S. Jagannath

Vs

Union of India and Others

Writ Petition (C) No. 1994

(Kuldip Singh, S. Saghir Ahmed JJ)

11.12.1996

JUDGMENT

KULDIP SINGH, J. –

1. Shrimp (Prawn) Culture Industry is taking roots in India. Since long the fishermen in India have been following the traditional rice/shrimp rotating aquaculture system. Rice is grown during part of the year and shrimp and other fish species are cultured during the rest of the year. However, during the last decade the traditional system which, apart from producing rice, produced 140 kgs of shrimp per hectare of land began to give way to more intensive methods of shrimp culture which could produce thousands of kilograms per hectare. A large number of private companies and multinational corporations have started investing in shrimp farms. In the last few years more than eighty thousand hectares of land have been converted to shrimp farming. India's marine export weighed in at 70,000 tonnes in 1993 and these exports are projected to reach 200 thousand tonnes by the year 2000. The shrimp farming advocates regard aquaculture as potential saviour of developing countries because it is a short-duration crop that provides a high investment return and enjoys an expanding market. The said expectation is sought to be achieved by replacing the environmentally benign traditional mode of culture by semi-intensive and intensive methods. More and more areas are being brought under semi-intensive and intensive modes of shrimp farming. The environmental impact of shrimp culture essentially depends on the mode of culture adopted in the shrimp farming. Indeed, the new trend of more intensified shrimp farming in a certain parts of the country - without much control of feeds, seeds and other inputs and water management practices - has brought to the fore a serious threat to the environment and ecology which has been highlighted before us.

2. This petition under Article 32 of the Constitution of India - in public interest - has been filed by S. Jagannathan, Chairman, Gram Swaraj Movement, a voluntary organisation working for the upliftment of the weaker sections of society. The petitioner has sought the enforcement of Coastal Zone Regulation Notification dated 19-2-1991 issued by the Government of India, stoppage of intensive and semi-intensive type of prawn farming in the ecologically fragile coastal areas, prohibition from using the wastelands/wetlands for

prawn farming and the constitution of a National Coastal Management Authority to safeguard the marine life and coastal areas. Various other prayers have been made in the writ petition. This Court issued notice by the order dated 3-10-1994. On 12-12-1994, this Court passed the following order :

> "Ministry of Environment and Forests, Government of India issued a Notification dated 19-2-1991, under clause (d) of sub-rule (3) of Rule 5 of the Environment (Protection) Rules, 1986 wherein it was declared that the coastal stretches of seas, bays, estuaries, creeks, rivers and backwater which are influenced by the tidal action (in the landward side) up to 500 metres from the High Tide Line (HTL) and the land between the Low Tide Line (LTL) and the HTL are Coastal Regulation Zone. The Central Government has imposed various restrictions in the said notification. Mr Mehta, learned advocate appearing for the petitioner, states that despite the issue of the notification unauthorised industries and other construction is being permitted by various States within the area which has been declared as Coastal Regulation Zone. ... Meanwhile we direct all the respondent-States not to permit the setting up of any industry or the construction of any type on the area at least up to 500 metres from the sea water at the maximum High Tide. The abovesaid area i.e. from the High Tide Level up to 500 metres shall be kept free from all construction of any type."

3. The Union of India and States/Union Territories of Gujarat, Maharashtra, Orissa, Kerala, Tamil Nadu, West Bengal, Goa, Pondicherry, Daman/Diu, Andaman/Nicobar and Lakshadweep have filed replies to the writ petitions. This Court on 27-3-1995 passed the following order :

> "This public interest petition is directed against the setting up of prawn farms on the coastal areas of Andhra Pradesh, Tamil Nadu and other coastal States. It is alleged that the coastal States are allowing big business houses to develop prawn farms on a large scale in the ecologically fragile coastal areas of the States consumed in violation of the Environment Protection Act, 1986 and the rules framed thereunder and various other provisions of law. It is also alleged that establishment of prawn farms on rural cultivable lands is creating serious environmental, social and economic problems for the rural people living along the coastal bed specially in the east coast. ... Meanwhile, we direct NEERI, Nagpur through its Director to appoint an investigating team to visit the coastal areas of the States of Andhra Pradesh and Tamil Nadu and give its report to this Court regarding the various farms which are being set up in the said area.
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> In case the investigating team finds that the ecologically fragile area is being environmentally degraded then it shall suggest the remedial measures in that respect. The NEERI team shall keep in view the Notification dated 19-2-1991 of the Ministry of Environment and Forests,

> Government of India, issued under the Environment Protection Act, 1986 and also the provisions of the Tamil Nadu Agriculture (Regulation) Act, 1995. The NEERI shall submit its report before 30-4-1995."

4. Pursuant to the above-quoted order, the National Environmental Engineering Research Institute, Nagpur (NEERI) submitted its report dated 25-4-1995 before this Court. This Court further directed NEERI to send an expert team to the coastal areas in other States and file its report within two months. The report was filed in this Court within the specified time. This Court on 9-5-1995 passed the following order :

> "This matter be listed for final hearing on 4-8-1995. Meanwhile we direct that no part of agricultural lands and salt farms be converted into commercial aquaculture farms hereinafter. We further direct that no groundwater withdrawal, be allowed for aquaculture purposes to any of the industries whether already existing or in the process of being set up. No further shrimp farms or any aquaculture farms be permitted to be set up in the areas in dispute hereinafter.
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> We direct the respective State Governments (the Collector concerned or any other officer appointed by the Government) to provide free access through aquaculture units to the sea coast to the fishermen/tourists after hearing the parties concerned.
>
> Mr Mehta has contended that due to these farms occupying most of the coastal areas it has become difficult for the villagers to search for fresh water. The State Government may examine this aspect and provide water by way of tankers wherever it is necessary.
>
> So far as the farmers in the State of Tamil Nadu are concerned they are all represented through Mr Kapil Sibal and his team, we direct the State of A.P. to send a copy of the order of this Court to all the aquaculture farms in the State of A.P. informing them that the matter shall be taken up by this Court for final hearing on 4-8-1995. This may be done by the State of A.P. by the end of June 1995.
>
> We direct the Pondicherry Administration to send a copy of the order of this Court to all the aquaculture farms in Pondicherry informing them that the matter shall be taken up by this Court for final hearing on 4-8-1995. This may be done by the Pondicherry Administration by the end of June 1995.
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> We further direct the Superintendent of Police and the Collector of the areas concerned to see that the order of this Court specially the directions given are meticulously complied with by all the farms."

Before finally hearing this matter, this Court passed the following order on 24-8-1995 :

"We are of the view that it would be in the interest of justice to have full representation before us so far as individual aquafarms in various States/Union Territories are concerned. We, therefore, adjourn the hearing to 17-10-1995. Meanwhile, we direct the coastal States/Union Territory Governments through their learned counsel who are present in the Court, to issue individual notices to all the aquafarms which are located in their respective territories. It may be stated in the notices that the same are being issued under the direction of this Court. It should also be specifically mentioned that if they want to be heard in these matters by this Court, they be present through their counsel/representatives in the Court, on the next date of hearing, which is 17-10-1995. We also direct the Marine Products Export Development Authority (MPEDA), through its counsel, Mr Harish N. Salve, to do the same exercise at its level also. Apart from that, we further direct all the State Governments/Union Territories to issue public notices in this respect in daily newspapers which have circulation in the coastal areas, informing the aquafarms regarding the hearing of these matters in this Court on 17-10-1995. This may be done on two consecutive days.

Notices and publication be completed within 3 weeks from today. Meanwhile, we direct all the State Governments/Union Territories not to give fresh licences/permission for setting up/establishment of any aquafarm in their respective territories till further orders."

5. Coastal pollution, universally, is an emerging problem. So far as India is concerned it has already become a serious environmental problem. Besides direct dumping of waste materials in the seas, discharge through marine out falls, large volumes of untreated or semi-treated wastes generated in various land-based sources/activities ultimately find way to the seas. The coastal waters directly receive the inland waters, by way of surface run-off and land-drainage, laden with myriad of refuse materials - the rejects or wastes of the civilisation. Apart from inputs from rivers and effluent outfalls, the coastal areas are subject to intensive fishing, navigational activities, recreations, ports, industrial discharge and harbours which are causative factors of water quality degradation to varying degrees. Contrary to the open sea, the changes in the quality of coastal waters, are much greater due to river discharges under tidal conditions.

6. With noticeable increase in marine pollution and the consequential decline in marine resources, serious concern was expressed in the United Nations' Conference on Human Environments in Stockholm (1972) attracting global attention towards the urgent need of identifying the critically polluted areas of the marine environments, specially in coastal waters, for urgent remedial actions. The Conference unanimously resolved that the littoral States should take early action at their national level for assessment and control of marine pollution from all sources and carry out systematic monitoring to ascertain the

efficacy of pollution regulatory actions taken by them. In the background of the Stockholm Conference and in view of 1982 Convention on the "Law of the Sea" defining jurisdiction of territorial waters, a model comprehensive Action Plan has been evolved under the United Nations' Environment Programme (UNEP). Keeping with the international commitments and in greater national interest, the Government of India and the Governments of the coastal States are under a legal obligation to control marine pollution and protect the coastal environment.

