ISSN 0971-3077

The Journal of

BOBP For Fisheries Management

BAY OF BENGAL PROGRAMME

Sponsored by the Governments of Denmark and Japan

BAY OF BENGAL NEWS

Vol.II No. 11 SEPTEMBER 1998

SHRIMP CULTURE

Problems and Challenges

Can the enormous potential of shrimp culture for furthering the national and social good be tapped without environmental ill effects? In this issue of Bay of Bengal News, *aquaculturists, economists and social activists examine various facets of the controversy. They agree that wise, responsible and sustainable shrimp culture is possible – and suggest ideas and mechanisms to bring it about.*

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CULTIVATING WATER

More than 20 years since the 1974 World Food Conference pledged to end hunger within 10 years, hunger still stalks the world. More than 800 million people go to bed hungry every night.

The 1996 World Food Summit re-examined the spectre of hunger. It asserted that Food for All is the "inalienable right" of every living person.

We face loss of arable land, declining productivity of land and soil due to land exhaustion, plateauing of agricultural technological productivity. Concrete steps to increase the productivity of our waters to meet demand for food and raw materials are urgent. After all, water resources have supported human life for thousands of years —particularly through fish — and can continue to do so, given proper planning and management. It's time we harvested more from water than we do now.

There was a time in recent history when water bodies and tracts of low-lying land — swamps, marshes, wetlands and bogs — were inundated. They were considered a menace to health because they harboured malarial mosquitoes and other vermin. Stories were told of criminals and convicts using such places to hide from the public eye. Even today, many people still describe marshy and waterlogged areas as wasteland.

Huge investments were made to drain and reclaim these waterlogged areas for houses and farms. Departments of irrigation and drainage were set up by many governments to oversee such public works investments. While these departments did channel water for irrigation, especially in arid and rain-deficient areas, considerably more effort was put into draining waterlogged areas. Was such draining essential? Was it because arable and residential land is growing scarce?

Governments drained and reclaimed, giving little thought to possible consequences for water table stability and the overall water cycle regime. Such projects, combined with indiscriminate deforestation, unwittingly altered the natural water recirculation patterns and the water cycle, which are crucial for husbanding the world's precious and limited freshwater stock. Charles Angell (p12) says that of the 71,000 odd hectares of shrimp ponds in Andhra Pradesh, about 56,000 ha or almost 80% constitute water surface area. These are cultivated to produce food, generate jobs and earn foreign exchange. There is therefore no need to drain such water areas.

While water tables continue to be drawn down from excessive use, we are forced to consider harvesting rain and collecting surface water and run-off to recharge the water tables. Have we come full circle? What tragic irony! Have we learned any lessons? Are we capable of learning?

Land subsidence is spreading as water tables sink, further aggravating the decline in land productivity, not to mention rise in sea levels and further inundation of coastal lands and vital ecosystems. This time around, it is saline water and not fresh water.

A water crisis looms large each day as we carelessly go about our daily business. The supply of water has been taken for granted by many of us who casually turn the tap - and sometimes forget to close it ! But people who travel long distances even to bathe, have come to accept such hardships as inevitable.

The importance of water as a life - support system must never be overlooked. We must use water as a resource that's extremely limited. Water is basic to life — 90% of the human body is nothing but water.

Not only should we be frugal with water, we should increase the per unit productivity of water. Technical and management know-how are available. Soil and plant scientists, including peat soil specialists, have been applying themselves to increase agricultural productivity, but there is no water scientist. Land economics is well known as a sub-discipline of economics, but water economics does not figure in any university curriculum.

Just as soil cultivation in agriculture has been modernised to increase agricultural productivity, water should be cultivated to greatly increase the production of goods and services per unit of water. Land and soil are able to absorb waste and recycle it. Water can do the same with the waste products of economic activity. Coastal wetlands can effectively assimilate human-generated waste and maintain water quality to support life in its myriad forms. These life forms are able to use, digest, assimilate, and convert concentrated wastes into useful materials. Or at least detoxify them.

Water involves three - dimensional volume. The entire water column can be cultivated—unlike land, where only the unidimensional surface area can be cultivated. We can seed water bodies to grow more fish and plants, both for food and for industrial raw materials. Heating and cooling for industries must be made more efficient and cost-effective through appropriate recycling. We can enhance the growth conditions of water through natural and artificial means. The Japanese Seto Inland Sea is a good example of water cultivation through advanced planning and management.

Water is a renewable food production support system. To date, very little is known about the fertility profile and patterns of water. (In contrast, the land and soil profile, and the fertility patterns of land, have been well researched and analysed). By cultivating water, we are cultivating our future. Are we up to it?

Kee-Chai CHONG

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WOMEN FEED THE WORLD

The theme for World Food Day (October 16), 1998 was "Women Feed the World". The FAO worldwide and in India held several observances on the occasion. They highlighted the fact that in many countries women work longer hours than men. They take part in food production activities, also shoulder the burden of preparing and processing the food, besides running the home and nurturing children. Yet they suffer from neglect, lack of recognition, and gender-based discrimination. To improve the lot of women, they need better access to food, education, technology, rural organization, credit, services, land, extension and training.

The FAO and BOBP held their own World Food Day observance in Chennai. It focused on a school in Besant Nagar, South Chennai, that teaches 650 students from Class 1 to Class 10 – most of them from fishing communities in Orur-Olcott Kuppam and Odamanagar.

As part of the observance, children, staff and special invitees - the mothers of the children – attended a function at the school on the evening of October 16. Four children spoke on "Women who feed the world". A professional troupe staged a play that dramatized the work and the life of women from fishing communities, and their sacrifices for their families.

The children presented mementoes to the five women who manage the school's Noon Meal Scheme, as a token of their gratitude. A special lunch was prepared for World Food Day.

Says the principal of the school, Mrs. Lakshmi Narasimhan, "The children indeed responded with great enthusiasm to the theme of World Food Day. They loved the idea of expressing their appreciation to their mothers and to 'women who feed the world'."

Fisherfolk children from a school in south Chennai enjoyed a special lunch on the occasion of World Food Day. Top: The students' mothers – women from the fishing community – were invitees to an evening function at the school. Above: A play was put up about the lives of fisherwomen.

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Shrimp culture in India: Where is it now?. Where is it going?

by M Sakthivel

The President of the Aquaculture Foundation of India describes the present status of shrimp culture in India, following the recent Supreme Court judgment. He also examines a number of "myths" concerning shrimp farming, and outlines measures necessary for sustainable shrimp farming.

Scientific shrimp culture has its origins in the early 1980s. In India, awareness about the potential of shrimp farming grew during the late 1980s, after demonstrations by MPEDA (Marine Products Export Development Authority). This led to heavy investment by many small-scale entrepreneurs and a few corporate firms, and nearly 100,000 ha were brought under shrimp farms.

The total area under shrimp culture today, including traditional farming, is about 150,000 ha. It benefits in all about a million people. Shrimp culture has had its share of teething problems, like any other nascent industry. These are gradually struggling towards solution.

But at one time the problems looked insurmountable. They were social — because of agitations against shrimp farming by several interests. There were health problems — shrimp were hit by diseases, particularly white spot. There were major legal problems — a landmark judgment of the Supreme Court that effectively crippled the industry. The few corporate interests wound up their shrimp farms and diversified into horticulture, building construction and other businesses.

The opposition to aquaculture has given rise to many myths. In sum, aquaculture is blamed for many of the ills that afflict coastal villages. Let us examine the myths, one by one.

1. *Shrimp farming is responsible for the reckless destruction of mangroves:*

It is true that expansion of shrimp culture has led to limited conversion of mangroves into shrimp ponds. (Mangroves were at one time regarded as wasteland — which is why they interested aquaculture investors.) But shrimp culture is just one of many coastal activities that impact on mangroves. To target shrimp culture alone while turning a blind eye to all the other causes of mangrove destruction is to betray bias against shrimp culture, unconcern for the scientific reality and indifference to the larger public good.

Non-mangrove areas have come to the fore in recent months, worldwide, for practice of semi-intensive or intensive shrimp culture. In China, shrimp ponds are mainly in non-mangrove areas. A recent study in the south of Thailand shows that only 14% of shrimp farms were originally mangrove areas. 49% were converted from rice fields, 27.5% were orchards, 6% consisted of unproductive land. However, in the Mekong delta of Viet Nam, clearance of mangroves both for timber and shrimp farming has been serious. It is therefore not right to generalize about shrimp farms destroying mangroves; the reality varies from country to country.

In India, the damage to mangroves from shrimp culture is negligible when

Selective harvesting of cultured shrimp helps obviate the need for complete draining of pond water.

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compared with damage from municipal and industrial pollution, chemical runoffs, coastal reclamation for agriculture and industry, harbour construction and deepening, urban development, shipwrecks, the shipbreaking industry, etc.

Remote sensing surveys show that mangrove areas in Andhra Pradesh have actually grown in places where shrimp farming has developed the most. Where shrimp farming is shown to have destroyed mangroves, aqua farmers should be told to carry out a replantation programme.

It must be pointed out that mangrove areas are not the best places for sustainable aquaculture farms. Mangrove land supports profitable shrimp culture only for short periods. In semi-intensive or intensive areas, acid sulphate soils common in mangrove areas may affect the sustainability of shrimp culture.

2. *Aquaculture degrades the soil:* Agricultural degradation of soil is far worse and far more serious than any degradation on account of aquaculture, but there is no tirade against agriculture on this account.

Large quantities of chemical fertilizers and pesticides are used every year in India to kill pests, ward off disease and keep farm productivity high. More than *50%* of the soil area has been affected by agricultural degradation. Bio-fertilizers are being publicised a great deal, but they cannot be produced in large enough quantities to replace chemical pesticides and fertilizers in the near future.

The main chemicals used in aquaculture are lime and chlorine. Chlorine is actually used everywhere to clean water. There is no scientific evidence that chlorine and lime lead to irreversible soil degradation. Further, most aquaculture in India is extensive, and does not need large applications of lime or chlorine.

