

Shrimp Farming Practices and its Socio-Economic Consequences in East Godavari District, Andhra Pradesh, India - A Case Study

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Development of shrimp farming in the state of Andhra Pradesh, India grew at a phenomenal rate during the years 1990-1995. In 1990, a total of 6,000 ha was under shrimp farming and this rose to 88,300 ha during 1997-98. Presently about 78,700 ha is under culture which accounts for more than 50% of the brackishwater area potentially available in the state. The average yield was around 1,000 kg/ha during 1990-1994. This dropped to about 550 kg/ha in 1995-96 and reached around 630 kg/ha in 1998-99. The present study was carried out in East Godavari district of Andhra Pradesh to understand the nature of shrimp farming practices followed, its impact on the socio-economic status of local population, the influence of extension support and the constraints if any faced by the farming community.

respect to the culture practices, water, feed and health management. For the socio-economic component of the study, data was collected from 120 randomly chosen shrimp farmers using pre-tested questionnaire. Meetings of various stockholders were held in 6 villages to assess the impacts of shrimp farming.

kg/ha as basal dose and if necessary top-dress with 50kg/ha once in 10-15 days to neutralize pH fluctuations. In addition to the above, 10-12 kg of urea and 3-5 kg of super phosphate are also commonly applied when algal blooms are poor. Pond water parameters including dissolved oxygen (DO), salinity, temperature and transparency are monitored regularly by the farmers.

Pond preparation

The farmers deep plough their ponds with tractors. Agricultural lime is applied @500-1000 kg/ha as a basal dose with 150 kg of dolomite and 25 kg of zeolite to adjust the pH, improve the plankton availability and to get a proper algal bloom. Some farmers apply dolomite as substitute to lime @ 750

Stocking

Shrimp (*P. monodon*) seed (PL-20) are purchased at the rate of Rs.400-500 per thousand pieces from commercial hatcheries operating in Kakinada, Visahapattinam and Tuni. The are stocked at a density of 4-7/m² in ponds. Nursery rearing of post larvae to

Study area

East Godavari district has an area of 10,807 sq. km, with a population of 45,41,000 (1991 census). It is a major rice producing state with 52% of the total area of the district under rice cultivation. This district ranks fourth in shrimp farming with 6,221 ha of water spread area in 4,810 farms. Generally, farmers culture tiger shrimp (*Penaeus monodon*) because of its high market value.

Out of the 13 coastal mandals of the district 8 (Talarevu, Kakinada rural, U. Kothapalli, I. Polavaram, Katrenikona, Uppalakuptam, Mamidikuduru and Razole) were chosen and detailed study was carried out in 30 shrimp farms with

Table 1: Andhra Pradesh – Extent of shrimp farming (District wise)

District	No. of farms	Land area (ha)	Water area (ha)
Srikakulam	211	647	542
Vizianagaram	8	101	48
Visakhapatnam	230	2830	2540
East Godavari	4814	7821	6221
West Godavari	16159	14374	11064
Krishna	37495	32856	26111
Guntur	10669	8821	7473
Prakasam	1707	5105	4084
Nellore	2050	7105	5684
Total	73343	79660	63767

juveniles is generally done in smaller ponds by the farmers. Before stocking, farmers have the seed tested for its quality including the PCR analysis for the white spot virus in private laboratories. This costs Rs.1,200-1,500 per sample for the tests.

Feeding

Different brands of commercial pelleted feeds are used. Two types of feeding strategies are used by the farmers - 'extensive' (35% c.p) for the first 60 days and 'intensive' (32% c.p) for the remaining period. The cost is Rs. 1,250/25kgs and Rs.1,050/25 kg respectively. Frequency of feeding varied from 2-5 times during the culture period (twice per day up to one month, 3-4 times/day up to second month and 4-5 times/day after 90 days). About 1-1.5t of feed/ha/crop is used. The average feed conversion ratio (FCR) for intensive feeding was 1.3-1.5 and for the extensive feeding 1.5-2.0.