7. According to the facts placed on record by the Central Pollution Control Board (the Board) the coastline of India's mainland is about 6000 kms long. Out of the total landmass of about 3.28 million sq kms nearly 0.15 million sq kms of coastal land-belt (considering 25 kms landward distance) girdles three sides of the country's sea front which in turn underlays about 0.13 million sq kms seabed up to the territorial limit. The country being riverine, has 14 major, 44 medium and 55 minor rivers which discharge annually about 1566 thousand million cubic metres of water through land drainage into the seas transporting a wide range of pollutants generated by land-based activities. Nine out of fourteen major rivers meet the sea in the east coast (Brahmaputra through Bangladesh) and the remaining five in the west coast (Indus through Pakistan).

8. Besides land drainage, there are large number of marine coastal outfalls discharging directly or indirectly industrial and municipal effluents into the seas. Uncontrolled disposal of land-based waste into the seas, through rivers and effluent outfalls, is a major cause of pollution of coastal waters. There are nine coastal States and one Union Territory (UT) in India namely, Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Pondicherry (UT), Andhra Pradesh, Orissa and West Bengal. More than one-fourth of the total population of the country is settled in the coastal areas. The Board in the report regarding "Pollution Potential of Industries in Coastal Areas of India" dated November 1995 gives the following data regarding aquaculture farms :

> "The effluent generation from aquaculture farms in the east coast only, in absence of data on west coast farms, is to the tune of 2.37 million cubic metres per day, out of which Andhra Pradesh has the lion's share of about 2.12 million cubic metres per day. ... It may be noted that in all the States, in most cases, the effluent discharge is indirect (through estuaries, creeks, canals, harbours). It may also be noteworthy that the effluents from aquaculture farms are discharged directly/indirectly into the coastal waters practically without any treatment. For disposal of solid waste, on the other hand, open dumping and land filling is a common practice."

9. In marine pollution control utmost importance has to be given to the beaches. The beaches and other areas of special interest, are to be maintained aesthetically and at permissible levels of enteric bacteria. Protection of ecologically sensitive areas and land-sea interface resource areas is equally important. The Central Board for the Prevention and Control of Water Pollution (Central Board) in its report "Coastal pollution control series COPOCS/1/1982" recommended as under :

"The mangrove forest at Pichavaram, the bird sanctuary and forest areas at Point Calimere and Coral reef at Mandapam are ecologically sensitive areas warranting special watch and preservation.

* Recreational coastal portions of some sectors of the stretch under investigation such as Marina and Elliot Beaches at Madras, Mahabalipuram, Pondicherry beach at Pondicherry and Poompuhar at the confluence of River Cauvery with the sea are to be maintained at appropriate quality level.

* Continuous monitoring of the coastal waters especially heavy metals and pesticides in the biota should be carried out to detect possible biomagnification of some toxic chemicals and to provide early warning."

The Central Board in its report "Coastal Pollution Control Series COPOCS/5/1986-87" sought protection of the ecologically fragile areas in the following terms :

"The mangrove forest and the wildlife sanctuary in Coringa Island, Pulicat Lake and the bird sanctuary at Nelapattu are the ecologically sensitive areas warranting special attention and protection. No industrial activity which may pose a danger to the ecosystem in these areas should be permitted.

At Pulicat Lake Area, Machilipatnam, Naupada and Ichchapuram, salt pan irrigation is practised. No water-polluting industry should be allowed nearby.

The domestic sewage and the industrial effluents entering Kolleru Lake through various drains be properly treated so that no pollutants enter the coastal waters through Upputeru drain."

10. Shrimps are basically marine. Shrimps are also called prawns. In commercial jargon, marine prawns are referred to as shrimps and freshwater ones as prawns. Prawns and shrimps are invertebrates and are decapod crustaceans. Sea is their home and they grow to adulthood and breed in the sea. The progeny start their life by drifting into estuaries and such other brackish water areas for feeding. In about 4-6 months the larvae grow into adolescence and go back to their real home of birth, the sea.

11. Aquaculture has been practiced for many centuries by small farmers and fisherfolk in Asia to improve their living conditions. However, there is a vast difference between the traditional methods and the new commercialised system. The traditional aquaculture, including shrimp, is usually small scale, using low inputs and relies on natural tidal action for water-exchange. In some countries, such as India, Bangladesh and Thailand, there is a tradition of rice/shrimp rotating, with rice-grown part of the year and shrimp and other fish species cultured the rest of the year. Chemicals, antibiotics and processed feeds are not used in the traditional method. In this low-yield, natural method, the harvest is small

but sustainable over long periods. It has no adverse effect on the environment and ecology. The modern method, on the other hand, is larger in scale and intensive or semi-intensive in nature. It is owned and operated by commercial and often foreign-owned companies which mainly export the shrimp. In intensive aquaculture, selected species are bred using a dense stocking rate. To maintain the very crowded shrimp population and attain higher production efficiency, artificial feed, chemical additives and antibiotics are used.

12. The Food and Agriculture Organisation (FAO) - an organ of United Nations Organisation (UNO) - published a report in April 1995 on a Regional study and workshop on the Environmental Assessment and Management of Aquaculture Development. Copy of the report has been placed on record by Mr Santosh Hegde, learned counsel for the State of Karnataka. India was one of the 16 countries who participated in the workshop. Dr K. Alagarswami, Director, Central Institute of Brackish Water Aquaculture, Madras presented a paper titled "the current status of aquaculture in India, the present phase of development and future growth potential", (hereinafter called Alagarswami Report). It has been published as an Annexure to the workshop-report published by the FAO. Para 5.1.2 of Alagarswami Report gives various types of technologies adopted by the aquaculture industry in India. It would be useful to reproduce the same hereunder :

> "5.1.2. Types of technology - Changes in technology with time :
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> Traditional : Practised in West Bengal, Kerala, Karnataka and Goa, also adopted in some areas of Orissa. Coastal low-lying areas with tidal effects along estuaries, creeks and canals; impoundments of vast areas ranging from 2-200 ha in size. Characteristics : fully tidally-fed; salinity variations according to monsoon regime; seed resource of mixed species from the adjoining creeks and canals by auto-stocking; dependent on natural food; water intake and draining managed through sluice gates depending on local tidal effect; no feeding; periodic harvesting during full and new moon periods; collection at sluice gates by traps and by bag nets; seasonal fields alternating paddy (monsoon) crop with shrimp/fish crop (inter monsoon); fields called locally as bheries, pokkali fields and khazan lands.
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> Improved traditional : System as above but with stock entry control; supplementary stocking with desired species of shrimp seed (P. monodon or P. indicus); practised in ponds of smaller area 2-5 ha.
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> Extensive : New pond systems; 1-2 ha ponds; tidally fed; no water exchange, stocking with seed; local feeds such as clams, snails and pond-side prepared feed with fishmeal, soya, oilcake, cereal flour etc.; wet dough ball form; stocking density around 20,000/ha.

Modified Extensive : System as above; pond preparation with tilling, liming and fertilisation; some water exchange with pumpsets; pellet feeds indigenous or imported; stocking density around 50,000/ha.

Semi-intensive : New pond systems; ponds 0.25 to 1.0 ha in size; elevated ground with supply and drainage canals; pond preparation methods carefully followed; regular and periodic water exchange as required; pond aerators (paddle wheel) at 8 per ha; generally imported feed with FCR better than 1:1.5 or high energy indigenous feeds; application of drugs and chemicals when need arises; regular monitoring and management stocking density 15-25/m [(1996) 3 SCC 212 : JT (1996) 2 SC 196].

Intensive : Ponds 0.25-0.50 ha in size; management practices as above; 4 aerators in each pond; salinity manipulation as possible; central drainage system to remove accumulated sludge; imported feed; drugs and chemicals used as prophylactic measures; strict control and management; stocking density 20-35/m [(1996) 3 SCC 212 : JT (1996) 2 SC 196].

Changes in technology : As already indicated, the initial concept and practice was to develop tide-fed systems. This slowly gave way to pump-fed systems. Presently, the emphasis is on sea water based farming systems for P. monodon with a water intake system extending far into the sea with submerged pipelines, pier system and gravity flow. From sandy clay soils, the present coastal farms are located in sandy soils also with seepage control provisions."

Alagarswami Report further states as under :

"The Ministry of Environment and Forests, Government of India, issued a Notification S.O. No. 114(E) in 1991, under 'the Environment (Protection) Act, 1986' declaring coastal stretches as Coastal Regulation Zones (CRZ) and regulating activities in the CRZ. This Notification has implications for coastal aquaculture, particularly those activities within 500 m from the High Tide Line .... No regulations to control the use of chemicals and drugs exist, Pollution Control Board general regulations on effluent discharges include hazardous substances, but they are not specific to aquaculture. In some regions, there is indiscriminate use of chemicals and pesticides, particularly in shrimp farms .... Under the Notification of Union Ministry of Environment and Forests, each maritime State is expected to have its own coastal zone management plan, which would consider aquaculture zonation requirements, along with shoreline development. The zone up to 500 metres from the waterline along the sea is restricted against any construction activity."

