of reservoirs, 2.0 million ha of tanks and ponds, 1.0 million ha of floodplain lakes and 1.4 million ha of brackishwaters. In addition, there are about 1.5 million ha of water logged land in the command area of reservoirs and inland and coastal saline regions, which are not suitable for agriculture, but can be used for aquaculture.

Resource potential

The nation has set a target of 12.0 million tonnes of fish by the turn of the century. The total additional fish production figure, although indicating a very high production level, is however, attainable by 2000 AD with modern S & T methods, controlled systems and by optimum use of the natural resources. Therefore, to meet the targets, efforts should be directed to create exponential growth through aquaculture and provide employment in rural areas by appropriate use of culturable resources.

Need for new policy

Though India has extensive fishery resources but the fishermen continue to be poor and backward. More than 60% depend on small-scale fishery due to lack of technological training and absence of adequate administrative, financial and extension support. Evidently, the fisheries development policies adopted so far have not produced desired results. India's marine fish production has been stagnating. The inland sector, notwithstandingn otable achievements, falls short of expectations and the fishermen community continues to remain shrouded in poverty. Thus, the need for a new policy approach is felt through large scale S & T demonstrations to ensure exponential growth and improve the socio-economic conditions of the fishermen community. Some technologies which can be suitably adopted in the rural areas are discussed in the paper.

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Composite fish culture

The average fish production from traditional pisciculture in India averages 600 kg ha^{-1} yr^{-1}. Better managed ponds, mainly through the FFDA's now produce 2 500 kg $ha^{-1}yr^{-1}$, although the composite fish culture technology has demonstrated fish production of more than 15 t $ha^{-1}yr^{-1}$. The technology now envisages productions of 25 t $ha^{-1}yr^{-1}$.

Oxygen plays a vital role in intensive pisciculture operations. Aeration helps in reducing the BOD levels and increasing primary production. It eliminates the anaerobic conditions in the culture system. Traditionally, Japan and Canada have been using aeration for intensive rearing of fish. Airlift circulatory system was introduced in aquaculture in 1978. Since then, mass culture of zooplankton, such as *Artemia, Brachionus* sp., *Moina* sp., *Fabria salina* and *F. euplotes* has been demonstrated. Under intensive system, use of compressed air for hatching of carp eggs and rearing of fry, which ensure 95% survival at the density of 5 000 spawn in one cubic meter have been demonstrated.

Relay culture for optimum use of carrying capacity

Traditionally, fishes raised in pond are harvested at the end of one, two or three years. In this system, the space and the nutrients are not utilised to the optimum level. To fully utilise the carrying capacity of the pond, it is suggested to undertake relay culture of fish in stages, with each stage lasting for 3-9 months. During this period, the fish which attain a weight of c. 1.5 kg are exploited and the rest are cultured till they attain optimum weight. The species composition for stocking depends upon the availability of food and nutrient in the ponds and tanks.

The return per unit of space and per unit of expenditure is optimum in relay culture. The practice is now being followed in West Bengal, Andhra Pradesh and in Haveli tanks of Madhya Pradesh. It is also useful for raising fingerlings in rural areas. In Banswada (Rajasthan) 400 tribals were benefited through fingerling raising. Relay culture helps in the use of seasonal ponds and makes full use of the carrying capacity of pond. The special advantage is that the operations have been divided in three parts; raising spawn to fry for 12-15 days, fry to fingerlings in 4-6 weeks, and culture for 90 days.

Culture in seasonal ponds

Seasonal pond retaining water for 3-9 months are a common sight in the country. The area of seasonal ponds is estimated to be more than one million hectares. These are not being used for agriculture. Their use for raising fingerlings as well as table-size fish has been demonstrated and fish productions ranging from 0.5-1.0 t ha^{-1} yr^{-1} achieved. Experiments undertaken in the tribal areas of Banswada (Rajasthan) by Agricultural University, Udaipur in collaboration with DOD have shown very encouraging results and so far 400 tribals have been trained for fish seed rearing and culture in seasonal ponds. Aquaculture in seasonal ponds can play a very important role in providing part time employment and augment income for women in rural areas. It is suggested to raise short term crops of 9-12 months where fishes attain weight of about 1 to 1.5 kg. The work done in tribal blocks in Chhattisgarh region of Madhya Pradesh has also given encouraging results.

Methi culture along sea beach

In metropolitan cities like Bombay large quantities of sewage is generated and discharged into coastal waters without treatment. Therefore, the coastal soils of such areas are rich in organic contents. In Bombay, a survey along Seven Bungalows was conducted for its use in Methi (*Trigonella foenum-graecum*) cultivation. Beach soil is sandy with 1-3% organic matter and is suitable for Methi cultivation of short duration.