Farmers generally used commercial feed attractants and vitamin-C @2-5g/kg of feed mixed with egg or fish oil as a binder. Commercially available probiotics mixed with zeolite @ 15 kg per ha was also applied once in 15-30 days depending on the pond bottom condition. Feeds and other inputs were

Table 3: Farm size distribution in East Godavari District

< 2 ha		2 - 5 ha		> 5 ha	
No	WSA (ha)	No	WSA (ha)	No	WSA (ha)
3959	3530	737	1339	118	1351

procured on credit basis and the trader was paid a commission of Rs.10-15/kg for harvested shrimp in addition to 24 - 36% interest for the loan. Most of the time the input traders monopolized marketing of the harvested shrimp crop as well. The farmers were forced to sell their produce to traders at a lesser price than the local market value. This system is called "buy back arrangement". The feed traders when supplying feeds under this system actively participated in the culture operations and rendered technical assistance to farmers.

Pond Management

During the first 30 days of culture period no water exchange is done. Thereafter 15-25% exchange is conducted once in 7-10 days. The farmers did not feel the need for frequent water exchange since the water quality in the ponds did not

deteriorate due to low stocking density and possibly also due to use of probiotics. Aeration of the ponds using paddle wheel aerators (2/ha) for 4-6 hours/day is conducted by most of the farmers who also regularly monitor soil and water quality conditions of ponds, feed intake and health of the animals. On an average, two laborers per hectare are employed permanently for the routine culture operation. Additional casual laborers are employed during pond construction/preparation, harvest and post harvest operations. The daily wages range between Rs. 50 and 60 for men and Rs. 30 and 40 for women.

Production and Marketing

Shrimp growth of the shrimp is better during the summer crop with a yield of 0.8 to 2.0 t/ha/crop in 120-150 days. The yield during the winter crop is around 0.5-1.0 t/ha but it also more uncertain. After harvesting the crop, the animals were segregated/graded into different size groups, counted, weighed, and iced. In some farms shrimp were deheaded before icing. Women conducted the post harvest operations. The harvested crops are sold to the local merchants/ middlemen at the farm itself. As mentioned earlier many farmers had entered in to a "buy back arrangement" with feed dealers who had supplied the feed and other inputs on credit basis. Price of harvested shrimp varied from Rs. 275-400/kg depending on the season, stage and time of harvest.

Socio-economic status of shrimp farmers

A brief profile of shrimp farmers of the district is presented in Table 4. It is evident that more than half of the shrimp farmers (53.3%) had degree or higher level of education. About three-fourths of the farmers (73.3%) had other occupations (agriculture, business) in addition to shrimp

Table 2. East godavari district- extent of shrimp farming

Mondal	No. of farmers	Area (ha)	Water(ha)
Kakinda Division			
Talarevu	961	2,336	1,905
Kajuluru	14	85	57
Karapa	46	139	102
Kakinada rural	10	27	18
U. Kothapalli	122	156	125
Rajahmundry Division			
Sakhinetpalli	516	656	524
Malikipuram	247	254	190
Razole	38	51	38
Mamidikuduru	306	376	314
Allavaram	738	1,094	782
Uppalakuptam	1,079	1482	1,244
Katrenikona	513	616	493
I. Polavaram	220	528	414
Total for the district	4,810	7,801	6,207

farming. Most were small farmers having a farm size of less than 5 ha of farm and about one third (33.3%) of them were large farmers with more than 5 ha.

Most of the farmers surveyed had more than five years of farming experience and did not appear to be not taking active interest in the affairs of local institutions. Their mass media exposure pertaining to shrimp farming was of fairly high (70%). More than half of the farmers had regular contact with extension personnel of the State Department of Fisheries (SDF) and other institutional agencies. The topics of discussion included issues such as seed quality, disease management, feed management. Their major sources of information were feed technicians, SDF personnel and fellow farmers. Barely one-fifth (16.7%) of the farmers had received training in shrimp farming related areas conducted by State Institute of Fisheries Technology (SIFT), Kakinada and (Marine Products Export Development Authority (MPEDA). Most of them wished to have training in disease prevention, seed quality detection, water quality management, application of probiotics and other advances in shrimp farming. Most of the farmers were high-risk takers. Most of them obtained inputs on a credit basis from local traders through buy back arrangements.