13. Alagarswami Report highlights various environmental and social problems created by coastal aquaculture. The relevant part of the report is as under :

"Physical factors

Shrimp farming along the coastal area of the whole country is developing at a rapid rate. Huge cyclone protection dykes and peripheral dykes are constructed by the shrimp farmers. In many cases as in Kandleru creek (Andhra Pradesh), the farm areas are the natural drainage areas for floods. Due to physical obstruction caused by the dykes, the natural drain is blocked and flood water accumulates in the hinterland villages. Protests are being made by people in some of the village against such dykes. The ponds are constructed right on the bank of the creeks without leaving any area for draining of flood water.

Right of passage of coastal fishermen

The shrimp farms do not provide access to the beach for traditional fishermen who have to reach the sea from their villages. As farms are located and entry is restricted, the fishermen have to take a longer route to the sea for their operations. This is being objected to by traditional fishermen.

Drinking water problems

The Corporate sector has purchased vast areas adjoining the villages which, in some cases, include drinking water public wells of the villages. The villagers cannot use these wells anymore as they are located in private land owned by the farmers. This is causing social problems.

Salinisation

It is reported that salinisation of land is spreading further landwards and the wells yield only saline water. In Tamil Nadu and Andhra Pradesh protests have been voiced against salinisation. Some of the socially conscious shrimp farm operators are providing drinking water to the affected villages by laying a pipeline from their own freshwater source wherever available. Apart from wells, the agricultural farms adjoining the shrimp farms are reported to be affected. However, there is increasing conversion of paddy fields as in the Bhimavaram area of Andhra Pradesh and even on the fringes of Chilka Lake into shrimp farms.

Mangrove areas

The status report on mangroves of India published by the Ministry of Environment and Forests (GOI, 1987) is shown in Table 5. In the earlier years, vast areas of mangrove were destroyed for agriculture, aquaculture and other uses. In the more recent years, the mangroves have been protected by law. However, the satellite imagery pictures show destruction

> of mangroves in Krishna and Guntur Districts of Andhra Pradesh for construction of shrimp farms. Gujarat State is planning major shrimp culture programmes in the Narmada region adjoining Gulf of Cambay. Protection of mangroves should receive attention."

14. Alagarswami Report further indicates that the demand for shrimp seed is growing with the expansion of shrimp culture and hatchery production is unable to meet it. Exploitation of natural seed resources is growing unabated, particularly in West Bengal, Orissa and Andhra Pradesh. Large quantity of fry by catch are discarded by the fry collectors because their value is insignificant. The report states "elimination of fry in the fry by catch is not only detrimental to the predators thriving on them, but it also creates an ecological imbalance".

15. Agitations by the environmentally conscious people of the coastal areas against polluting aquaculture technologies has been noticed by Alagarswami Report as under :

> "People's awareness
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> People in general have become aware of the environmental issues related to aquaculture. A current case in point is the agitation against a large commercial farm coming up in Chilka Lake (Orissa). People have demanded an EIA of the project. People in Nellore District in Andhra Pradesh have raised environmental issues and called for adoption of environmental-friendly technologies and rejection of 'imported' technologies from regions which have suffered environmental damage. Protests have been voiced by the local people in Tuticorin area in Tamil Nadu. Both print and visual media take up environmental issues with a great deal of zeal. This appears to augur well for regulating coastal shrimp farming with eco-friendliness."

16. The intensive farming technique and the pollutants generated by such farming have been noticed by Alagarswami in the following words :

> "In intensive farming, stocking densities are on the increase. In one instance, P. indicus was stocked at 70 post larvae/m2 [(1996) 3 SCC 212 : JT (1996) 2 SC 196], almost reaching the levels of Taiwan before the disease outbreak in 1988. This necessitates heavy inputs of high energy feeds, the use of drugs and chemicals and good water exchange. The organic load and accumulation of metabolites in the water drained into the sea should be very high as could be seen from the dark-brown colour and consistency of the drain water."

17. The Alagarswami Report further states that paddy fields are being converted to shrimp farms, as in some parts of Andhra Pradesh (e.g. Bhimavaram). Some paddy lands along the fringe of Chilka Lake have been lost to shrimp farming.

18. The report suggests future management strategies - quoted hereunder - for farms and Government in resolving any conflicts or environmental problems :

> "As shrimp farming is developing fast, the following strategies have been developed for avoiding problems which have arisen in other countries (or reducing their impact) :
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> 1. India needs to boost production of shrimp through aquaculture with environment and development as a unified motto.
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> 2. Since the area available is vast, this can be achieved by application of environmentally-friendly technologies for optimal production rates against maximum production rates.
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> 3. Sustainable development or shrimp aquaculture should be guided by the principles of social equity, nutritional security, environmental protection and economic development with a holistic approach to achieve long-term benefits.
>
> 4. New definitions and parameters of extensive, semi-intensive and intensive culture systems as suited to Indian conditions and Government policies rather than copying models of other countries (particularly those which have rushed and suffered) and the development of guidelines thereof.
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> 5. Diversification of species among shrimps and to integrate fish wherever possible to suit the different agro-climatic and aquatic zones of the country.
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> 6. Careful development of Coastal Zone Management Plans under CRZ to meet the requirements of coastal aquaculture development plans with some flexibility (as required) for specific areas.
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> 7. Identification of aquaculture zones or careful consideration and provision of buffer zones against possible impact on other land uses; also intermediate buffer zones within aquaculture zones.
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> 8. Consideration of the living, social and vocational needs of local people in villages/towns in aquaculture plans in order to avoid conflicts.
>
> 9. Development of sets of regulations on use/ban of drugs and chemicals, including antibiotics in hatcheries and farms; on abstraction of groundwater and salinisation problems.
>
> 10. Development of standards for effluent discharge as applicable to local conditions.

11. Development of viable technologies for secondary aquaculture to gainfully utilise nutrient enriched farm effluents and encourage farmers to adopt such technologies with the necessary support.

12. In view of the fact that coastal farms are located generally in remote areas and cannot be monitored by external agencies on a reasonably effective basis, farmers/group of farmers should equip themselves with facilities to monitor possible important parameters at periodic intervals and maintain such records for their own benefits and for production to inspecting agencies.

13. Brackish Water Fish Farmer Development Agencies to be strengthened in all respects, including environmental management and disease diagnosis, prevention and control, through appropriate training and setting up district level laboratories for essential analytical and diagnostic work.

14. Manpower development at managerial and technical level.

15. Research-extension-farmer group meet for appropriate technologies and feedback.

16. Effective monitoring and enforcement of regulations, use of nets and fishing in any specified water for a period not exceeding two years. Thus, legal provisions were made on fisheries matters in India nearly a century ago."

19. Alagarswami's Report identifies salinisation of land, salinisation of drinking water wells, obstruction of natural drainage of flood water, passage of access to sea by fishermen and public, self-pollution of ponds, pollution of source water, destruction of mangroves, land subsidence and pressure on wild seed resources and consequences thereof as environmental issues in shrimp culture. Para 6.2 of the report lists the following preventive measures :

"6.2 PREVENTION

(i) Aquaculture units causing harmful changes to the environment; and

(ii) Non-aquaculturists from modifying the environment to the detriment of aquaculture production units.

1. Enforcement of legal provisions under the relevant Acts of the Government.

2. CRZ regulations to consider specific needs of aquaculture as an expanding production activity and the Coastal Zone Management Plans of

the States/Union Territories to carefully plan taking into consideration present situation and future needs.

3. Early development of regulations on permissible levels of most significant parameters of water quality keeping in view the limited intervention of aquaculture for promoting growth of stock in the medium.

4. Environment Impact Assessment (EIA) and Environmental Monitoring Plan (EMP) to be insisted upon for larger units and self-assessment/monitoring for smaller units, subject to verification at inspection.

5. Zonations and appropriate siting of farms; not to proliferate indiscriminately but to develop in a planned manner for sustaining production (Alagarswami, 1991).

6. More hatcheries to be encouraged and supported to meet seed demands to reduce pressure on wild seed resources.

7. Feed mills to maintain quality of feeds and to ensure water stability as required; self/external inspection mechanism to be introduced to maintain specific standards.

8. Mangrove forests not to be touched for aquaculture purposes."

The FAO Report - based on Alagarswami Report - states the impact of aquaculture on the environment, in India, as under :

"The impact of aquaculture on the environment are as follows :

By shrimp culture : Loss of agricultural land and mangroves, obstruction of natural drains, salinisation, destruction of natural seed resources, use of drugs and chemicals, and extraction of groundwater. Social conflicts have arisen."

20. Alagarswami Report - quoted by us extensively - is an authentic document relating to the functioning of shrimp culture industry in India. It has rightly been suggested in the report that sustainable development should be the guiding principle for shrimp aquaculture. The industry must develop under the unified motto of Environment and Development. Environmentally - friendly technologies are to be adopted with a view to achieve optimal production. The report calls for a ban on the use of drugs, chemicals and antibiotics in the shrimp culture farms. The report clearly indicates that except the traditional and improved traditional, the other methods of shrimp aquaculture are polluting and as such may have an adverse impact on the environment.