3. *Seepage of salt water into farms, salinization of drinking water:* The coastal zone is not preferred for agriculture — it is saline because of the proximity to the sea and to creeks and estuaries. Thousands of acres of coastal land therefore lie idle in several states. But in a few states, shrimp culture is being practised in a small coastal area. One should be happy that shrimp culture is converting useless land to productive use.

As long as coastal aquaculture is confined to the coast, salt water seepage and salinization are not serious problems. It is only when farms are set up more than 500rn from the high tide line that the problem of salt water seepage can become serious.

Of the 1.4 million ha available in India, aquaculture has developed on only 7% of the area (about 100,000 ha.) Of this area, productive agricultural land next to aquaculture farms is not even 2% or 2,000 ha. Of this 2,00øha, land affected by salt water seepage is negligible.

But the question of salt water seepage is blown out of all proportion, and talked about as if all of agriculture and all the drinking wells along India's coastline have been affected by aquaculture. Has anyone assessed the magnitude of damage? This so-called damage should be set off against the large quantity of food that aquaculture can produce. At any rate, coastal waters have always been brackish. Wells dug in coconut plantations or on coastal land supply mostly brackish water (Chong, 1998, per corn).

4. *Pollution of drinking water:* No survey has been conducted to assess the aquifers along the coastline or the quantity of fresh water available during the year. On the basis of a few complaints, the feeling has been created that drinking water wells all along the coastline have become saline due to coastal aquaculture.

NEERI (National Environmental Engineering Research Institute) has indicated that there is no damage to drinking water sources from aquaculture.

5. Aquaculture affects marine life: Effluents from shrimp farms actually increase the productivity of coastal waters. Example: the biological production and standing stock of lagoon fauna in Kuang Krabaen Bay of Thailand has increased many times over. Fishermen have increased their incomes.

6. *Aquaculture increases unemployment among rural women:* This is not true (See page 17.) On the other hand, aquaculture has generated new opportunities for both men and women by putting wasteland to use. While rice cultivation requires about 180 labour days per crop, aquaculture requires about 600 days per crop. Thus, it has not only added to employment, but also increased the incomes of the labour force. Many coastal areas face serious labour shortages, and labourers are actually being brought in from the hinterland.

Aquaculture is more labour-intensive than agriculture. Taiwan has 60,000 ha of aquafarms that produce nearly 500,000 tonnes of shrimp. They employ nearly 90,000 people directly in the farm and 500,000 people in aquaculture-related services. If one million ha are brought under aquaculture in India, they can generate 10 million jobs.

The aquaculture industry encompasses a number of activities — broodstock bank operation, hatchery production of seeds, nursery rearing, seed trading, farming in grow-out ponds, harvesting, pond-cleaning, transporting, deheading of shrimp, peeling, freezing, packing, manufacture of feed, therapeutics and pharmaceuticals, pond construction and renovation, manufacture of equipment (such as pumps, aerators, compressors, generators, pipes, electrical items, electronic water testing kits), net manufacture, processing and marketing including export-related activities. Together, these activities have considerable job potential. Educational and training institutes in aquaculture would provide skilled manpower.

7. *Aquaculture is an industry of the rich:* This is again untrue. More than **99 % of** shrimp farmers belong to the small-scale sector. There are a few middle-level entrepreneurs. A dozen-odd companies that had set up large farms haven't done well — most of them have wound up their shrimp culture operations.

However, corporate firms that have entered the shrimp industry have helped develop the basic infrastructure for shrimp farms along with support services such hatcheries, seed and feed supply. They have also helped develop roads, communications and power supply in rural areas.

Shrimp farming is sometimes branded as an industry of multinationals. This is incorrect — not a single MNC at present is into shrimp culture in India. There are however some joint ventures set up with overseas technical know-how that handle the supply of inputs such as shrimp feed.

The time has come for everyone concerned with shrimp culture to learn

Making small-scale coastal aquaculture sustainable

The Aquaculture Foundation of India, based in Chennai, has received a $10,000 grant from Holland for a six-month experimental project. It will facilitate improved coastal aquaculture management and environmental sustainability in selected districts of Andhra Pradesh and West Bengal. This is to be accomplished through awareness-building, on-farm analysis, strengthening the institutional capacity of agencies concerned, and technical assistance.

The project will focus particularly on improving water, feed and soil management of shrimp farmers in East Godavari, West Godavari and Krishna districts (Andhra Pradesh), and North 24 Parganas, South 24 Parganas and Midnapore districts of West Bengal. It is to be implemented in co-operation with the fisheries departments of Andhra Pradesh and West Bengal, two NGOs (Sravanti and Ramakrishna Ashram) and the BOBP.

Under the project, select government and NGO staff will be trained to undertake rapid appraisals of coastal aquaculture farming systems. They will then carry out field work in select clusters of small-sized coastal aquaculture farms, using farming systems research methodology. Aim: to document present culture practices carried out by a cluster of farmers around one water source in each district.

The findings of the field work and the documentation will be presented at an expert consultation, which will bring together experts from government, industry and the NGO sector from India and abroad. A set of guidelines will be developed for sustainable small-scale aquaculture, covering topics such as pond site improvement and redesign, culture management, water quality management, feed management, effluent management and disposal.

A comic book will be developed from the guidelines, in Telugu and Bangla. It will be made available to fisheries extension officers and distributed widely to improve coastal aquaculture management practices among small-scale shrimp farmers.

lessons from the past, and plan for a future of healthy growth — one based on the principles of sustainable development. The industry and the country have suffered enough since 1994 from litigation, disease and ill-informed criticism.

Sustainable shrimp farming in India requires the following steps:

1. *Identification of suitable areas for development of new farms:* A survey to identify suitable areas from the economic, technical, social, legal and environmental standpoints is essential. A location-specific community master plan should be prepared and publicly announced, to avoid all the problems the industry could face in future.

2. *Regulation of existing shrimp farms:* All existing shrimp farms need proper regulation from the environmental standpoint. Since they have been developed without any master plan, or proper guidelines and controls, a detailed survey is needed to identify defects and go in for corrective measures. This is essential to protect the environment and correct flaws in existing farms.

3. *Buffer zones in farming areas:* Saltwater seepage and salinization of wells and agricultural land should be avoided at any cost by setting up buffer zones in farming areas wherever required. This is essential for the survival of land-based coastal aquaculture. The government should come forward to create the basic infrastructure, and protect both coastal aquaculture and agriculture.

4. *Prevention of soil degradation:* Since aquaculture farms use a lot of chlorine and lime, many fear that shrimp farming areas will soon become a biological desert. Proper R&D is required to preserve the natural nutrients of the soil and prevent soil degradation.

5. *Preserving the quality of the environment:* This is very essential for sustainable shrimp culture. Like fisheries co-management, aqua co-management has to be practised by all farmers. As Dr Kee-Chai Chong of the BOBP puts it, aquaculture can be a "self-cleaning" sector. Self-imposed discipline is essential to keep the surrounding environment healthy and follow the principle of responsible aquaculture. Regular monitoring of water quality and environmental impact assessment should be carried out to minimize disease-related problems.

6. *Standardization of technology applications and inputs:* Technology is available for a range of shrimp culture systems — from simple extensive to super-intensive. But when disease breaks out, there is no standard technology to treat it. Shrimp farmers are therefore applying a lot of new inputs such as probiotics and immuno-stimulants and trying out their efficacy. To avoid virus infection, farmers are resorting to culture of tigershrimp in low saline or freshwater conditions.

Greedy farmers always have a tendency to adopt semi-intensive or intensive farming techniques without grasping the implications of high stocking density. A "standard technology" package with the best available information has to be evolved.

7. *A national policy for aquaculture:* Aquaculture in India has always been under the shadow of agriculture. Its potential hasn't been sufficiently realized, its development opportunities not sufficiently tapped. Aquaculture is actually a multi-disciplinary science. It needs to be delinked from agriculture, even from fisheries, and studied and planned as a distinct development entity.

For sustainable development of aquaculture, the government should come out with a national policy for aquaculture, supported by legal and administrative structures and an appropriate budget. Only then will this nascent industry realise its potential, with benefits accruing to government, the national economy, exporters, small-scale fish farmers and fish lovers as a whole.

The Aquaculture Authority in India: What it is, what it does

A significant landmark in the history of shrimp culture in India is the setting up of an Aquaculture Authority (AA) by the Government of India. Such an Authority was recommended by the Supreme Court of India in its judgement of December 11, 1996, on shrimp farms in coastal areas. The Authority is now functioning under the administrative control of the Ministry of Agriculture, Department of Animal Husbandry and Dairying. This interview with the Chairman and the Member-Secretary of the Authority describes the structure and activities of the AA.

Q: Why did the Supreme Court of India consider an Aquaculture Authority necessary?

A: The Supreme Court said that the Authority should be constituted before 15 January, 1997, under Section 3 (3) of the Environment (Protection) Act of 1986. The Central Government should confer on the Authority "all the powers necessary to protect the ecologically fragile coastal areas, seashore, water front and other coastal areas" and "specially deal with the situation created by the shrimp culture industry in Coastal States and Union Territories."

The Court said the Authority should be headed by a retired Judge of the High Court. Other members would be appointed by the Central Government: persons with expertise in aquaculture, pollution control and environment protection. The Authority would have the power to issue directions under Section 5 of the Act, and for taking various measures concerning Section 3 of the Act.

The Authority would implement the "precautionary principle" and the "polluter pays" principle.

Q: Who is the chairman of the Aquaculture Authority? Who are the other members?

A: The Chairman is Justice G Ramanujam, former judge of the Madras High Court. The Member-Secretary is Dr Y S Yadava, Fisheries Development Commissioner, Government of India. Other members are Dr K Gopakumar, Deputy Director General (Fisheries), Indian Council of Agricultural Research; Mr. R H Khwaja, Joint Secretary, Ministry of Environment & Forests; Dr G R M Rao, Director, Central Institute of Brackishwater Aquaculture; Dr Satish Chandra, Retd. Director, National Institute of Hydrology; Mr. V Venkatesan, Director, Marine Products Export Development Authority; and Prof. R C Das, Retd. Chairman, Orissa Population Control Board.