Fisheries for public health

Occurrence of malaria, filaria and other water borne diseases have been causing great misery and suffering in parts of Rajasthan, M. P., Orissa, Tamilnadu etc. Under the National Malaria Eradication Programme, larvicidal fishes and *Gambusia* spp. are being used for biocontrol of mosquitoes and filaria. These programmes have helped to reduce and eradicate water borne and communicable diseases. They have also resulted in reducing use of DDT and other insecticides which are harmful for health.

Fishery Estates

The Govt. of India has been concerned about the poverty of fishermen and formulated various schemes for increasing fish production and ameliorating the condition of fishermen during different plan periods. It was expected that increase in fish production would automatically improve the socio-economic conditions of fishermen, but this did not happen.

Mechanised fishing vessels were introduced in coastal areas. The most valuable catch from these vessels are prawns and the fishing industry is primarily engaged in their export and most of the benefits go to the traders and exporters. Some small fishermen have also been benefited but majority of them are still very poor. Some of them work as landless labour also. It is, therefore, necessary that fisheries development is reoriented. The twin objectives of producing fish at reasonable rates and assuring better return to fishermen thus need top priority.

The analysis of scientific data indicated that the coastal fisheries in India has reached the level of optimum exploitation and in some areas a few species are over-exploited. Therefore, from coastal areas using traditional approach, only marginal increase in fish catch may be possible. This may not help to ameliorate the socio-economic conditions of fishermen. The difficulty has become more acute due to increase in oil prices. The introduction of Purse seine in Karnataka and Goa had increased the catches of the mechanised vessels but Rampani fishermen who are very poor are not able to get enough mackerels and sardines in their catches. Comparable situations have arisen in other States also.

Therefore, it is necessary that the coastal resources, near shore areas and the backwaters, bays and mangrove swamps should be managed in a manner that along with increase in fish catch, area development also takes place and the fishermen become the real beneficiaries. Therefore, introduction of "Fishery Estates" in integrated area development is envisaged. The approach suggests application of new technologies and funding from government agencies and implementation and management through fishermen. The major aspects to be included in this are;

1. Harbour, Jetties and boat building,
2. Coastal Fisheries,
3. Brackishwater farm, supported by Hatchery and demonstrations,
4. Model fish farm including seed bank and Hatchery for supply of Fish and Prawn seed, and
5. Housing colony with science centre, technical education for operatives and social services like medicine and health centres.

The scheme is highly adaptable and is designed to meet the needs and resources of any given area. All these activities need not exist in each Fishery Estate but they can be adopted and modified to suit the local resources and manpower needs. However, the basic factor is that the area development is expensive. Its planning and construction should be done by the State, which should also run model centres for technology transfer and provide facilities for job training to the local people. This will help in upgrading the skills of fishermen so that they become capable to execute and manage all the activities in a Fishery Estate. Fishery estates can be organised for Mixed farming, Reservoir development, Marine fishing, Marketing and Harbours and boat management (Fig. 1).

Fishery Estates for Coastal Saline Soils and Backwaters

The coastal saline soils are lying fallow and need special attention. In India, during the last decade brackishwater culture technology has been developed. Now it is possible to earn Rs. 30,000/- or more per hectare per year by fish and prawn culture. It is, therefore, suggested that the existing backwaters and low lying areas can be converted into Fishery Estates.

Table 1. Financial break-up for establishing a Fishery Estate.

Major items	Rs. (in lakhs)
Capital cost on construction of 100 ha farm* in an area of 175 hectares	95.00
Seed bank & Prawn hatchery	45.00
Central supplies and wind mills, water, electricity etc. ...	35.00
Trainer's training centre for Farmers, SC and ST people ...	15.00
Hardware, Ice Factory, Boats & Cold storage	45.00
Civil amenities like Housing (rural huts), Primary School, Dispensary, Committee Hall & Storm shelter. Part of this fund should come from concerned ministries	67.00
Recurring Expenditure	20.00
TOTAL	322.00