21. Mr M.C. Mehta, learned counsel for the petitioner, has taken us through the NEERI Reports and other voluminous material on the record. He has vehemently contended that the modern - other than traditional - techniques of shrimp farming are highly polluting and are detrimental to the coastal environment and marine ecology. According to him only the traditional and improved traditional systems of shrimp farming which are environmentally friendly should be permitted. Mr Mehta has taken us through the Notification dated 19-2-1991 issued by the Government of India under Section 3 of the Environment (Protection) Act, 1986 (the Act) (CRZ Notification) and has vehemently contended that setting up of shrimp farms of the coastal stretches of seal, bays, estuaries, creeks, rivers and backwaters up to 500 metres from the High Tide Line (HTL) and the line between the Low Tide Line (LTL) and the HTL is totally prohibited under para 2 of the said notification. The relevant part of the Notification No. S.O. 114(E) dated 19-2-1991 is as under :

> "2. Prohibited Activities. - The following activities are declared as prohibited within the Coastal Regulations Zone, namely :
>
> (i) setting up of new industries and expansion of existing industries, except those directly related to waterfront or directly needing foreshore facilities;
>
> (ii) manufacture or handling or storage or disposal of hazardous substances as specified in the Notifications of the Government of India in the Ministry of Environment and Forests No. S.O. 594(E) dated 28-7-1989, S.O. 966(E) dated 27-11-1989 and G.S.R. 1037(E) dated 5-12-1989;
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> (iii) setting up and expansion of fish-processing units including warehousing (excluding hatchery and natural fish drying in permitted areas);
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> # * * *##
>
> (v) discharge of untreated wastes and effluent from industries, cities, or towns and other human settlements. Schemes shall be implemented by the authorities concerned authorities for phasing out the existing practices, if any, within a reasonable time period not exceeding three years from the date of this notification.
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> # * * *##
>
> (viii) land reclamation, bunding or disturbing the natural course of sea water with similar obstructions, except those required for control of coastal erosion and maintenance or clearing of waterways, channels and ports and for prevention of sandbars and also except for tidal regulators, storm water drains and structures for prevention of salinity ingress and for sweet water recharge.

* * *##

(x) harvesting or drawal of groundwater and construction of mechanisms therefor with 200 m of HTL; in the 200 m to 500 m zone it shall be permitted only when done manually through ordinary wells for drinking, horticulture, agriculture and fisheries;

* * *"##

22. According to Mr Mehta the shrimp culture industry is neither "directly related to waterfront" nor "directly needing foreshore facility" and as such is a prohibited activity under para 2(i) of the CRZ Notification. Mr Kapil Sibal on the other hand has argued that a shrimp farm is an industry which is directly related to waterfront and cannot exist without foreshore facilities. Relying upon Oxford English Dictionary Mr Sibal contended that "waterfront" means land abetting on the sea, that part of a town which fronts on a body of water. According to him "foreshore" in terms of the said dictionary means the part of the shore that lies between the High Tide and the Low Tide. According to Webster's Comprehensive Dictionary, International Edn., the expression "foreshore" means "that part of a shore uncovered at low tide".

23. It is, thus, clear that the part of the shore which remains covered with water at the High Tide and gets uncovered and becomes visible at the Low Tide is called "foreshore". It is not possible to set up a shrimp culture farm in the said area because it would completely submerge in water at the High Tide. It is, therefore, obvious that foreshore facilities are neither directly nor indirectly needed in the setting up of a shrimp farm. So far as "waterfront" is concerned it is no doubt correct that a shrimp farm may have some relation to the waterfront in the sense that the farm is dependent on brackish water which can be drawn from the sea. But on a close scrutiny, we are of the view that shrimp culture farming has no relation or connection with the "waterfront" though it has relation with brackish water which is available from various water bodies including sea. What is required is the "brackish water" and not the "waterfront". The material on record shows that the shrimp ponds constructed by the farms draw water from the sea by pipes, jetties etc. It is not the "waterfront" which is needed by the industry. What is required is brackish water which can be drawn from any source including sea and carried to any distance by pipes etc. The purpose of CRZ Notification is to protect the ecologically fragile coastal areas and to safeguard the aesthetic qualities and uses of the sea coast. The setting up of modern shrimp aquaculture farms right on the sea coast and construction of ponds and other infrastructure thereon is per se hazardous and is bound to degrade the marine ecology, coastal environment and the aesthetic uses of the sea coast. We have, therefore, no hesitation in holding that the shrimp culture industry is neither "directly related to waterfront" not "directly needing foreshore facilities". The setting up of shrimp culture farms within the prohibited areas under the CRZ Notification cannot be permitted.

24. Para 2(viii) of the CRZ Notification quoted above, prohibits the bunding or disturbing the natural course of sea water with similar obstructions. A bund is an embankment or dyke. Alagarswami Report in para 4.3.2 (quoted above) has specifically mentioned that

huge cyclone protection dykes and peripheral dykes are constructed by the shrimp farmers. The report further states that due to physical obstruction caused by the dykes the natural drain is blocked and flood water accumulated in the hinterland villages. The report notices that the shrimp ponds are constructed right on the bank of the creeks without leaving any area for draining of flood waters. A shrimp farm on the coastal area by itself operates as a dyke or a bund as it leaves no area for draining of the flood waters. The construction of the shrimp farms, therefore, violates clause (viii) of para 2 of the CRZ Notification. In view of the findings by the Alagarswami Report it may be useful to hold an inquiry/investigation to find out the extent of loss occurred, if any, to the villages during the recent cyclone in the State of Andhra Pradesh because of the dykes constructed by the shrimp farmers.

25. Annexure 1 to the CRZ Notification contains regulations regarding Coastal Area Classification and Development. The coastal stretches within 500 m of HTL of the landward side are classified into four categories, namely, CRZ-I, CRZ-II, CRZ-III and CRZ-IV. Para 6(2) of the CRZ Notification lays down the norms for the development or construction activities in different categories of CRZ areas. In CRZ-III Zone agriculture, horticulture, gardens, pastures, parks, playfields, forestry, and salt manufacture from sea level may be permitted up to 200 m from the high tide line. 'The aquaculture or shrimp farming has not been included as a permissible use and as such is prohibited even in this zone. A relevant point arises at this stage. Salt manufacturing process like the shrimp culture industry depends on sea water. Salt manufacturers can also raise the argument that since they are wholly dependent on sea water theirs is an industry "directly related to waterfront" or "directly needing foreshore facilities". The argument stands negatived by inclusion of the salt manufacturing industry in CRZ-III Zone under para 6(2) of the CRZ Notification otherwise it was not necessary to include the industry therein because it could be set up anywhere in the coastal regulation zone in terms of para 2(1) of the CRZ Notification. It is thus obvious that an industry dependent on sea water cannot by itself be an industry "directly related to waterfront" or "directly needing foreshore facilities". The shrimp culture industry, therefore, cannot be permitted to be set up anywhere in the coastal regulation zone under the CRZ Notification.

26. We may examine the issue from another angle. Sea coast and beaches are a gift of nature to the mankind. The aesthetic qualities and recreational utility of the said area has to be maintained. Any activity which has the effect of degrading the environment cannot be permitted. Apart from that the right of the fishermen and farmers living in the coastal areas to eke their living by way of fishing and farming cannot be denied to them. Alagarswami Report states that "the shrimp farms do not provide access to the beach for traditional fishermen who have to reach the sea from their villages. As farms are located and entry is restricted the fishermen have to take a longer route to the sea for their operation. This is being objected to by traditional fishermen."

27. The Alagarswami Report further highlights drinking water problem, salinisation and destruction of mangrove by the shrimp culture industry. The relevant paragraphs have already been quoted above. The increase of stocking densities, heavy inputs of high energy feeds use of drugs and chemicals result in the discharge of highly polluted

effluents into the sea, creeks etc. and on the sea coast by the shrimp farms. It is, therefore, not possible to agree with Mr Sibal that commercial shrimp farming has no adverse effect on environment and coastal ecology.

28. We may at this stage refer to the two investigation reports dated 23-4-1995 and 10-7-1995 by NEERI regarding the ecologically fragile coastal areas of India.

29. The report dated 23-4-1995 stated that a 13-member team of scientists, led by Dr A.S. Bali and Dr S.K. Kaul inspected the shrimp farms situated on the ecologically fragile coastal areas in the States of Andhra Pradesh and Tamil Nadu between 10-4-1995 and 19-4-1995. It is further stated that the coastal areas in the Union Territory of Pondicherry were also inspected by the team. Regarding the CRZ Notification, the report states as under :

> "The MEF's notification dated 19-2-1995 stipulates that the aquaculture farms on the coastal areas should not be constructed within 500 m from the high tide tine (HTL) of the seas. The hatcheries, however, may be constructed between 250 m and 500 m from HTL of the sea.
>
> The inspection team observed during field investigations that the MEF's norms for location of aquaculture and hatcheries have been violated in the States of Andhra Pradesh, Tamil Nadu, and the Union Territory of Pondicherry. ... There is an urgent need to ensure scrupulous implementation of the provisions made in the MEF's notification dated 19-2-1991 in the States and Union Territory inspected by the team. In addition, the damage caused to the land and water ecosystems by coastal aquaculture activity, as detailed in the report, must be restored to its original ecological state. The cost for eco-restoration of the coastal fragile area must be borne by individual entrepreneurs of the coastal aquaculture farms in keeping with the Polluter Pays principle. ... Further, no activity of commercial coastal aquaculture should be undertaken even beyond 500 m HTL unless a comprehensive and scientific Environmental Impact Assessment (EIA) Study has been conducted by the entrepreneur, and the Environmental Management Plan approved by the respective State Department of Environment, Pollution Control Board, Shore Development Authority, and also by the Ministry of Environment and Forests. Appropriate terms of reference for EIA have been incorporated in the report."