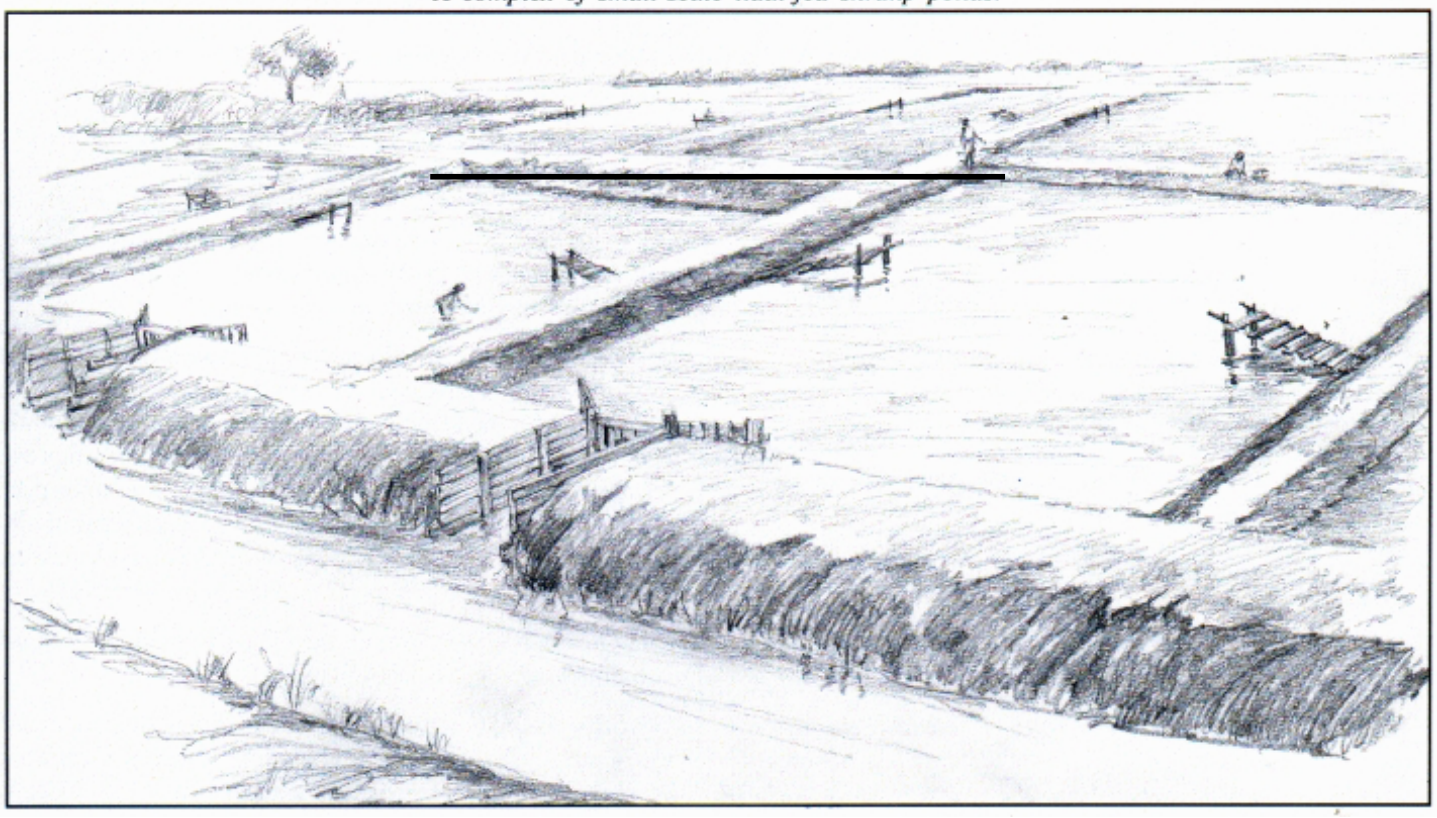
The Authority has its headquarters in Chennai, but meetings are held at various places in the coastal areas to discuss and take decisions on issues relating to shrimp culture.

Q: How many meetings have been held so far? What was the agenda at these meetings?

A: The Authority has so far met eight times – twice in New Delhi, twice in Tamil Nadu, once each in Andhra Pradesh, Orissa, Kerala and Goa. Eminent persons in the fields of coastal aquaculture and environmental protection, besides private sector entrepreneurs etc, are special invitees to these meetings.

A half-day workshop is held at each meeting. The workshop exposes members of the Authority, most of whom are not aquaculturists, to various aspects of shrimp farming, and to

A complex of small-scale tidal-fed shrimp ponds.



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Testing of water quality in a shrimp pond.

a wider perspective. For example, at the meeting in Kochi, a paper was presented by Dr John Kurien. He spoke on environmental considerations while undertaking shrimp culture activities.

The eighth meeting at Goa was attended by the Head of the Aquaculture Division of National Institute of Oceanography, and by a Joint Secretary from the Department of Environment. The Authority also met a group of shrimp farmers separately to ascertain their problems.

The Authority has finalised its rules and procedures for applications for new shrimp farms. It has accordingly delegated tasks to coastal states to process such applications and make their recommendations, since the States are familiar with local issues and locations. Every coastal state has constituted district-level and State-level committees to screen and forward applications for shrimp farms, along with the committees' recommendations. These are put up for the final approval of the Authority.

Thus, recent meetings of the Authority have started considering applications from shrimp farmers.

Q: How many applications for shrimp farms have been received so far? How many have been accepted?

A: More than four hundred applications have been received so far - from Kerala, West Bengal and Orissa. So far 49 applications have been approved.

Q: Does the Authority cover fresh water aquaculture as well?

A: No, the scope of the AA is confined to coastal aquaculture.

Initially, there was some confusion among aquaculturists, officials, etc., about the scope and functions of the Authority. A person who wanted to capture and export grouper from the Andamans was asked to seek the AA's permission. So was an NRI (non-resident Indian) from Trichi who wanted to start a turtle project. He got Government sanction, but he was asked to obtain an okay from the AA as well. We have clarified the specific issues which need to be referred to the Authority.

The AA's rules Of procedure as well as the forms in which applications are to be made for the approval of the Authority etc. have been published extensively — in 18 or 19 newspapers in local languages of coastal states. We have issued press releases and advertisements. Important features of the rules of procedure have been publicised through fisheries magazines like *Fishing Chimes* (March, 1998).

I think there is now greater clarity and better awareness about what the AA is meant to do.

Q: An important part of the Supreme Court judgment is that farmers practising traditional and improved traditional systems of shrimp farming are allowed to adopt improved technology for increasing production, productivity and returns, with prior approval of the Aquaculture Authority. Has the AA decided on any measures to help them?

A: Yes, indeed. The Aquaculture Authority has already finalised comprehensive Guidelines for adoption of improved technology for the benefit of such farmers. The Guidelines lay down specific parameters for the adoption of improved technology by shrimp farmers, especially on design aspects, stocking density, pelleted feed, etc. They specify permissible activities on the part of shrimp farmers, and suggest measures the farmers should take to protect the ecosystem.

The Guidelines were formulated by a five-member technical committee set up by the Authority.

We believe that through these Guidelines, and other activities, the Aquaculture Authority is helping achieve the objectives of sustainable and eco-friendly aquaculture. - **S.R.M.**

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SUSTAINABLE SHRIMP AQUACULTURE

A social scientist's perspective

by John Kurien

Some versions of modern shrimp aquaculture are desirable andsustainable, if they are subjected to larger social control .... Such control can be achieved if private initiative follows economic, ecological, technological and social norms collectively decided by the investors, the state and the community.

In January 1994, I was interviewed by the Delhi-based environmental magazine *Down to Earth.* The interviewer asked many questions on the emerging fisheries development and management scenario in India and around the world. My answers were based on my understanding of fisheries and the socio-economic and political milieu within which it functions.

When the interview was published, I was slightly taken aback. The interview was headlined "Indian aquaculture heading for disaster." Though I had not used these words, I had made a gloomy prognosis based on an analysis of the dynamics of a techno-economic intervention undertaken without the slightest social or environmental control, primarily for the pursuit of runaway profits for investors.

In this era of no-holds-barred globalization and the promise of the magic of the "free market", the fate that has befallen shrimp aquaculture in India indicates what we lose when we take short cuts to earning quick money — be it as a nation in desperate search of foreign exchange, or as private investors in the scramble for quick, easy profits. It also questions the widely held assumption that reasonable individual actions will necessarily lead to larger societal good. It highlights the tragedy of equating liberalisation and globalisation with the withdrawal of the state from regulating economic activity for the larger social good.

I personally believe that sustainable shrimp aquaculture is possible. It has actually been undertaken in my home state Kerala for hundreds of years. But then this system of shrimp aquaculture has been labelled "traditional" to give it the stigma that sticks to this world! It might have more scientifically been described as "low-energy, low-input, low-output, sustainable" shrimp culture. This would be in line with "modern" versions of shrimp aquaculture, that are more scientifically described as "high-energy, high-input, high-output, unsustainable" shrimp aquaculture.

"Modern" shrimp culture was introduced into Asian countries during the late 1970s in response to the insatiable demand for shrimp from consumers in developed country markets. They could not live with the unpredictability and seasonality of the marine harvest, which means that shrimp was not always on the menu in restaurants or the frozen food shelves of supermarkets. For perennial supply you need perennial production, hence the promotion of shrimp culture along the coastal tracts of developing tropical countries.

I'm not deriding shrimp culture. I'm not going to suggest that indigenous, traditional culture practices be extended

Cultured shrimp - a full-grown species of P. monodon.

Shrimp catches from the sea have declined in Asia because of four decades of incessant bottom trawling, says the author.

ad infinitum. This is neither a wise nor a feasible proposition. The point I wish to make is that even some versions of "modern" shrimp aquaculture are acceptable, desirable and indeed sustainable. But there is an important caveat which needs to be added: they are acceptable, desirable and sustainable, if they are subject to larger social control. And by social control I DO NOT mean nationalised or public sector aquaculture, but rather the exercise of individual private initiative within sound ecological, economic, technological and social norms collectively decided by the investors, the state and the community in which the activity will take place.