Participation of women in shrimp aquaculture

Women farmers are uncommon in shrimp aquaculture. But in East Godavari district the women of coastal villages took an active part in shrimp farming. Aquaculture is the main occupation of the women with agriculture as an additional source of employment for most of them. Their major participation was in pond construction, seed segregation and counting, collection of seed, de-weeding of the pond, harvesting of shrimp by handpicking, grading (according to size), counting, weighing, icing and deheading of shrimp. Women had regular employment for 4-5 months in a year in addition to their agricultural employment. They were paid Rs. 35-40/day and a woman labor can earn Rs. 1,200/month from shrimp culture.

Integrated farming of Shrimp/Paddy/Coconut

Most of the farmers had paddy and coconut plantations in addition to shrimp ponds. The availability of water through Godavari irrigation canal helped them in raising two paddy crops. Irrigation water for paddy farming is mixed with creek water and used in shrimp farms as well. The use of irrigation water in shrimp farms had not resulted in any conflicts among the farmers. Most of the agricultural farmers have converted some of their agricultural lands into shrimp farms and both agriculture and aquaculture exist side by side. The paddy yield was about 2,000-2,500kg/ac/ crop which fetched an income of about Rs.10,000 to 12,000 per crop. The straw produced is used for as fodder for the cattle. Coconuts were planted on the farm bunds at a density of 40-50 plants/ha and an income of about Rs.4,000-5,000/ha is realized from the fourth year onwards. Shrimp farming fetched an average income of about Rs.100,000-120,000/ha/year.

Conversion of agricultural land

In East Godavari District, conversion of agricultural fields into shrimp farms is the only negative consequence reported by the farmers and local villagers. It was observed that due to the highly profitable nature of shrimp farming farmers have converted some portion of their paddy fields in to shrimp farms.

Employment and Wage improvement

The major positive consequence of the shrimp aquaculture reported is that it provides regular and additional employment to local villagers, both for men and women, directly or indirectly. This is particularly important in lean agricultural seasons. Agriculture provided on an average of two months employment broken throughout the year whereas in aquaculture it was continuous in a period of 4-5 months. Development of shrimp farming has almost doubled the wages of laborers. The daily wage for men had increased

Table 4: Profile of Shrimp farmers of East Godavari District

Profile Characteristics	Frequency & Percentage N=120
Educational status	
1.Primary school level	16 (13.33)
2.Middle school level	12 (10.00)
3.Upto SSLC	28 (23.33)
4.Above graduation	64 (53.33)
Occupation	
1.Aquaculture alone	32 (26.67)
2.Aquaculture+others	88 (73.33)
Farm size	
up to 2 ha	52 (43.33%)
upto 5 ha	28 (23.33)
above 5 ha	40 (33.33)
Farming Experience	
Up to 5 years	88 (73.33%)
above 5 years	33 (26.625)
Social participation	Minimum 81 (67.5%)
Mass Media Exposure	
Low	26 (21.66)
Medium	81 (67.5)
High	13 (10.8)
Extension Agency contact	
Low	20 (16.67%)
Medium	68 (56.67%)
High	32 (26.67%)
Training undergone	20 (16.67%)
Risk Taking Ability	High 86 (70%)
Credit (Buyback system)	81 (67.5)

from Rs. 30 - 40 to Rs. 80-100. In case of women, it had increased from Rs. 15-20 to 35-40. The villagers reported that the standard of living in coastal villages have improved after the development of shrimp farming. Development of local infrastructure like link roads, transport, communication facilities etc had been possible because of shrimp farming in coastal areas.