Regarding the socio-economic assessment of aquaculture in the area, the report gives the following finding :

> "A socio-economic assessment of aquaculture in the ecologically fragile coastal areas in the States of A.P. and T.N. has been conducted by the NEERI team. This assessment, detailed in the report, indicates that the

cost of ecological and social damage far exceeds the benefits that accrue out of coastal aquaculture activities."

The adverse impacts of aquaculture farming on the environment and the ecologically fragile areas in the States of Andhra Pradesh, Tamil Nadu and Union Territory of Pondicherry have been stated in the report as under :

"3.0 Observations on the Impacts of Aquaculture Farming on Ecologically Fragile Areas in States of A.P., T.N. and Union Territory of Pondicherry :

Coastal aquaculture units are situated within 500 m of High Tide Line of the sea. This is not in consonance with the MEF's notification dated 19-2-1991.

It is a common practice to convert agricultural land, and land under salt production, into coastal aquaculture units which infringes the fundamental rights to life and livelihood.

Conversion of agricultural farms and salt making lands into commercial aquaculture farms is rampant in the fragile coastal areas of Andhra Pradesh, Tamil Nadu and Union Territory of Pondicherry.

Brackish aquaculture units have been installed in deltaic regions which is an ecologically unsound practice.

Natural saline canals which travel from sea to the mainland are being used for brackish aquaculture farming. The flow of the natural saline canals is being obstructed due to prawn farming activity which has resulted in the spread of brackish water over agricultural farms resulting in loss of agricultural lands, and potable water.

Villages situated along the sea coast, deltaic regions, and natural saline canals are under threat due to diversion of land to aquaculture farms.

Traditional fishermen have lost their landing grounds for fish catch.

Coastal aquaculture has resulted in loss of mangrove ecosystems which provide protection against cyclones and other natural hazards, and which provide natural habitat for spawning of marine biota. Indiscriminate destruction of mangrove areas in and around the creeks, estuaries, and sea has resulted in loss of natural breeding grounds for shrimps.

Natural Casuarina plantations have also been destroyed. This may result in increasing damage from cyclones and intrusion of saline water into the mainland.

Coastal aquaculture farms have not been scientifically designed and located, resulting in excessive ecological damages.

No proper peripheral drainage has been provided around the aquaculture farms.

The saline water intake and effluent discharge points from aquaculture farms are located in close vicinity, resulting in contamination of feed water to the aquaculture units threatening their productivity.

Three types of saline water supply systems are in vogue for the aquaculture farming, viz.

- direct pumping from the sea, creek, and estuary,

- direct pumping from deep sea with jetties,

- using high tides of sea for carrying saline water through excavated canals.

These activities for feed water supply to the aquaculture ponds have resulted in :

- loss of fish catch (except in the case of feed water supply through sea water canal system),

- loss due to damage of fishing nets,

- degradation of fragile coastal land.

Large commercial aquaculture farms have installed fencing in and around the farms resulting in blockage of free access for the fishermen to the seashore.

The wastewater discharge from the aquaculture farms released into the creeks is not properly flushed out of the creek during low tides thereby leads in the accumulation of pollutants in the creek, affecting the quality of intake water to aquaculture farm with concomitant loss in productivity, and damage to creek ecosystem.

Disappearance of the native fish species due to increase in salinity of the creek water has been observed by the team and reported by the fishermen. Increase in salinity has also reduced the ingress of shrimp seedlings in the creek.

Indiscriminate catch of natural shrimp seedlings from the coastal waters, creeks and estuaries has resulted in reduction of their availability, which in turn has forced the commercial aquaculture farmers to import the seeds.

Unscientific management practices adopted by the commercial aquaculture farmers and improper design of aquaculture farms including inadequate drainage systems have resulted in skin, eye, and water-borne diseases in the contiguous population.

Commercial aquaculture farm owners have not contributed to any social infrastructure facilities for the villagers.

Employment avenues of the contiguous population have considerably reduced due to the commercial aquaculture farming. The unemployed villagers are seeking employment in nearby towns and cities.

Owners of the commercial aquaculture farms are using various means to encroach upon the government lands and also forcing the agricultural landowners/salt-making villagers to sell their lands. In addition, the fishermen are also being forced to migrate to other coastal areas."

Regarding the socio-economic status of the ecologically fragile coastal areas in the States of Andhra Pradesh and Tamil Nadu, the report states as under :

"During the inspection of the aquaculture units located on the Ecologically Fragile Coastal Areas of A.P. and T.N., the inspection team collected data and information and discussed the issues related to socio-economic status of the affected people with the farmers, fishermen, NGOs and government officials.

The basic socio-economic issues are presented in Table 4.1 which also lists the parametric values in the assessment of the damage caused by the aquaculture units located in the Ecologically Fragile Coastal Areas. Tables 4.2 and 4.3 present the socio-economic assessment of aquaculture in the Ecologically Fragile Coastal Areas of the States of A.P. and T.N.

Tables 4.2 and 4.3 bring forth that the damage caused to ecology and economics by the aquaculture farming is higher than the earnings from the sale of coastal aquaculture produce."

30. The NEERI has, thus, given a positive finding that the damage caused to ecology and economics by the aquaculture farming is higher than the earnings from the sale of coastal aquaculture produce. The finding is based on the assessment keeping in view fourteen parameters listed in Tables 4.2 and 4.3 regarding the States of Andhra Pradesh and Tamil Nadu respectively. The parameters taken into consideration are land, equivalent wages for the farmers to be earned, equivalent amount of agricultural produce (rice, husk), loss

due to cutting of Casuarina in terms of fuel, loss in terms of grazing grounds, loss involving diseases, loss caused by cyclones due to cutting of Casuarina forests, loss due to desertification of land, loss in terms of potable water, total loss due to mangrove destruction, loss in fishing income, loss due to damage of fishing nets and man-days lost due to non-approachability to sea coast. These losses are computed in money and are then compared with the total earnings from the sale of coastal aquaculture produce. On the basis of the assessment of socio-economic status of aquaculture in a systematic manner the NEERI has reached the conclusion that the damage caused to ecology and economics by the aquaculture farming is higher than the earnings from the sale of coastal aquaculture produce. Paras 6.1, 6.2 and 6.3 of the report clearly show the environmental degradation caused by the shrimp culture farming by its adverse impact on surface water, contamination of soil and groundwater and destruction of mangrove vegetation. The said paragraphs are reproduced hereunder :

> "6.1 Impact on Surface Waters
>
> Mangrove vegetation is important in protecting marine and terrestrial ecosystem. This vegetation is also important as it removes the pollutants like carbon, nitrogen, phosphate and other nutrients, as also certain toxic compounds. The importance of mangrove plants especially Vettivera zaizonoids is known in reducing the impact of pollution due to discharge of aquaculture pond effluents, and the Cauvery Delta farmers are now propagating the cultivation of this species in estuaries. Mangrove vegetation also acts as a barrier of floods and provides spawning grounds and nesting places for fishes; it also supports avian fauna (birds) thus maintaining the natural ecosystem.
>
> The observations on the water quality in the aquaculture ponds show that the pond water harbours a dense algal bloom compared to the water in estuaries, creeks or sea indicating eutrophic nature of pond effluent. When water in large volumes, from the ponds is discharged during flushing of ponds, in a creek or estuary, the pollutants remain stagnated in the estuary or near sea coast due to the typical tidal activity in creeks. As a result, the raw water source to the ponds gets contaminated in course of time. The wastewater discharge from the ponds warrant proper treatment before discharge. Uncontrolled discharge of wastewater triggers a series of deleterious impacts, e.g.
>
> * With the increase in eutrophication levels, there is a shifting in dominance of phytoplankton flora in pond effluents from diatoms to blue-green algae. Decomposition of dead blue-green algae may lead to the generation of toxic substances, e.g., ammonia, hydrogen sulphide etc. Further, some of the blue-greens also excrete biotoxins in large quantities which are toxic to aquatic animals, i.e., prawns in ponds or fishes in estuaries or coastal waters. Large amount of blue-green algae was recorded by the inspection team in Sirkali area (e.g. S&S Industries &

Enterprises Ltd; High Tide Sea Farms) and Killai area (Aqua Gold Shrimp Farm; MRV Aquafarm; Mohi Aquafarm). The presence of Oscillatoria, Microcystis and some other filamentous blue-green algae is undesirable in the pond effluent as they choke the gills of fishes.

* The suspended solids released from the ponds are laden with unconsumed food and other organic contaminants. Accumulation of these organics in the intake water creates problems in the intake water quality when the intake and discharge points are in close proximity.

6.2 Contamination of soil and groundwater

The shrimp farms are constructed well above the ground levels. Seepage of pond effluents in the surrounding fields was noted by the inspection team in a number of farms. Seepage of pond effluent deteriorates the soil quality in the adjoining aquacultural fields. It has also contaminated potable water in surrounding villages.

Deterioration of groundwater quality in villages that are over one km away from the pond sites was not noticed. This observation is based on analysis of borewell water at three sites by the inspection team. This observation justified the locational constraints on aquaculture farms in coastal areas.