Unfortunately in India, we have seen nothing of this kind of modern shrimp aquaculture. Both big and small investors are guilty of flouting basic norms with regard to water treatment, use of antibiotics, seed quality, pond fertilisation, feeding ratios and effluent disposal practices. When the total number of farms in a given area is small, none of these objectively undesirable features create a problem. They get restricted to the confines of the individual farm. But as the numbers increase in anarchic fashion, because of the absence of social control, we are confronted with an invisible, impending disaster. It creeps towards a threshold beyond which it manifests itself as an "environmental surprise"

What each individual operator has "externalized" from his system affects others of his ilk. One farmer "internalizes" what is "externalized" by another via the common water intake system. We refer to this as "reciprocal externality." This results in a sort of mass industrial *harakiri* if you wish. But there is the other "unidirectional externality" where totally unsuspecting people who have nothing to do with aquaculture, but perhaps live near the farms, are affected in a variety of ways. Basically both these types of "externalities" have been generated in the brief history of the boom and bust of modern shrimp aquaculture in India. It happened in Taiwan, in the Philippines, in Thailand, in Ecuador, wherever unplanned shrimp aquaculture was practised in the 1980s and 1990s. Though in India we were one of the last to mount the cultured shrimp bandwagon, we did not learn from the tragic experience of others. This is for the simple reason that institutional memory is anathema to the dynamics of quick profiteering.

What we need to achieve sustainable shrimp aquaculture is something akin to the old "industrial estate" concept.

First, identify areas suitable for shrimp aquaculture on the basis of sound scientific advice, taking all relevant parameters into consideration. How appropriate these areas are must be ascertained by consulting with the community and enabling a genuine public hearing to assess the pros and cons of the location of a shrimp aquaculture estate.

Once such sites are selected, local bodies such as *panchayats* can provide all the appropriate infrastructure, particularly for water intake and effluent treatment, with funds from the Central Government, MPEDA or any other promotional agency. Plots in the estate would be given out on long-term lease, subject to a maximum holding size which bears some proportion to the total estate size. Rental should be fixed according to the "intensity" of the aquaculture to be undertaken. But the upper end of this intensity must be fixed in keeping with the carrying capacity of the total built-up and the natural ecosystem of the area. A system of positive discrimination must be worked out for those whose operations are less import-intensive, less input-intensive, less effluent-generating. This will ensure that individual and corporate-oriented shrimp aquaculture contribute to the greater societal goals of raising NET foreign exchange earnings, creating positive energy balances and lowering the level of effluent insertions into the ecosystem. The size of the "ecological footprint" of shrimp aquaculture can thus be greatly reduced. The sustainability of the ecosystem spectrum in producing cultured shrimp would be maintained.

The belief that the solution to the problem of declining shrimp catches from the sea lies in shrimp aquaculture is untenable. It does not ask why these catches are declining in the first place. At least in Asian waters, is it not due to

The rise, fall and recovery of shrimp culture

The early 1990s were the boom period of shrimp culture in India. Farmers set up shrimp farms in remote coastal areas and tried to create the basic infrastructure themselves. Ancillary industries and support services, such as shrimp hatcheries and feed mills, came up under the private sector. The Government encouraged shrimp farming to maximize foreign exchange earnings. It offered liberal bank finance and allotted land.

Then came the problems and they started mounting. Discharge of effluent. Poor water quality, which led to "choking". The breakout of virus diseases. Allegations of salinization of drinking water and of agricultural crops. People already suffering from drinking water scarcity, and travelling long distances to fetch it, said that shrimp farms had damaged drinking water wells.

The fact that some states in India were new to shrimp farming, the general ignorance of shrimp culture, and the lack of an extension service, led to shrimp farms becoming everyone's favourite whipping boy.

Opponents of shrimp farming in Tamil Nadu instituted a public interest litigation in the Supreme Court. The Tamil Nadu Government and the Union Government woke up very late to protect shrimp farming, and fought the case in the Supreme Court. NEERI, the National Environmental Engineering Research Institute, submitted an unscientific report based on a cursory study, charging shrimp farms with environmental pollution. The Supreme Court, in its ruling of December 11, 1996, ordered demolition of all shrimp farms within the Coastal Regulation Zone.

The Supreme Court later stayed its order, saving hundreds of thousands of small-scale shrimp farmers from ruin.

The Government of India proposes to introduce an aquaculture bill in Parliament. It is designed to ensure sustainable development of the shrimp culture industry, with safeguards to protect the environment and the social cause. Once this bill is passed, shrimp culture will be poised for healthy, sustainable growth.

Meanwhile, the Aquaculture Authority (AA) has been constituted as recommended by the Supreme Court. It has started functioning, with headquarters in Chennai. Applications for new shrimp farms are now being screened by district-level and state-level committees for forwarding to the AA. But the Surveyor General of India is yet to fix the high tideline as recommended by the Supreme Court. Meanwhile, some experts question the sanctity of a uniform width for the Coastal Regulation Zone, along a coastline that varies in topography from place to place. An environmental survey to identify sensitive zones is essential to prevent disputes.

- M.S.

over four decades of incessant and excessive bottom trawling? Why don't we address that issue first, by adopting more environmentally benign methods for harvesting shrimp in accordance with its natural seasonability? We could then merely "top up" the supply deficit with cultured shrimp.

My own analysis of state policies in several Asian countries about the promotion of shrimp harvests — first from the sea and then from the culture ponds — shows that history is repeating itself. The thrust of the policies is rather short-sighted. They merely aim at increasing hard-cash foreign exchange, irrespective of the social and environmental liabilities inflicted in the process within the country. We are guilty of promoting financial capital — which on yielding phenomenal private profits from aquaculture, moves on to other pastures, never looking back to see the damage it has inflicted on the nation's natural capital of land and water. All this must change, else we will end up writing a requiem for shrimp aquaculture.

Given the enormous foreign exchange potential of shrimp, I believe there is a strong case for creating a fund for shrimp resource management. This can be generated at both the consumer end and the producer nation end. A miniscule tax of about one cent on every kilogram of shrimp served in rich-country restaurants will yield a self-generating fund of a few million dollars. A consultant to some restaurant chains in the United States tells me that no consumer would mind this insignificant burden, provided the idea behind it — that this collection will be used as an "eco-restoration fund" — is well marketed.

Further, he cautions me that the fund should not be managed by environmentalists (!) but by a consortium of the stakeholders in the shrimp industry — from the retailers in the developed world to the producer organisations in the developing world. Fair enough. At the producer nation end, a small share of the foreign exchange earned can be earmarked for creating the infrastructure for "shrimp aquaculture estates" along the lines I mentioned earlier. It can also be utilised to reorient our marine shrimp harvesting and encourage more sustainable practices and bolster the yields from "traditional" shrimp aquaculture which has existed for centuries.

Ideally, ecological, social and economic space exists for a complementary process of shrimp capture and culture in Asian countries. Taking full advantage of these synergies in each realm will help us achieve a development and management regime for shrimp that is self-reliant — based on traditional and scientific knowledge, natural resources, human capabilities, entrepreneurship skills, technological prowess and promotional institutions.

Striving to achieve such objectives cannot be seen as part of a technological or managerial fix. It can be undertaken only in an institutional framework in which the state, the market and the community work in tandem. This is not a process without tensions. But then, new innovations and dynamic processes are generally the product of creative tension. When we speak of sustainable shrimp aquaculture today, crafting such institutional changes is the real challenge before us. All else is secondary.

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SMALL - SCALE SHRIMP FARMERS OF ANDHRA PRADESH FACE NEW CHALLENGES

by Charles Angell

The 70,000-odd shrimp farmers of Andhra Pradesh experienced a period of very rapid growth in shrimp culture, but then confronted major problems such as shrimp disease, pollution and legal conflict. Will the entrepreneurial spirit they have displayed as farmers be adequate to meet these new challenges?

During my seven-year tenure with BOBP as senior aquacultunst (1986—1993), I had the privilege of travelling around the region and witnessing the development of shrimp farming in India, Bangladesh and Sri Lanka. The BOBP played a role early in the shrimp farming story with its demonstration farm at Polekurru, East Godavari district, Andhra Pradesh (AP). This pioneering effort demonstrated modern methods of shrimp culture. Not surprisingly, the first shrimp farms of Andhra Pradesh sprang up along Polekurru creek.

My last visit to Kakinada as BOBP staffer came about late in 1993. Interest in shrimp farming was awakening, and a few daring entrepreneurs had started small farms. These founding fathers were developing management strategies to suit their individual circumstances. They demonstrated considerable ingenuity as they sought ways to minimize investmentcosts and risk. Even at that early stage, the then Deputy Director of Fisheries lamented the lack of a coordinated coastal zone management plan.

Early this year, I had the opportunity of returning to Kakinada during a short assignment with BOBP in early April. Mr B.V. Raghavulu, Mr A. Ramesh Babu and other members of the AP fisheries staff accompanied me during field visits and organized meetings with local farmers. It was nothing short of astounding to see the tremendous development of the industry in just five years. There is literally no space left for expansion! In contrast to the pattern of development in Nellore and further south in Tamil Nadu, the vast majority of shrimp farmers are small scale. Small shrimp farms have mushroomed along the shores of every available source of brackishwater. The picture painted in the press of a corporate- dominated industry is quite erroneous, at least in Andhra Pradesh. Farms larger than 2 ha make up only 3% of the total area of the 71,000 odd hectares of shrimp ponds in the state. About 56,000 ha are actual water surface.

When shrimp farming started in the early '90s in the Polekurru area, farmers depended on wild seed collected by hundreds of fishers in local estuaries. Import restrictions on feed imports made it very difficult to obtain manufactured feed. Local feed mills did not have the technology to produce efficient shrimp feeds. How the situation changed injust a few years as the Indian economy began to open up! Small private hatcheries mushroomed along the coast and imported feeds became available to small farmers. Shrimp seed supplies are much more reliable now and farmers can plan their stocking and harvesting with much less risk.

The numbers are really staggering! It takes almost 71,000 farmers to operate these ponds, which provide a good living for them and earn foreign currency for

A typical shrimp pond along the Saripalam Canal in Andhra Pradesh.