Ancillary industries

Our study revealed that the growth of ancillary industries (such as hatcheries and feed manufacturing) along with other services (such as nursery or seed trade, feed retailing, transport, earth movers and other construction equipments, shops dealing with aquaculture products, petty shops and money lending) had helped in providing large scale employment to the local people and preventing emigration of rural poor to urban areas. Development of shrimp farming has contributed enormously to the local economy as well as that of the state.

Extension support

Due to the nature of shrimp farming the diffusion of appropriate information at appropriate time is vital. The main sources of information for farmers are given in Table 5. Three quarters of shrimp farmers (76.67%) indicated that local feed technicians and feed traders were their main source of information. Local feed traders, due to their sharing arrangement with shrimp farmers, regularly visited farmers and provided all necessary information. About fifty percent of respondents reported that personnel from state fisheries department and fellow farmers provided them necessary information. One fourth (25%) of farmers indicated that institutional information sources like MPEDA and Research institutions were their information sources. Printed literature from feed companies, institutions and meetings, seminars, farmer discussions were the other sources of information.

Constraints

The main constraints expressed by farmers are ranked according to their severity in Table 6. Viral disease

Table 5: Information sources of shrimp farmers in East Godavari district

Information Source	Frequency (N=120)	Rank
Feed technicians/traders	92	I
State Department of Fisheries	62	II
Fellow Farmers	56	III
MPEDA & Research institutions	30	IV
Printed literature from feed companies, SDF & Research Institutions etc	18	V
Seminars/workshops by feed companies	8	VI

Table 6: Constraints of shrimp farmers in East Godavari district

Constraints	Percentage N=120	Rank
Disease menace	98 (81.67)	I
Poor seed quality	81 (67.50)	II
Price fluctuation-low price at the time of harvest and middlemen	74 (61.67)	III
Weed infestation	62 (51.67)	IV
Poor cooperation among fellow farmers	58 (48.33)	V
Poor water quality	49 (40.83)	VI
Lack of Credit and Insurance	28 (23.33)	VII
Lack of electricity	21 (17.50)	VIII
Lack of technical guidance	16 (13.33)	IX
Lack of Govt. support	14 (11.67)	X
Cyclones	10 (8.33)	XI
Theft	6 (5.00)	XII

Table 7: Suggestions for improvement of shrimp farming practices in East Godavari district as suggested by the shrimp farmers

Suggestion	Frequency N=120	Rank
Ensure good quality control in seed - may be through certified by SDF Personnel.	72 (60%)	I
Price information through mass media	64 (53.33%)	II
Educate the farmers to chlorinate the diseased/contaminated water before release into creek or educate farmers to have separate drainage channel.	49 (40.83%)	III
Disease diagnostic centers at coastal towns	46 (38.33%)	IV
Credit and insurance	36 (30%)	V
Speedy settlement of legal hurdles	32 (26.67%)	VI
Government. support	28 (23.33%)	VII
Technical guidance	26 (21.67%)	VIII
Electricity on nominal charge	24 (20%)	IX

outbreaks were considered as the major constraint by 82% of the farmers. The quality of shrimp seed from hatcheries is of great concern to 68% of the farmers. Weed infestation which is site specific, is one of the major constraints in certain areas of the district (52%). Other constraints reported include poor cooperation among farmers, poor water quality, price fluctuations during the time of harvest, middlemen in the market chain, lack of electricity to shrimp farms, inadequate technical guidance, lack of credit and insurance.

Suggestions

Table 7 contains some of the suggestions identified by the farmers for sustainable shrimp production. Sixty percent of the farmers suggested that quality seed from hatcheries should be ensured through seed certification by SDF. About half of the respondents (53.3%) suggested that dissemination of price information through mass media channel during harvesting would help the farmers to secure good price for their produce. Most suggested that shrimp farmers

should be educated on the importance of chlorination of contaminated water before it is released into the creek and on developing favorable attitudes towards fellow farmers. Establishment of disease diagnostic centers at coastal villages, technical assistance by the scientists, SDF personnel, speedy settlement of legal hurdles, institutional credit and insurance and provision of electricity on nominal charges were the other suggestions.