6.3 Destruction of mangrove vegetation

The inspection team noticed destruction of mangrove vegetation at most of the prawn farming sites for the development of shrimp farms.

Significant destruction of mangrove forests was observed near the Aqua Gold Shrimp Farm at Village Vellar in Killai Taluk of South Arcot District similarly on Pichavarum estuary in Village Pichavarum in Killai Taluk of South Arcot District of T.N., the shrimp farms are constructed by clearing mangrove vegetation. Mangrove vegetation in Kuchipalam Village is also facing threat due to the expansion of prawn farming activity.

The final conclusions and recommendations are in para 6 of the NEERI Report which is as under :

"8.0 Conclusions and Recommendations on the attenuation of the Impact of Aquaculture Farming on Ecologically Fragile Areas in States of A.P, T.N., and Union Territory of Pondicherry :

Socio-economic assessment of aquaculture in the ecologically fragile areas in the States of A.P. and T.N. reveals that the cost of ecological and social

damage far exceeds the benefits that accrue out of the coastal aquaculture activities.

The MEF's norms for location of aquaculture and hatcheries have been violated in the States of A.P., T.N. and Union Territory of Pondicherry.

The current practice of installation of coastal aquaculture farms within 500 m HTL violates the fundamental rights and livelihood of people in the States of A.P and T.N., and the Union Territory of Pondicherry.

The State of A.P. has adopted twenty-point guidelines as ad hoc measures for management of aquaculture in the district of Nellore. These guidelines have not been made mandatory in the State of A.P. as a whole. Also, these guidelines do not address all socio-economic, and ecological aspects of coastal habitats.

The State Government of T.N. has enacted a Bill to provide for the regulation of coastal aquaculture on 10-4-1995. This Bill is not in consonance with the MEF's notification dated 19-2-1991 as it allows the construction of aquaculture units within 500 m of HTL of the sea.

The cost of eco-restoration of the coastal fragile area must be borne by the individual entrepreneur of the commercial aquaculture farms in keeping with the Polluter Pays Principle.

No commercial coastal aquaculture activity should be undertaken even beyond 500 m HTL unless a comprehensive and scientific environmental impact assessment (EIA) study has been conducted by the entrepreneur, and the environment management plan (EMP) approved by the respective State Department of Environment, Pollution Control Board, Shore Development Authority, and also by the Ministry of Environment and Forests.

Agricultural lands are being converted into commercial aquaculture farms, which causes unemployment to the landless labourers and also in loss of cultivable land.

Commercial aquaculture farms are being installed near the cultivated lands and the salt water from the farms damages the productivity of the adjoining lands.

Groundwater also gets contaminated due to seepage of impounded water from the aquaculture ponds.

Desertification of cultivable land is on the increase due to salinity intrusion.

Due to commercial aquaculture farms, there is a loss of

* mangrove ecosystems

* casuarina plantations

* grazing grounds for cattle

* potable water to contiguous population

* fish catch

* fishing nets

* agricultural produce

* manpower loss due to non-approachability of fishermen to seashore directly.

There is a perceptible increase in the diseases of skin and eye, and water-borne diseases in the contiguous population.

The designs of the aquaculture farms are inadequate. No provision has been made for wastewater treatment facility enabling recycling and reuse of wastewater.

Prohibition on conversion of agricultural lands and salt farms into commercial aquaculture farms must be enforced with immediate effect.

No groundwater withdrawal must be allowed for aquaculture purposes.

Free access through aquaculture unit to the sea coast must be provided to the traditional fishermen.

No aquaculture farm based on brackish water should be installed on inland brackish water bodies.

Wild seed collection from creek and sea must be prohibited. Seed must be procured from hatcheries. If seed collection is noticed it must immediately be seized and dumped back into the creek.

An eco-restoration fund must be created by collecting the stipulated fees from the owners of aquaculture farms. In addition, one per cent of total export earnings per annum must also be collected from commercial aquaculture farm owners and used for rejuvenation of coastal ecosystem with special reference to plantation of mangroves and common

ecosensitive zones. The wastewater treatment system with reuse and recycle must be installed by all units. The smaller units can form a cooperative and treat their water through common effluent treatment plant. The aquaculture units must be closed down if the wastewater treatment system is not functioning to its design efficiency."

31. The second NEERI Report dated 10-7-1995 states that a 19-member team of scientists led by Dr A.S. Bali and Dr S.N. Kaul inspected the shrimp farms situated on the ecologically fragile coastal areas in the States of West Bengal, Orissa, Kerala, Karnataka, Goa, Maharashtra, and Gujarat during 20-5-1995 and 10-6-1995. The summary of salient comments in the report regarding aquafarming in the State of West Bengal is as under :

* Organic pollution in creeks and estuaries with respect to BOD;

* microbiological deterioration of water quality;

* accumulation of organic carbon and heavy metals in the sediments of shrimp farms;

* Shanon Weaver index values less than 3 indicate organic contamination;

* borewell water characteristics near M/s Index Port Ltd., Sarberia, Basanti, North 24-Parganas; show intrusion of salinity in drinking water source;

* conversion of land and traditional fish farm at M/s Index Port Ltd., North 24-Parganas;

* conversion of land, traditional fish farm and mangrove plantation at M/s Sundarban Aquatics, South 24-Parganas;

* violation of CRZ regulations regarding high tide line (HTL) has taken place at M/s Sundarban Aquatics, South 24-Parganas. In addition, violations of CRZ for setting up the aquafarm on creeks have taken place at the following places :

- M/s Index Port Ltd., North 24-Parganas,

- M/s Sundarban Aquatics, South 24-Parganas,

- All shrimp farms developed by BWFD at Ramnagar, Midnapore."

The comments regarding the aquafarming in the State of Orissa by the NEERI team are as under :

"* Organic pollution in creeks and estuaries with respect to BOD;

* deterioration of microbiological water quality;

* accumulation of organic carbon and heavy metals in the sediments of shrimp farms;

* Shanon Weaver index values less than 3 indicate organic contamination;

* characteristics of borewell water samples near M/s Sundeep Aquatics, District Bhadrak and M/s Suryo Udyog Pvt. Ltd., District Balasore, show intrusion of salinity into drinking water;

* conversion of cultivable land for the establishment of aquafarms/hatcheries in all districts;

* violation of CRZ regulations by all aquafarms on creeks in the districts of Balasore and Bhadrak. Hatcheries have been constructed/under construction within 200 m of high tide line (HTL) in contravention of CRZ regulations."

The status of aquafarming in the State of Kerala as indicated in the NEERI Report is as under :

"The comments on aquafarming in the State of Kerala are presented in the footnotes of Tables 2.2.1.2 through 2.2.1.7. Summary of the salient comments is given hereunder :

* Organic pollution in river, creeks and estuaries;

* deterioration of microbiological water quality;

* accumulation of organic carbon and heavy metals in the sediments of shrimp farms;

* Shanon Weaver index values less than 3 indicate organic contamination;

* well water characteristics in the vicinity of M/s Agalapuzha Aquafarm, Kozhikode show the intrusion of salinity in drinking water source;

* conversion of land, and traditional fish farm by M/s Vasu Aquafarms at Kozhikode;

* conversion of land, traditional fish farm, and mangrove plantation by M/s West Coast Aquafarms Irinavu, Kannur;

* violation of CRZ regulations regarding the location of aquafarms on creeks has taken place at the following sites :

- M/s Consolidated Aquafarm, Poyya, Trissur.

- M/s Jaladhi Aquafarm, Cherchi.

- M/s Keetodiyal Aquafarm, Arookutty, Alleppey.

- M/s Mejovi Fisheries, Irinavu, Kannur."

The report further indicates the status of aquaculture in the State of Karnataka as under :

* "Organic pollution in river, creeks, and estuaries;

* Shanon Weaver index values less than 3 indicate organic contamination;

* well water characteristics in vicinity of M/s Raja Ram Bhat Aquafarm, Hanmav, Kumta show the intrusion of salinity in drinking water source;

* conversion of agricultural land into shrimp farms was observed at

- M/s Popular Aquafarm, Tallur, Kundapur

- M/s Raja Ram Bhat Aquafarm, Hanmav, Kumta

- M/s Shri Arya Durga Aquafarm, Karwar

* destruction of mangrove vegetation by M/s Popular Aquafarm, Tallur, Kundapur was observed by the inspection team;

* violation of CRZ regulations by aquafarms situated on the creek or Razadi River at Kundapur, Hanmav creek at Kumta, and Hgnashree creeks were noted by the inspection team."

The comments of the NEERI Report regarding aquafarms in the State of Goa are as under :

"* Organic pollution in river, estuary and discharges from ponds;

* Shanon Weaver index values less than 3 indicate organic contamination;

* well water characteristics in vicinity of M/s Govt. Prawn Farm, Choraho, indicate salinity intrusion;

* conversion of agricultural land into shrimp farm was observed by the inspection team at M/s Sky Pak Aquafarm Ltd., Paliyam, Goa;

* violation of CRZ regulations by all the aquafarms on the creeks, viz. Masem creek at Kankun, and Chahora at Pernem were observed by the inspection team."