Pump set along the Saripalam canal.

the country as well. The industry has spawned 27 feed mills, 146 hatcheries and 46 processing plants in the state, creating much additional employment. Dr. R. Paulraj and his team from the Central Marine Fisheries Research Institute estimate that each hectare of shrimp pond requires 600 person days of labour per year compared to 180 for paddy.

Mr. K. Narasimharaja is typical of these small farmers. Mr. Narasimharaja sold his contracting business in U.P. and moved to Polekurru to set up his 1.6 ha shrimp farm along the Matlapalam Canal. "Shrimp farming is my business now and supports my family," he says. Mr. Narasimharaja purchases his shrimp post - larvae (PLs) from a local hatchery. I asked him if he had the PLs tested for white spot virus. "No, I can't be sure that the PLs they sell me would be from the same batch tested. But the large farm just downstream had their PLs tested and they got the virus anyway," he replied. Mr. Narasimharaja minimizes risk by stocking at low density, only 2 PLs per square meter. This is a typical response to risk among Andhra shrimp farmers. Although no studies have been done, these low stocking rates probably minimize discharges of organic matter, BOD and nitrogenous wastes. It is likely that most waste is digested within the pond itself.

Mr. Narasimharaja survived the severe outbreak of white spot disease in *1995* which wiped out his crop. Since then, the virulence of the virus seems to be declining. "Shrimp farming is my sole support – I must keep going," he says. As we discussed the problem of white spot disease and methods for controlling it, the subject of reservoirs was raised. Reservoirs have proved effective as a means of controlling several viral diseases on larger farms. "I cannot afford to include a reservoir. My farm is too small. If I convert some of it to a reservoir, my profits will be wiped out. My main problem is polluted water in the canal from which I draw water for the farm!" he exclaimed.

Mr. Narasimharaja's farm, like all of those along the Matlapalam Canal, was constructed above the high water mark on saline clay soil. This zone was formerly covered with halophytic plants, mainly *Salicornia.* Such soils are very common in coastal areas and are unsuitable for agriculture. The adjacent mangrove forest reserve has not been encroached on by shrimp farms. As Mr. Narasimharaja noted, the major problem in this area, as in many others, is the poor quality of water supplied.

A visit to the Sanpalam Canal in West Godavari District revealed the adaptability of small- scale shrimp farmers. The soil along the canal is slightly saline, although aman type paddy can be cultivated during the wet monsoon. Hence, there is a mixture of paddy and shrimp farming. Paddy is cultivated during the wet monsoon, while shrimp are farmed during the dry season. In fact, when the shrimp ponds are initially filled with fresh water from the canal, the salinity rises to 4 or 5 ppt! Ground water is naturally saline at 4 to 5 ppt. This has been so since the area was set.tled and is not the result of shrimp farming activity. The Saripalam Canal has become silted; 'farms along its course get little brackish water.

Some of the farms, like that of Kedasu Kamakaraju, are very small indeed. His is only 0.14 ha. Mr. Kamakaraju stocks at low density, uses hatchery seed and manufactured feed. Some of the ponds are too shallow, and the farmers need some technical assistance to help them with pond management. Outbreaks of white spot disease have been very sporadic in the area. Some farmers were heavily impacted, others not. The farms

Sampling of shrimp in a pond along the Saripalam canal.

in the Saripalam cluster are squeezed between the higher elevation paddy fields and the canal. There is no room for reservoirs, either common or individual. Here too stocking densities are very low – this minimizes waste treatment and disposal problems. No aeration is required with the present management strategy.

I saw many other examples of small-scale shrimp farming in East Godavari, Krishna and West Godavari districts. Hundreds of small farms hug the banks of the Krishna River, occupying former vegetable gardens. Many of these farms are poorly constructed. The ponds are so shallow that benthic algal mats choke off the oxygen supply. During my visit, sporadic outbreaks of white spot disease were already beginning to affect some of the farms. The fisheries department is stretched too thin to adequately serve the hundreds of farms, so the latter depend primarily on occasional advice offered by feed company representatives.

With so many farmers around, it was possible to visit only a small number. Mr. Raghavulu and his staff had organized discussion groups with farmers in each of the districts, so we were able to get a feel for the problems and prospects faced in each of these districts, White spot virus attacked almost all farms in 1995. Sporadic outbreaks continue, but there does not seem to be a clear pattern now. One of the commercial feed mill companies has set up a laboratory for testing hatchery PLs for white spot virus. The small farmers we talked to expressed skepticism over the efficacy of the tests: they said the only large farm in Polekurru used PLs which tested negative for the virus but were wiped out anyway. Furthermore, the hatcheries are unwilling to test small batches of PLs. These unorganized farmers have no leverage either with the hatcheries or with other suppliers of inputs such as feeds and fertilizers.

Our discussions with small-scale shrimp farmers in the three districts revealed that there are no associations or groups which deal with management issues. Although farms have developed in clusters along water sources, there is no attempt to coordinate discharges and share information and knowledge. Smaller farmers tend to blame larger operators for problems. Some lively arguments ensued during our discussion groups!

Experience in Thailand and Sri Lanka has demonstrated the effectiveness of reservoirs in managing water quality and reducing the risk of white spot virus disease. Very small farms like those found in Andhra Pradesh are unable to incorporate even separate drainage and water supply canals, let alone large reservoirs. There are no buffer zones between farms along most of the canals, hence no space is available. If 20 to *50%* of the farm would be converted to reservoir, profits would be wiped out. Some farms could intensify their technology and boost production to justify reservoirs, but this would bring in a host of new problems.

The pond dynamics of the area have not been sufficiently studied, although much is made of shrimp farming as a source of pollution. This may indeed be the case with intensive operations, uncommon in Andhra Pradesh. The low stocking densities and low feed application employed by most Andhra farmers probably contributes little pollution to adjacent waterways. Before any conclusions are reached, some good field studies are needed to identify what pollutants are discharged, if any.

Protests by environmentalists and social activists culminated in 1996 with a decision by the Supreme Court of India banning all shrimp farming within 500 metres of the high water mark. Although aimed primarily at industrial shrimp farmers, it posed a fatal threat to the small- scale farmers of Andhra Pradesh. At the same time, the Court directed the government to establish an Aquaculture Authority (see pages 7-8). The AA was given the power to issue licenses for traditional and improved traditional farms within the Coastal Regulatory Zone (CRZ). Naturally, every farm in the CRZ claimed to be of the improved traditional typ&. AA has indeed granted licenses to many of the small farms. -

The Aquaculture Foundation of India, under the leadership of Dr. M Sakthivel, one of the great pioneers of shrimp farming in India, ispromoting legislation at the national level which will treat aquaculture as a legal activity in the CRZ. While the legal crises are being met, it will be incumbent on the industry to prove that it is a responsible steward of coastal resources. Given the meagre resources of the state fisheries departments and the disorganization of large numbers of small-scale shrimp farmers, this will be no easy task.

Dr. Alagaswamy of the Central Institute of Brackishwater Aquacualture, Madras defined improved traditional shrimp farming as similar to tide - fed traditional farming but with controlled stocking in ponds of 2 to 5 ha. The MI has allowed pumped water supply provided the other conditions are met.

ENVIRONMENTAL AND SOCIAL ISSUES IN COASTAL AQUACULTURE - A CASE STUDY

By R. Paulraj, M. Rajagopalan, M. Vijayakumaran,
E. Vivekanandan and R. Sathiadhas*

How does shrimp farming impact the environment and the lives of coastal populations? The authors summarize the results of a study conducted in nine coastal areas of a district in Tamil Nadu. They analyzed soil, water and plankton samples, obtained data from the landings of marine fish, and interviewed hundreds of fisherfolk. Conclusion : No negative impact, some positive impact.

Sustainable utilization of land and water resources is vital if a developing country with a large population, such as India, is to ensure nutritional and livelihood security for its people. Coastal aquaculture offers vast scope in this context; it provides opportunities for utilizing the saline wastelands and water resources available along the 8,129 km-long coastline of India.

More than three million hectares of coastal soils are reportedly affected by saline subsoil water, rendering it unsuitable for productive agriculture. Of these, 1.2 million hectares are considered suitable for the farming of marine organisms in brackishwater and seawater based systems. A variety of cultivable indigenous marine species which have nutritional, therapeutic, ornamental or industrial value, are available along the coast.

Although coastal aquaculture is several decades old in India, culture operations have by and large have been confined to the states of West Bengal, Kerala and Goa. The explosion in world demand for shrimp, and the short supply from capture fisheries, led to the growth of commercial shrimp farming in the early 1980s. This became an important industry during the late 1980s. The attractive returns from shrimp culture drew small and marginal farmers as well as corporate entrepreneurs into the business. Result: a variety of shrimp culture operations – extensive, improved intensive, and semi-intensive. By 1984, a total area of about 43,000 ha was under shrimp culture. Traditional extensive culture was practised in most of this area. It yielded a total production of 15,000 t and an average yield of 0.4t/ha. Shrimp culture witnessed rapid growth during the next 10 years. A total of 100,700 ha was brought under culture during 1994-95, leading to a production of 83,000 t and an average yield of 0.8 t/ha. Since that time, though the area under farming increased to 1,36,000 ha during 1996-97, there was a substantial fall in production (to about 70,000 t), and in average yield (to about 0.S2tJha), mainly on account of disease outbreak, and partly on account of legal disputes stemming from social and environmental concerns, particularly in Tamil Nadu.

Some of the coastal villagers believe that brackishwater shrimp farming is detrimental to human habitation. The following are their major claims and apprehensions: (i) Most of the shrimp farms are converted farmlands; agriculture may not be feasible in future in these areas. (ii) Stagnant brackishwater in shrimp ponds seeps through the soil and makes potable well water brackish. (iii) Untreated effluent water from shrimp farms is allowed to stagnate around farms and dwellings, posing health hazards. (iv) Many agricultural labourers are displaced because of a decline in agriculture on account of shrimp farming. (v) Fishing by coastal fishermen suffers.