*For 400 families

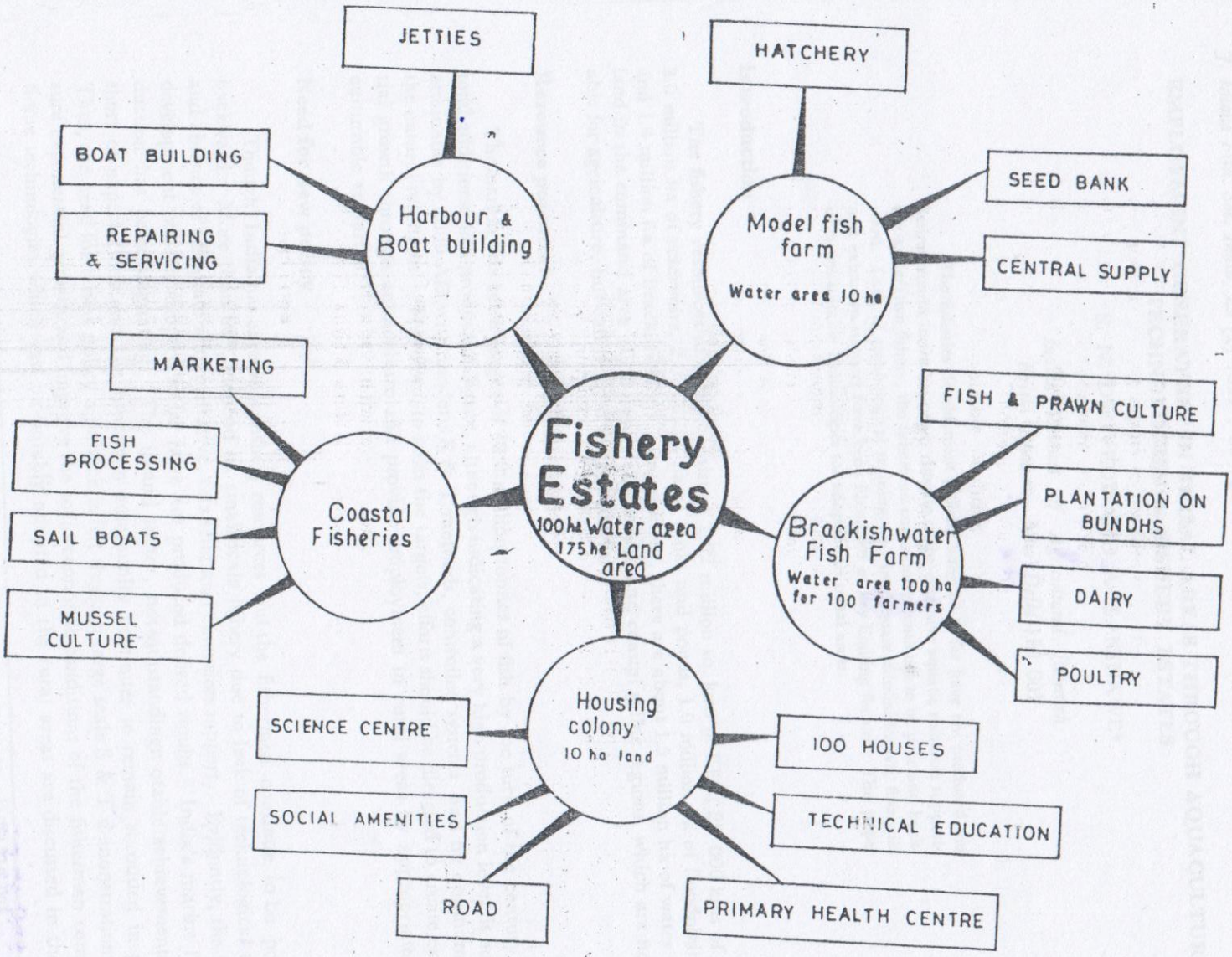

Fig. 1 A model fishery estate covering 100 ha water area

The construction of Fishery Estates is expensive and cannot be undertaken by farmers. Therefore, the State will construct these farms and will also provide staff for 5 years and all capital and some recurring inputs to the farmers. It is proposed that 3 or 4 ponds of one hectare water area may be leased to each family on a nominal lease amount. One Fishery Estate is intended to provide self employment to 100 families. On an average, there may be four persons per family. Therefore, about 400 persons will be self employed. They will earn an income of Rs. 30,000/- per year per family. These estimates are indicative. It has been assumed that the land is available free of cost. The type of construction used are functional, appropriate and lowcost making use of locally available facilities.

Ecosystem and Energy Conservation

The estates are intended to make optimum use of coastal ecosystems and also ecycle organic wastes. This will ensure maximum production per unit area by using all available resources for mixed farming system. The scheme has in-built energy saving devices, like the use of windmill for pumping water. The wind mill can also recirculate water and air in ponds and provide irrigation to plants. The manure and water in ponds will help the plants to give higher production without any extra cost. The biotechnology approach is used to improve upon genetic factors for fast growth, develop formulated feeds and biodegradation to economise use of fertilizers and food.

Ancillary Occupation

In extra time, fishermen and women can also work for handling and processing low value fish for edible purposes. They will also get benefit of the other schemes which will operate in the area e.g. provision of sail boats for fishing in near shore areas, mussel culture in semi-closed bays, boat building, fish processing and marketing. Secondary employment will also be generated for maintaining and running of pumps, windmills, air compressors fish processing plants, ice factories and transport vehicles.

Social Guarantees

The other main features of the scheme are the social guarantees which ensure benefits fishermen and SC and ST people.

Conclusion

Adoption of fish culture, fishing, fish processing and marketing schemes which are labour intensive are most useful for rural people. However, they need extensive support and demonstration for successful implementation by the small scale fishermen.