Summary of the salient comments on aquaculture in the State of Maharashtra is as under :

"* Organic pollution in river, estuary and discharges from ponds;

* microbiological deterioration of water quality;

* accumulation of organic carbon and heavy metals in the sediments of shrimp farms;

* Shanon Weaver index values less than 3 indicate organic contamination;

* conversion of agricultural land into shrimp farms;

* violation of CRZ regulations regarding location of shrimp farms on creeks, viz. Dharamtar, Satpati, and Dahanu."

The comments regarding the State of Gujarat are as under :

* Organic pollution in river, estuary and discharges from ponds;

* destruction of mangrove and shrubs in the marine zone by M/s GFCCA, Onjal and M/s Sea Crest Pvt. Ltd., Mendhar;

* violation of CRZ regulations for setting up the shrimp farms on the creeks, viz. Kanai, Ambika and Purna."

Para 3 of the NEERI Report dated 10-7-1995 gives in detail the impact of aquaculture farming on ecologically fragile coastal areas of India :

"3.0 Observations on the Impacts of Aquaculture Farming on Ecologically Fragile Coastal Areas of India :

3.1 East Coast

* The shrimp farms at Ramnagar, Midnapur District are located right on the creek, and therefore, are not in consonance with the CRZ regulations.

* No wastewater/sediment treatment facilities exist at any of the aquaculture farms.

* No direct withdrawal of water from creek/estuary.

* No conversion of land has taken place except in cases of M/s Index Port Ltd., North 24-Parganas and M/s Sundarban Aquatic Farms Ltd., South 24-Parganas.

* Wild shrimp seedling collection by villagers including children is a common practice.

* M/s Index Port Ltd., North 24-Parganas has created the following problems :

- design of aquaculture farm is not proper, and no wastewater/sediment treatment facility exists in this shrimp farm;

- intensive mode of operation creates wastewater problems. Presently, there is no treatment facility existing for reuse and recycle of treated wastewater;

- deposition of clay in the intake water reservoir, and no proper mechanism exists for its disposal;

- seepage from the bunds create additional problems around the farm;

- inspection team observed that groundwater in the vicinity of this aquaculture farm has become saline;

- conversion of agricultural land, and traditional fishing farm;

- barbed wire fencing along the periphery of the farm has resulted in restriction to free access for the farmers, fishermen and cattle to the creek;

* M/s Sundarban Aquatic Farms Ltd., South 24-Parganas has created the following problems :

- conversion of agricultural land, traditional fish farming and mangrove plantation;

- the aquafarm is located below ground level. Therefore, it is difficult to assess the seepages from this farm unless peizometers are installed around the aquafarm;

- a well-designed sedimentation tank is being used as a wastewater treatment system. However, it is not adequate. Necessary arrangements have to be made for recycle and reuse of wastewater;

-no provision exists for treatment of sediments;

- the location of the aquafarm is not as per MEF notification dated 19-2-1991, keeping in view high tide line, and minimum distance from the creek.

The important areas of environmental concern regarding shrimp farming in the State of Orissa are :

WORLD BANK AIDED PROJECTS

Narendrapur, Bhadrak District

World Bank aided project comes within the National Park area. Therefore, it is desirable that this project proposal must be dropped. It was also informed to the inspection team that two private shrimp farms are in operation at present near the proposed World Bank Aided Project which must be closed immediately, in view of proximity of the National Park.

Beidipur, Bhadrak District

There are plans to construct large shrimp farms. It is necessary to mention that this area is profusely covered with wild seaweeds, which has direct relationship with the ecology of the marine biota. Keeping this aspect in view, a detailed EIA is required before finalising the development of shrimp farms in the area which must include private farms in the region.

In addition, there is a salt dyke which prevents the flow of sea water into the agricultural lands. It is worth mentioning that more than 50 shrimp farms, 1 ha, each have come up in this area. This leads to conversion of fertile agricultural lands into brackish water-based shrimp farming resulting in salinity, intrusion and desertification of land.

Jagatjore - Banapada, Kendrapara District

Construction work of shrimp farm is in progress. Mechanised systems for excavation, and construction are being used. In addition, inhabitants are prosecuted. There is a signpost "Trespassers will be prosecuted". It was informed to the inspection team by the nearby villagers that this place was used for agriculture. Farmers, fishermen, and cattle had free access to the nearby creeks. Now it has been limited to a large extent. In addition, the inspection team was informed about indiscriminate cutting of mangrove bushes around the area. This project must be reviewed critically keeping Bhitar Kanika Wild Life Sanctuary in view.

Local entrepreneurs have started small shrimp farms of about 1 ha each. This will cause waterlogging problems in the area. Finally, the high tide line (HTL) just touches the saline dyke. Therefore, World Bank project proposal and other shrimp farms fall within 500 m of HTL, and do not conform to the MEF's notification dated 19-2-1991.

Chilka Lagoon

The silt carried by two main rivers, viz. Daya and Bhargabi gets deposited in the lagoon. There is little exchange of water from the sea because the mouth of the lagoon (35 kms long) has been blocked by three factors, viz.

* silt

* improper mixing, and

* large clusters of shrimp farms hinder the passage of water into/out of the lagoon.

The bird sanctuary at Nalaban has also been affected by siltation and shrimp farming activities. 35 kms of the canal mouth of the lagoon needs immediate attention, because the exchange of sea water into and from the lagoon is vital from ecological considerations. In addition, deposited silt has to be removed. Shrimp farms must be closed down immediately to restore the Chilka Lagoon, to its original ecological condition by application of scientific management practices.

Subarnarekha Mouth

A large number of shrimp farms have come up on both sides of the lower reaches of the Subarnarekha river to utilise the tidal brackish water as observed by the inspection team. It was reported to the inspection team by local people that this has resulted in waterlogging in upper reaches of Subarnarekha River.

The inspection team observed that the shrimp farming is at least three times more than what has been presented by the State Government of Orissa.

All the shrimp farms do not observe the MEF notification dated 19-2-1991. The creek/estuarine water-based shrimp farms are also not observing the CRZ guidelines of MEF.

Agricultural land is being converted to shrimp farming because of Land Reform Act of Government of Orissa.

Artificial creeks are being constructed to allow high tides of creek/estuarine water into the large reservoir. In addition, this factor must result in flooding of low-lying areas.

Reservoirs act as a settling-cum-concentration basin. Therefore, it is necessary sometimes for the shrimp farmers to dilute this water by withdrawing groundwater, resulting in depletion of groundwater resources in the nearby villages. In addition, groundwater has become saline. This is confirmed by the situation in Adhuan Village in Bhadrak District.

The shrimp farming has resulted in several social problems viz.

- denial of free access to fishermen

- denial of job opportunities

- conversion of agricultural land to shrimp farming

- social displacement

- salination of groundwater

- reduction in grazing ground of cattle, and free access to creek/estuarine water.

Wild shrimp seedling collection is still in practice. This will have detrimental effect on the ecology of the sea, creek, and estuarine waterbodies.

Direct pumping from the creek/estuarine water system is being practised. This results in reduction of fish catch and must be stopped immediately.

No shrimp farm had any type of wastewater and sediment treatment systems including hatcheries.

All hatcheries are located within 200 m of the HTL in contravance of the MEF's notification dated 19-2-1991. It is necessary to stop the commissioning of all new hatcheries which are not being constructed as per CRZ regulations.

Intake points and wastewater discharge channels of the prawn farms are nearby. This is not a scientific water management of shrimp farms.

It has been observed by the inspection team that some shrimp farms have barbed wires along the periphery of project site, e.g.

- M/s Deep Sun Culture Pvt. Ltd.

- M/s Surya Udyog Pvt. Ltd.

- M/s Manas Prawn Farm

Therefore, there is no free access to creek and estuarine water for the fishermen and cattle.

3.2 West Coast

The shrimp farming activity in the west coast is mostly confined to the traditional extensive type of farming. Limited number of commercial shrimp farms having areas

more than 5 ha, working on the semi-intensive type have been installed in the coastal areas since last 3 years.

Though in limited numbers, prawn farms working on the semi intensive type specifically in the States of Karnataka, Maharashtra, and Gujarat are situated within 500 m of high tide line of the sea, which is not in consonance with MEF's notification dated 19-2-1991.

Incidence of conversion of agricultural land into coastal aquaculture units, which infringes the fundamental right to life and livelihood, could be noticed in States of Karnataka (Kumta Taluk), Maharashtra (Ratnagiri District and Palghar Taluk) and in Gujarat (Valsad District).

In States situated on the west coast of India brackish water aquaculture units have been mainly installed along the estuaries and river banks, where impounded backwater is being used for shrimp farming. Such practices of extensive type of farming may not have significant adverse impact on environment due to the fact that limited quantities of brackish water are required for recharging these ponds, and the wastewater generation is negligible. However, this practice of utilisation of backwaters will prove to be unsound if carried out for large-scale farms using semi-intensive type of farming.

Villages situated along the sea coast, and backwater zones, specifically at Gunda, Kumta and Karwar (Karnataka), Palghar and Dahanu (Maharashtra) and Valsad (Gujarat) are under threat due to conversion of land into aquaculture farms.

In the State of Karnataka, the inspecting team observed that M/s Murudeshwar Food and Export Ltd. prawn aquafarm units are located within 100 m of HTL.