To assess the effects of shrimp farming on the environment and on the coastal population, a study was undertaken in Nagai Quaid-E-Milleth district, Tamil Nadu, in September 1995. Several small and large farms in nine coastal areas were covered by the study. Soil, water and plankton samples were collected from inlets and outlets of the farm areas, from shrimp ponds and from the wells of nearby villages, and analysed. Estimates were made of hydrological parameters, nutrients, bacterial counts in the water and soil samples. Data on marine fish landings for the relevant

Stocking of shrimp seed in an aqua farm in Nagai Quaid-E-Milleth district, Tamil Nadu

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fishing villages, which were available with the CMFRI, were analysed.

Socio-economic data were collected on the basis of interviews with hundreds of fisherfolk and villagers.

LOCATION OF SHRIMP FARMS

The total geographical area of Sirkazhi, Tharangampadi and Nagapattinam *taluks* is about 1.07 lakh hectares (source: Assistant Director of Statistics, NQM District). The net sown (agriculture) area in these three *taluks* accounts for *57%*, 60% and 58% of the respective total geographical areas.

The area acquired for shrimp farming in the district is about 2,000 ha, which is less than 2% of the total area. The area developed for shrimp farming is about 800 ha. Shrimp farming has paved the way for utilisation of barren, uncultivable lands. The land, which was under cultivation about 20 years back, became uncultivable – or cultivable with the prospect of just one crop per year because of inconsistent water supply, as this area comes under the tail end of the Cauvery irrigation system. Hence, farmers were frantically looking for an alternative use of this land for the last few years.

Shrimp farming activity in the district commenced on a small scale in 1991 and became intensive from 1993. The shrimp farms are spread over 31 villages of Sirkazhi, Tharangampadi, Nagapattinam, Thiruthuraipoondi and Vedaranyam *taluks*. In these *taluks*, more than 100 farms are in operation. All the farms are located near the coast or in the vicinity of estuarine systems where adequate saline water supply is available. For understanding the nature of soil and water prior to the commencement of shrimp farming, a 1984 map of the Soil Survey and: Land Use Organization, Government of Tamil Nadu, was referred to. The soil in the shrimp farming areas is mostly sandy, coastal alluvial or unconsolidated, excessively drained and rapidly permeable. According to the 1984 survey, the coastal area was affected by surface and sub-surface salinity and alkalinity. In Thiruthuraipoondi, Nagapattinam and Sirkazhi *taluks*, where most of the shrimp farms are located, about 4,814 ha, 1,502 ha and 13,807 ha of the coastal areas were affected by surface, sub-surface and complete salinity respectively in 1984 itself.

In its Special Report No. 85 (1994), the Soil Survey and Land Use Organization (SS and LUO) and Soil Testing Laboratory, Aduthurai, Tamil Nadu Agricultural University, concluded that all the shrimp farms surveyed are located in uncultivated wastelands where crops have not been raised for the last 20 years.

ENVIRONMENTAL CHARACTISTICS

Prior to the commencement of shrimp farming in coastal areas of the district, the Tamil Nadu Government estimated that about *75%* of the coastal area in the district is saline in nature either in the surface or in the sub-surface or both. The cause of salinity in the soil is a combination of factors – geographical, climatic, hydrolOgical, monsoonic etc. The survey also showed that 80% of the soil is highly alkaline (pH *8.5)*. In 1984, the Tamil Nadu Government recommended shrimp farming as a venture with potential for improving the socio-economic conditions of the population in Nagai Quaid-E-Milleth district.

The quality of ground water in the entire coastal area is saline. Water samples collected from the bore holes of aquifers in the depth range of 3-294 mm (SS and LUO, 1984) reveal that the quality of medium and deep aquifers is moderate to poor. Though the top aquifer is better in quality, the potential is not sufficient for irrigation.

As all the shrimp farms are located in the marine deposits, the quality of ground water is already brackish, as established by the Public Works Department (SS and LUO, 1994). Hence the possibility of pollution of ground water (which is

Women assess the quality of shrimp seed in Nagai Quaid-E-Milleth district, Tamil Nadu.

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already brackish) by the aquaculture farms is minimum.

In general, ground water is not used by aqua farms. Many farms which were using ground water stopped doing so because of the regulations of the Tamil Nadu Government. Presently all the shrimp farms use saline water either by pumping from the sea or from the backwaters.

Analysis of the hydrological parameters in the water samples revealed the following features:

The possible negative effects of unregulated shrimp farming like significant increase in Total Suspended Solids (TSS), Biochemical Oxygen Demand (BUD) and Chemical Oxygen Demand (COD) and eutrophication of creeks and estuaries due to high nutrient shedding from farm effluent were not evident in any area surveyed during this study (Table 1). The TSS, BUD, COD and nutrient levels were within permissible limits in all places with a few exceptions.

Marginally high BUD levels were recorded in the outlet canals of two farms (2 to 5 ha area) along Kaduvaiyar, Vellayar and Vedaranyam Canal. This was mainly due to high levels of TSS in the estuarine inlet itself.

Concentration of heavy metals was negligible in the effluent of all the farms.

Since the nutrients in the outlet are within permissible limits, they did not create plankton bloom in any of the farms – except in the stagnant outlets of one non-functional farm. It is reported from Finland that low-level enrichment of sea water by farm effluent increases congregation of fish up to 10 times in the discharge areas.

Though zooplankton concentration was higher in a few estuary-based ponds, the concentration was normal in the outlet water. Similarly, there were no marked differences in organic carbon in the pond inlet and outlet waters.

Barring one farm in Poompuhar, the bacterial population in the pond water and outlet were not very different. Coliforms count was high in both water and soil in all the farms.

Table 1: Comparison of admissible levels of different parameters in the effluents discharged in estuaries and the actual range of estimates in the farm outlet water [All values (except pH) are in mg/i.]

Parameters	Admissible Level		Estimated Range
	Pollution Control Bd (TN Govt.)	Mm. of Agri. (Govt. of India)	Present Study
pH	5.5 - 9.0	6 - 8.5	7.4 - 8.00
DO (minimum level)	3	3	3.1 - 8.8
BOD	50	20	1.4 - 22.8
COD	100	75	54.5 - 103.6
TSS	100	100	41.4 - 123.0
Ammonia	1	0.5	BDL - 1.0
Phosphate	5	0.2	0.025 - 0.25
Heavy Metals			
Copper	3	-	0.052 - 0.317
Chromium	2	-	0.015 - 0.105
Zinc	1	-	0.2 - 0.3
Cadmium	2	-	BDL - 0.003
Lead	0.1	-	BDL

BDL : Below Detectable Levels.

farms. In one of the farms, there was no culture activity since July 1995, and in the other, the farming was in the initial stage, with very limited exchange of water. The increase in the BUD was due to stagnation of water in the outer canal.

A marginal increase in the TSS was noticed only in the outlets of small

In a few places, agricultural activity was being initiated right across the peripheral bunds/canals of farms, indicating that paddy farming could be undertaken, provided freshwater is available in the vicinity of shrimp farms.

Water in the agricultural fields, in the freshwater ponds, and in the wells near the shrimp farms, was almost fresh; but alkalinity was high in some places due to alkaline soil.

It is likely that the concentration of TSS, COD and nutrients in the farm effluent might increase towards the end of each crop. It is noticed that most of the larger farms incorporate effluent treatment plants in their existing design. Effective use of effluent treatment system will reduce the concentration of these factors in the farm effluent.

To control disease, the current trend is to drastically reduce water exchange by recycling the treated effluent. This is a welcome sign, since the quantum of water used will be less.

SOCIO-ECONOMIC IMPACT OF SHRIMP FARMS

Shrimp farming has considerably increased the value of land in the respective areas. Before the commencement of shrimp farming, the land value in coastal Nagai Quaid-E-Milleth district was only Rs.18,000 - 20,000 per ha. This went up 10 times to about Rs.1.8 lakhs per hectare. More than 60% of the coastal villagers accepted the fact that their land value has increased due to shrimp farming in their area.

Further, a major impact of shrimp farming was on the change in land ownership pattern in the coastal areas. About 19% of the coastal land holdings were sold due to the small size of the land (less than one ha.), 39% were sold to capitalize on high prices, 33% due to inadequate profitability in crop production and about 8% due to non-availability of labour. Traditional agriculturists in the coastal areas have profitably utilised the money realised from the sale of their lands to buy fertile farmlands away from the shore.Those who have bought the lands for shrimp-farming are mostly from other regions.

Employment opportunities have gone up because of shrimp farming. The average labour requirement per ha. of paddy cultivation is about 180 labour days per crop, whereas in shrimp farming it is about 600 labour days/crop. Only one crop of paddy (and that too unreliable) can be raised in a year as against the possibility of two crops in shrimp farms. Most out-of-work farm labourers have been absorbed in shrimp farms, besides a considerable number of unemployed youth.

It was observed that shrimp farms required fewer female labourers than paddy cultivation did. About 30% of the labour in paddy farms is female. Since women are paid lower wages than men, they are much in demand in paddy fields of adjoining regions. So the growth of aquafarms has not made any difference to their employment prospects. But aquafarms have created regular jobs for a substantial number of male agricultural labourers. Aquafarms have also boosted job prospects in subsidiary occupations like catering, transportation and handling of construction materials etc. Agricultural labourers, on an average, earn an annual income of Rs. 7,500, whereas shrimp farm labourers earn Rs. 12,000. Hence the household income of families in this area has gone up considerably. The conditions of roads in several villages have improved, following the advent of the shrimp culture business.

Shrimp ponds under preparation.

EFFECT ON MARINE FISHERY

Has shrimp farming affected the fishing activities of fishermen? Data on marine landings in Nagai Quaid-E-Milleth District, available with the National Marine Living Resources Data Centre (NMLRDC) or CMFRI, Kochi, were analysed for the four-year period from 1991 (before commencement of intense fanning activity) to 1994. There was no major change in the effort and in the annual fish landings during the period (Table 2). Thus shrimp farming activity has not made any difference to fishing activities of coastal fishermen.

RECOMMENDATIONS

The EIA study did not reveal any significant adverse impact from shrimp farming on the environment in the Nagai Quaid-E-Milleth District. Of late, awareness of the need to preserve the environment has been rising among small and large farmers and the corporate sector. For sustainable shrimp farming, the following measures are recommended:

Some villagers fear that impounding sea water may cause high salinity in the adjacent lands because of possible downward and lateral movement of saline water. Mobility of saline water towards higher elevation will be a minimum, and can be arrested by cutting a deep trench in the buffer zone, *4.5* m away from the pond. The trench may be 1.8 m deep, 0.9 m wide and may be lined with clay. The water collected in the trench may be drained through the outlet canal.