Conclusions

Shrimp farming is successfully practiced in East Godavari District although with some constraints. The farming system in the district has unique features such as buy-back arrangements between the farmers and feed traders, mixing of borewell and creek waters with fresh irrigation water for culture, use of extensive and intensive feeds and integrated shrimp cum coconut - paddy farming. Private input dealers continued to be the prime information sources and disease outbreaks appeared to be the major threat to shrimp farming. In this connection it was suggested that a mechanism for seed certification by the State fisheries department has to be developed to ensure healthy shrimp seed. Shrimp aquaculture has contributed significantly in employment generation and infrastructure development of the coastal community and over all development of coastal areas. Since all strata of the coastal community are involved in one or other aspects of shrimp farming directly or indirectly there is no conflict or complaint against shrimp farming. But the conversion of agricultural fields to shrimp ponds has to be checked and shrimp farming should be regulated.

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expected production output, cost structure, cash flow and economic indicators including the rate of return and your required break even point. You can also use the software to model the financial impact of a change in your business environment. If, say, the cost of labour goes up or the market price of oysters changes you can quickly see how it will affect profitability.

The CD includes a quite detailed reference section which contains licensing kits; contact information for farmers associations and government authorities; several species profiles and research notes including farming of triploid Sydney rock oyster and the native *Ostrea angasi* oyster; and several reports including a strategic plan produced to guide the development of the industry and the an operational review of the NSW Shellfish Quality Assurance Program.

The software was developed as a joint project by NSW Fisheries, the NSW Oyster Research and Advisory Committee, NSW Department of State and Rural Development and the Queensland Department of Primary Industries, Australia.

Available from the QDPI Online Shop, <http://dpishop.dpi.qld.gov.au/bookweb/details.cgi?ITEMNO=9780734501639>

Conclusion: We like it, a very useful decision making tool for oyster farmers. Cost AUD\$ 220, Recommended.

CD: FAO Field Project Reports on Aquaculture: 1966-1995

We love this CD, it is a goldmine of information covering 1,712 reports produced by 257 FAO aquaculture field projects between 1966 and 1995. Many are included as full text documents including a complete set of 92 publications produced by NACA from inception to 1995 plus another 48 from the Asia Sea-Farming Development and Demonstration project. The CD has a lot of early information and training manuals on culture of shrimp, freshwater prawns and Asian seabass, and many publications on integrated aquaculture including a training manual from the Asian-Pacific Regional Research and Training Centre for

Integrated Fish Farming, Wuxi, China.

Other Asian projects covered include the Bay of Bengal Programme, the South Pacific Aquaculture Development Project and many others. The CD also covers FAO projects in other regions of the world. Conclusion: Highly recommended - you can't get this information anywhere else.

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CD: Simple Methods for Aquaculture

This CD contains five training manuals on Simple methods for aquaculture and the Handbook on small-scale freshwater fish farming. The manuals are written in an easy-to-read style focusing on the practical aspects of semi-intensive fish culture in freshwaters from site selection and fish farm construction to the raising, final harvesting and marketing of the fish. They present methods and equipment useful not only to those responsible for field projects and aquaculture extension but also for use in aquaculture training centers. The manuals included are: i) Water for freshwater fish culture; ii) Soil and freshwater fish culture; iii) Topography for freshwater fish culture iv) Pond construction for freshwater fish culture; v) Management for freshwater fish culture and vi) Handbook on small-scale freshwater fish farming. The manuals are in HTML format with many illustrations.

The CD slipcase includes a brief summary of how to set up the CD and how to browse the manuals and the entire contents is also available in both French and English. Conclusion: Recommended - a well presented training package. System requirements: Pentium I with 16MB RAM, 14" monitor, CD drive and Windows 95+.

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