A biopond for treating pond effluent is recommended for groups of small farmers and large farms. The usage of sludge - digesting microbes for the management of pond detritus and the prevention of black mud formation at the bottom of the culture ponds as well as in the biopond is also recommended. The treated water should not be allowed to stagnate in discharged canals. To maintain free flow of the treated water, desilting of the creeks and opening of bar mouth of the estuaries as and when required, is necessary, as being done by one of the farms.

In order to reduce organic matter and plankton load, secondary aquaculture of shell fish (green mussel, edible oyster, and clams), finfish (mullets, chanos, pearl spot) and sea weed, depending on the suitability of sites, is recommended.

The guidelines issued by the Ministry of Agriculture, Government of India, and the Tamil Nadu Aquaculture (Regulation) Act 1995 for sustainable development and management of brackishwater aquaculture, may be followed.

Table 2: Annual fishing effort (in thousands of fishing hours) **and** catch (tonnes) from major gears in Nagai Quaid-E-Milleth District, Tamil Nadu

	1991		1992		1993		1994	
Gear	**Effort**	**Catch**	**Effort**	**Catch**	**Effort**	**Catch**	**Effort**	**Catch**
Gill Net	1387	15400	1030	12911	1213	5108	1549	17244
Bag Net	20	2785	16	5649	12	3346	27	3385
Hook & Line	29	196	*45*	262	18	157	39	264
Other Gears	-	634	-	1910	-	1933	-	510
Total	-	19015	-	20732	-	20544	-	21403

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WANTED: INFORMED COMMUNICATION IN COASTAL SHRIMP AQUACULTURE

By Kee-Chai CHONG

Communication is vital to development. Informed and responsible communicators discuss development challenges and opportunities. They monitor development practices to ensure that they are consistent with the national good. They highlight errors of omission and commission on the part of the development practitioners – the government, private enterprise or individuals.

An issue that has aroused a great deal of development interest in recent years is coastal shrimp aquaculture. Much has been written about the subject in recent months. I am sad to say that some of the writings have lacked substance and depth, or even objectivity and balance. In some, communication mischief may be intended! We badly need informed and responsible communication on the subject.

The critics of shrimp aquaculture have savaged it on many grounds. That it destroys mangroves, degrades the soil, causes salinisation of drinking water, generates pollution through toxic effluents, undermines the health of marine life, displaces coastal inhabitants, affects the catches and earnings of fisherfolk. India's Supreme Court, in its order of December 11, 1996, banned all shrimp farms within 500m of the Coastal Regulatory Zone.

As a result of the order, production fell and many people were put out of work. The country lost valuable foreign exchange. Further, environmental degradation continued – because shrimp culture is not the sole cause of environmental havoc, contrary to what some critics would have us believe.

Shrimp aquaculture has indeed had some undesirable impact on the coastal ecological landscape and seascape. But it is not shrimp aquaculture *per se* that is at fault but a small minority of producers, in particular large-scale capital-intensive operators. Many of these large-scale capital-intensive operations have gone out of business due to bankruptcy. Small farms or small-scale low-capital operations continue to operate successfully with little or no environmental impairment, in India and other countries.

Blaming aquaculture for the sins of some practitioners, and imposing severe bans on all aquaculture operations, is as logical as closing down all road traffic because some vehicle drivers are rash. Just as an oil spill is the result of careless navigation, the unintentional destruction of mangroves by coastal shrimp aquaculture is an accident, driven by the effort to minimize costs and maximize profits.

There's no industry that is problem-free. A responsible approach would be to address problems and attempt to solve them, so that the industry runs on healthy lines, rather than campaign to close down the industry. On the issue of shrimp culture, all stakeholders must strive for responsible and sustainable operations, so that we help an industry that provides jobs and incomes, boosts foreign exchange earnings, and has tremendous development potential.

A Code of Conduct for Communication

Solutions to development problems lie in spreading awareness about both the positive and negative impact of development. Consensus-building, negotiation, mediation, dispute settlement and compromise are vital

Shrimp culture is only one of many activities that impact on mangroves, says the author. (Mangroves from Pichavaram reserve, Tamil Nadu)

Communication among stakeholders – to establish a convergence of perceptions and opinions, work out compromises and solve problems - is vital, says the author. (Photograph shows a BOBP supported stakeholder and consensus consultation)

processes in such a dialogue. All stakeholders must engage in open communication, which can promote better understanding and appreciation of one another's stakes. Mere hostility, through the media and other fora, vitiates the climate for agreement. Perhaps a code of conduct for responsible communication is called for, just as a code of conduct for responsible aquaculture has been promulgated to guide its future development.

Many of today's generation are schooled in environmental sciences or sensitized to them – in particular to integrated coastal zone management as an approach to resolve multi-resource user conflicts. In recent years, they have also been exposed to participatory planning and community-based approaches to resource development and management. They are more open to communication on these subjects now than in the past – when exposure to environmental science was negligible. They are quite willing to listen to informed criticism, accept any mistakes and change their course of action. But the criticism has to be responsible and well-founded.

Early Portrayal of Mangroves Led to its Unsustainable Use

Take the subject of mangroves. Society is partly responsible for the conversion of mangroves to coastal shrimp aquaculture. In the 1980s and earlier, mangroves in the tropics and subtropics were described as mosquito-infested and disease-afflicted wasteland. In fact, society even dismissed them as undrainable, unreclaimable and unproductive for agriculture. (See page 2)

This is because mangrove soils are mostly acid-sulphate soils and waterlogged – unsuitable for most development or commercial activity. Even fish do not thrive in such acid sulphate soil-based water conditions. We did not know better then. Nor was technology available then to reclaim such areas. Clearly, technology and human ingenuity were needed to overcome these constraints.

Urban sewage gets discharged into the sea off Royapuram - one of the many causes of coastal pollution.

Later, this so-called wasteland turned out to be suitable for aquaculture. It is precisely the early portrayal of mangroves as wasteland that drew aquaculture investors looking for sites, especially when the life cycles of marine finfish and shellfish were closed and scientific breakthroughs in fish feed formulation occurred. In the Philippines, mangrove areas were leased for milkfish culture for one peso per hectare per year!

Governments all over the world look for economic engines to drive their national economies. They particularly look for foreign exchange earning opportunities. Any government must explore all possible developmentoptions. Although marine finfish such as milkfish and mullet were the first candidates for culture, the insatiable world demand for shrimp led to its early intensive culture in the mangroves, amidst low-intensive or extensive small-scale operations. To be sure, some of the small farms also switched to intensive production to cash in on the growing demand for shrimp. Coastal shrimp aquaculture provided the economic engine; the rest is now history

Scapegoat for Mangrove Destruction

Of all the causes of mangrove destruction, why is coastal shrimp aquaculture singled out as the main villain? One would assume that if there is no coastal aquaculture, mangroves would remain virgin land. This is not so. Land-locked countries where coastal shrimp aquaculture is not possible are ravaged by villains of many kinds: landfills and other kinds of reclamation for urban and industrial development that denude the land. As for coastal areas, oil refinery installation, dredging for deepening shipping channels, sand mining, shoreline or beach erosion, municipal andindustrial waste discharge, shipbreaking, dry-docking shipyards etc. are equally damaging to the coastal environment and to mangroves. Not to mention oil spills.These causes of coastal area degradation and mangrove destruction hardly arouse much interest. In fact, even agriculture and forestry practices are more injurious to the environment. So are industrial and manufacturing activities.

What about damage to coral reefs – which are excellent natural buffers against storm surges and inundation? The reefs are systematically denuded and destroyed by coral mining, extensive deforestation, municipal sewage discharge, etc. When disasters strike along the coast, partly because of the destruction of coral reefs, no one is spared. Loss of life and property is suffered not only by coastal communities but by everyone, including shrimp investors. The media report these disasters, without identifying and laying bare the causes of the disasters – coral mining, deforestation, sewage discharge etc.

For reasons yet to be determined, coastal shrimp aquaculture suffers from an image problem. Is it because it is supposed to produce a commodity for the "haves" rather than the "have-nots"? Profit margins in shrimp culture are said to be large, at US$ 4-5/kg. Do such margins provoke social envy, raising questions about who benefits from them, and whether such margins are sustainable?

Women help prepare shrimp pond in Andhra Pradesh - highlighting the potential of coastal shrimp aquaculture for jobs and development.

The Five Communication Effects

Shrimp aquaculture produces food, even if it is only for the haves right now. But it is produced by the have-nots, who stand to benefit. In Indonesia, a 25 year fisheries planning model completed in 1992 showed that by 2010, no shrimp will be available for export because domestic demand will absorb all of the shrimp output. (Chong, 1992)

Changes to the natural state of a resource base are inevitable when they are used by human beings. Resource modification is part and parcel of development to sustain living conditions. Accidents in the form of resource damage can and do occur. No resource can remain in a virgin state, so long as there are people.

Theodore Levitt talks of five communication effects: source effect, sleeper effect, message effect, communicator and audience effects. When one assesses source and message effects, one must examine the credibility of the message source or sponsor, the nature of the message, its purpose, its objectivity. Communicator and audience effects deal with the impact the communicator produces on the audience, whether the audience is sufficiently competent to receive the message and act on the message in a responsible manner. The sleeper effect describes the declining influence of the source or its credibility over time.

In coastal shrimp aquaculture, the sleeper effect is beginning to take effect. Evidence and experience are beginning to show that the destruction of mangroves and of the coastal environment due to shrimp aquaculture is not as severe as it is made out to be. Such degraded sites are slowly recovering and being recolonised. Aquaculture disease outbreaks are better understood with the help of research, and prevention methods are being developed to prevent its recurrence.

It is high time therefore that communication on coastal shrimp aquaculture improves and matures, and is motivated by the broader national interest – so that a valuable development opportunity continues to be tapped and an emerging industry survives and strengthens.

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"THE SHRIMP INDUSTRY WANTS TO PURSUE ECO-FRIENDLY POLICIES"

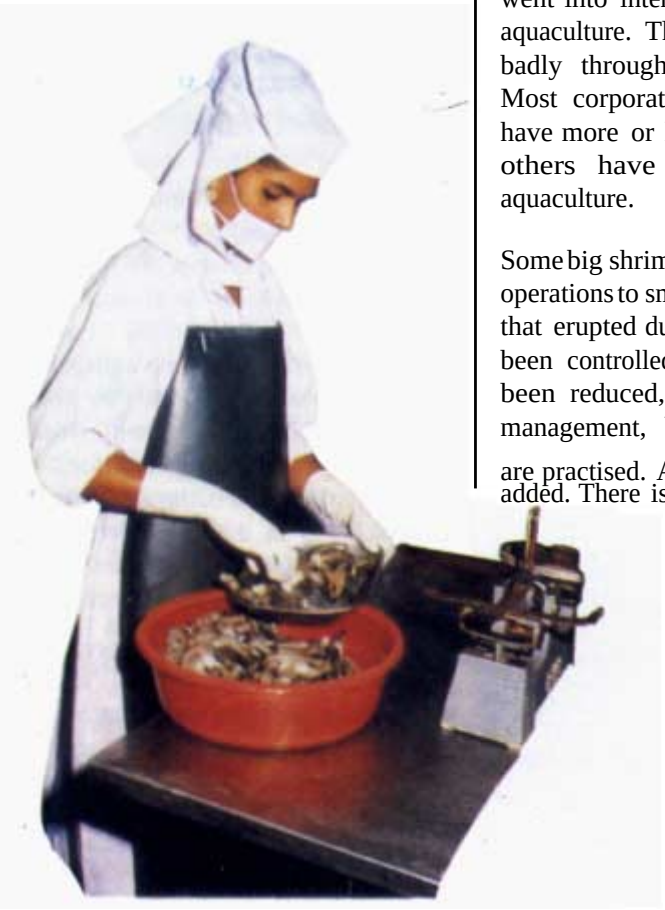
Elias Sait, 40, is managing director of the Chennai-based ALSA Marine, one of India's leading shrimp exporters. As vice-president of the Seafood Exporters' Association of India, he is one of the industry's spokesmen. Sait talked to Bay of Bengal News *recently about shrimp aquaculture, export of shrimp from both capture and culture sources, and how the industry can overcome its present problems.*

Bay of Bengal News: Mr Sait, please tell us about your company's shrimp related operations.

Elias Sait: ALSA Marine is 12 years old, part of the ALSA group which has diverse interests. It has shrimp processing factories at Calcutta, Vizag, Madras, Bhubaneswar, Vellore and Cochin, and a shrimp farm in Nellore. Last year we exported about Rs. 600 million worth of shrimp. A subsidiary company of ours engages in trawling, using Australian deep-sea trawlers.

Our Calcutta factory uses cooking plant and value-added equipment. An ultra-modern plant in Vizag is EEC-approved. A new processing plant with cooking facilities is to come up during the next six months in Madras near the Satyanayalam-Nellore highway.

Shrimps are weighed after grading



Like the rest of the industry, we went through bad times during the past 2-3 years. The company is now undergoing revival and restructuring. It's a pioneer in value addition.

BBN: You have been an eye-witness to the industry's ups and downs. Could you describe them?

Sait: Traditional aquaculture has been practised in West Bengal for 30-40 years. During the second half of the 1980s, commercial aquaculture made its presence felt in Andhra Pradesh (AP) and Tamil Nadu, when a number of farms of size 800 to 1,000 acres came up.

Between 1989 and 1997, the industry's foreign exchange earnings went up from Rs. 800 crore to Rs. 4,600 crores. The main contributor to the increase was aquaculture (Rs. 20,000 million).

During the early 1990s, most investment went into intensive and semi-intensive aquaculture. These firms have suffered badly through recent developments, Most corporate farms in Vijayawada have more or less closed down. Some others have gone into extensive aquaculture.

Some big shrimp farmers are leasing out operations to small farmers. The diseases that erupted during 1994-95 have now been controlled. Stocking density has been reduced, there is better water management, better farming methods are practised. A lot of acreage has been added. There is still a lot of potential for aquaculture. Only 10% of coastal wetlands have been exploited. If we tap all of our wetlands, to generate lots of jobs, would be able and create wealth,

Bhimavaram (AP) is an example. Its economy has flourished on account of aquaculture. But environmentalists are up in arms. They claim that aquaculture has polluted waters, created groundwater scarcity, converted agricultural land to shrimp farming. I must point out that these allegations are backed only by bias, not evidence.

It's less than 5% of shrimp farms in the area that have caused problems. Unfortunately, there was no regulation by the government. Now the government is coming out with an aquaculture policy to ensure proper treatment of pond water etc. As a matter of fact, water going out of shrimp farms is not polluted. But the industry is examining the question with an open mind — it wants to pursue practices that are eco-friendly and soil-friendly.

Once the government's new aquaculture policy becomes law, activities will get a fillip. India has one of the biggest coastlines in the world. It could be one of the biggest exporters of shrimp. A small country like Thailand does better than India on the shrimp export front, though it has far less land than India. The so-called aquaculture boom has been identified with corporate activity, because of the high-profile investment made by a few companies. When these companies started doing badly, people thought the entire industry was doomed. But aquaculture did very well last year, when a number of small firms took to extensive aquaculture.

BBN: Earlier, you described your company as a pioneer in value addition. Can you elaborate?

Sait: India's export market has been dominated by Japan (60% by way of

Japan treats fish as a commodity. Indian industry should move towards value addition — toward producing cooked ready-to-consume products in convenient packs to be placed with supermarkets and retail stores, for

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Women busy sorting shrimp at a processing plant in Chennai, India.

immediate use by foreign households and restaurants. These would command a higher value than raw fish and shrimp which provide only slight profit margins. The cooked shrimp has absolutely no bacteria.

When we cater to households and housewives, the packing strategy has to be different. A housewife may not be able to use a 2-kilo block of frozen shrimp. In the IQF (individually quick-frozen) mode, each fish is frozen separately, it's convenient for her to buy and use. A housewife can buy a 500-gram pack, a 1-lb pack, or a 1-kilo pack.

Progress toward value-addition would mean depending less and less on Japanese markets, unless Japanese buyers themselves shift focus — and start buying from final sellers like supermarkets and retail stores, instead of from trading companies. We must sell more to the US and Europe, where they buy cooked shrimp, or raw cuttlefish, squid and shrimp. In ALSA Marine's business, Japan accounts for only 20%, US and Europe account for 80%.

Japan is the biggest consumer of new products. Special infrastructure is not necessary for exporting bulk-frozen products to Japan. The Japanese do the reprocessing and value addition themselves. But we are trying to move away from commodity markets by improving the infrastructure. We get better value from US and Europe.

Our company is presently restructuring operations. To utilize our facilities better, we do processing and export of shrimp for other companies.

BBN: Is cultured shrimp regarded as superior to captured shrimp for the purpose of export?

Sait: The cultured variety is fresher than the captured, it's better from that standpoint. So far as nutrition value goes, there's not much difference between the two. Some people may prefer shrimp caught naturally in the sea, to shrimp reared on the land. An artificially created environment cannot be better than the natural sea environment. I personally prefer sea-caught shrimp to cultured shrimp - even though there may be no difference in taste.

BBN: How do you see the future?

Sait: I am an optimist. The future is very bright if the shrimp processing industry grows on the right lines, and if shrimp culture overcomes its present problems. This will be possible if government policies provide the right encouragement for aquaculture — through import to enable export, value addition, upgrading of facilities and infrastructure, and finance to make restructuring of firms possible. Exports could touch Rs. 120,000 million in five years.

The S&ifood Exporters' Association plays an important part in the process of growth. It represents the needs of the industry at various levels, including the Ministry of Food Processing, institutions like banks, and foreign importers.

The industry needs discipline. Maybe a code of conduct is needed. Foreign buyers sometimes complain about quality. They should know that our association stands for quality and fair practices, and that we mean business.

STREET PLAYS TO PROMOTE CODE OF CONDUCT FOR FISHERIES

The Code of Conduct for Responsible Fisheries — which the Government of India, along with other governments, has signed — is to be promoted in Tamil Nadu through street plays.

The BOBP and the Department of Fisheries, Tamil Nadu, agreed that the Code should be promoted vigorously among fisherfolk so that they are aware of the Code and observe it in practice. A Tamil translation of the Code will soon be brought out and distributed widely among fisherfolk. Locally relevant street plays that highlight the value of the Code will also be organized among fisherfolk communities.

'Nenjil Natham', a Nagercoil theatre troupe, is to put up the plays, under the supervision of Fr Joseph Justus. In October 1998, BOBP's Rene Verduijn (Resource Economist - Associate Professional Officer) travelled to Nagercoil to assist in preparatory effort. It was emphasized that the Code of Conduct should be put into a local context, A framework for the street play was agreed on. A one-month training course was held for 20 youngsters from local fishing communities at the communication centre of the Bishop's House in Nagercoil. Skits, dances and songs were to be developed and refined during the course.

The next issue of *Bay of Bengal News* will report on the first performance of the play, staged on 21 November, 1998, on the occasion of the multi-stakeholder meeting in Nagercoil, to discuss fisheries management and the well-being of coastal fishing communities in Kanniyakumari district.

The photographs on this page are rehearsal shots.

BAY OF BENGAL NEWS

Bay of Bengal News is a quarterly publication of the Bay of Bengal Programme (BOBP), a regional multi-agency fisheries programme which covers seven countries around the Bay of Bengal – Bangladesh, India, Indonesia, Malaysia, Maldives, Sri Lanka and Thailand. The Programme plays a catalytic and consultative role: it develops, demonstrates and promotes new methodologies, techniques, technologies or ideas to help improve the conditions of small-scale fisherfolk communities in the member countries. The BOBP is sponsored by the governments of Denmark and Japan, and by member governments in the Bay of Bengal region. The main executing agency is the FAO (Food and Agriculture Organization of the United Nations.)

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