The intake and discharge points of M/s Samudra Aquafarms and M/s Skyline Biotechnologies Pvt. Ltd., Kagil, Kumta are very close to each other which may create problems of contamination in the ponds. The prawns grown in these farms were reported to be affected by viral infection. Disposal of sediments from the ponds was also observed to be carried out on the side of the river.

It was also observed by the inspecting team in the State of Karnataka that aquafarm of M/s Rajaram Bhat Pvt. Ltd. at Honnavar in Kumta Taluk has been installed on the periphery of the village. The bunds constructed for making the ponds have obstructed the free flow of storm water, and domestic wastewater from the village to sea and this has created health hazards for the villagers. Intrusion of saline water in the soil was also observed, and reports on damage to coconut plantations in nearby areas were also received. Contamination of drinking water sources due to saline water intrusion was observed.

In the State of Karnataka, M/s Agnasana Aquafarm Pvt. Ltd. has come up adjacent to a school in Village Gunda, and the constructed bund of the pond touches the compound of the school. Seepage of saline water from the bund and subsequent damage to the foundation of the school building, and damage to coconut plants in nearby areas was

observed. Such practices of allowing the ponds to come up near residential and public utility places must be stopped immediately.

Coastal aquaculture has resulted in loss of mangrove ecosystems to a limited extent on the west coast. However, significant destruction mangroves could be noticed in the coastal areas of the districts of Karwar and Kumta (Karnataka), Palghar and Shrivardhan (Maharashtra), and Valsad (Gujarat). Since the mangrove ecosystems provide natural habitat for spawning of marine biota, the practice of indiscriminate destruction of mangrove ecosystem due to installation of shrimp farms must be stopped.

No proper peripheral drainage has been provided around the aquaculture ponds following semi-intensive mode of farming in the States of Kerala, Karnataka and Maharashtra, and the wastewater from the ponds was observed to be discharged into the receiving bodies without treatment.

The brackish water intake and effluent discharge points for the ponds are located in close vicinity resulting in contamination of feed water of the aquaculture units. The situation is predominant at Kumta (Karnataka), Palghar (Maharashtra) and Valsad (Gujarat) where a large number of medium and large aquafarms have been installed.

Since large number of medium and big farms have been installed on the coastal areas at places mentioned above, the wastewater discharged into the creeks and backwater zones is not properly flushed out during low tide, thereby, affecting the intakes water quality of aquaculture farms.

The situation in the State of Goa has not reached such an alarming situation as yet due to limited number of farms, and abundant quantities of backwater available in the riverine zones of Zuari and Mandavi rivers. However, future expansion of the shrimp farming practices warrant careful control, in view of tourism potential of the State.

Shrimp farming activity in the State of Gujarat is presently confined to the coastal areas of Valsad, Bharuch and Surat. Two large commercial shrimp farms are proposed to be installed in the Jamnagar district where salt farms are being operated currently. Sanctions for such installations warrant careful consideration to avoid damages to the highly ecosensitive coral reef zones near this coast."

The conclusions and recommendations as given in para 7 of the NEERI Report are as under :

> "7.0 Conclusions and Recommendations on the attenuation of adverse Impacts of Aquaculture Farming on Ecologically Fragile Coastal Areas :

7.1 East Coast

The shrimp farming activity in east coast is mostly confined to the traditional and extensive mode. However, a large number of commercial shrimp farms have started

functioning on modified extensive, semi-intensive and intensive modes since last three years.

The large-scale shrimp farms and hatcheries have violated CRZ a Notification of MEF dated 19-2-1991 in the States of West Bengal and Orissa.

Incidence of conversion of agricultural land into coastal aquaculture units which infringe upon the fundamental rights to life and livelihood were noticed particularly in the State of Orissa.

It is desirable to establish aquaculture farms on modified extensive mode. Semi-intensive and intensive mode of aquaculture must not be adopted in the States of West Bengal and Orissa.

Maintenance of quality of the feed, and stocking of healthy seed from the Government-approved hatcheries associated with appropriate water management practices warrants proper attention in the prawn farming activities of the coastal areas.

The proposed guidelines for shrimp farming in the State of West Bengal do not address all socio-economic and ecological status of coastal habitats.

The State of Orissa has not formulated any guidelines related to aquaculture practices.

The cost of eco-restoration of the coastal fragile area must be borne by the individual entrepreneurs of the commercial farms in keeping with the Polluter Pays Principle with specific reference to :

- Sundarban Mangrove/Littoral Forest, West Bengal

- Chilka Lagoon, Orissa

- Bhitar Kanika Wild Life Sanctuary, Orissa

- National Park, Orissa

- Subarnarekha Mouth, Orissa

No commercial coastal aquaculture activity should be undertaken even beyond 500 m HTL unless a comprehensive and scientific environmental impact assessment (EIA) study has been made by the entrepreneur and the environment management plan (EMP) approved by the respective State Department of Environment, Pollution Control Board, and also by the MEF.

Agricultural lands are being converted into commercial aquaculture, which causes unemployment to the landless labourers and also in loss of cultivable land.

Groundwater also gets contaminated due to seepage of impounded water from aquaculture farms.

Due to commercial aquaculture farms, there is a loss of :

- mangrove ecosystem

- grazing grounds for cattle

- potable water to contiguous population

- fish catch

- agricultural produce

- economic loss due to non-approachability of fishermen to creek, estuary and sea directly.

The designs of the aquaculture farms are inadequate. No provision has been made for wastewater treatment facility enabling recycling and reuse of wastewater in shrimp farms and hatcheries to minimise water exchange. In addition, there is a necessity to treat deposited sediments from the shrimp farms. Sediments can be converted into manure for land application after proper treatment.

Prohibition on conversion of agricultural land must be enforced with immediate effect.

Wild seed collection from creek, estuary, and sea must be prohibited. Seed must be procured from hatcheries.

An eco-restoration fund must be created by collecting the stipulated fees from the owners of aquaculture farms. In addition, one per cent of total export earnings per annum must also be collected from commercial aquaculture farm owners, and used for rejuvenation of coastal ecosystem. The wastewater treatment system including sediment control with reuse and recycle must be installed by all units. The smaller units can form a cooperative, and treat water through common effluent treatment plant. The aquaculture units must be closed down if the wastewater treatment system including sediment control is not functioning to its design efficiency.

A strict vigilance by the State Department of Fisheries and Pollution Control Board is required to keep a check on pollution abatement measures. It may be mentioned that even a small, one ha shrimp farm can be tailored to function on any mode of production, i.e. modified-extensive; semi-intensive and intensive. Therefore, strong control measures for production and pollution (wastewater and sediments) are essential.

Water (from sources such as creek, estuary or sea) cess must be charged from the shrimp farm owners.

Cultivable lands must not be converted for aquaculture. There is a perceptible difference between cultivable and not cultivated land. Thus, even if aquaculturist buys agricultural land and keeps them fallow for say 2 or 3 years, that does not mean that the land has become non-cultivable. Currently almost all the farms that exist are cultivable lands except those in Midnapur District (7 aquafarms in wastelands). Even those farmers who do not sell their land to prawn farm owners, are affected due to lack of drainage from paddy fields which in turn causes flooding of the crop during rainy season.

The location of shrimp farms in Midnapur District on wasteland developed by the Department of Fisheries, Government of West Bengal fulfils all scientific conditions except :

- CRZ guidelines for creeks

- Wastewater and sediment management practices, and

- Mode of operation which is mostly semi-intensive and intensive.

There are two commercial aquaculture units in the State of West Bengal, viz., M/s Sundarban Aquatic Farms Ltd., and M/s Index Port Ltd., which are violating the regulations of MEF dated 19-2-1991 as discussed hereunder :

M/s Sundarban Aquatic Farms Ltd : Conversion of agricultural land and traditional fish farm, and destruction of mangrove plantation have taken place. In addition, this farm falls within 500 m from HTL. Further, CRZ regulations for location of aquaculture farm near the creek have also been violated.

M/s Index Port Ltd. : Conversion of agricultural land and traditional fish farm have taken place. Groundwater has become saline around the farm. Shrimp farms are not well designed resulting in seepage. Barbed wire fencing has restricted free access to farmers, fishermen and cattle to the creek. In addition, CRZ regulations for location of aquaculture farm near the creek have also been violated.

No treatment facilities have been provided by both the farms.

It is necessary to review the World Bank aided projects and commercial shrimp farms in and around Chilka Lagoon, keeping in view the MEF norms dated 19-2-1991 in the State of Orissa, viz.

Narendrapur project must be abandoned as it is within the National Park. Also the existing commercial farms in operation must be closed down.

Bideipur project requires EIA studies. Several farms have come up on the other side of the saline dyke which must also be included for evaluation in the EIA studies.

Jagatjore-Banspada project is within 500 m HTL. Farmers, fishermen and cattle earlier had free access to the nearby creek, which has been limited to a great extent due to the commercial shrimp farming activity. Also indiscriminate cutting of mangrove bushes has been reported. This project must, therefore, be reviewed critically keeping Bhitar Kanika Wild Life Sanctuary in view.

The commercial shrimp farms in Chilka Lagoon must be abandoned keeping in view the ecological condition of the lagoon and also the location of National Bird Sanctuary.

7.2 West Coast

MEF's norms for location of aquaculture farms and hatcheries have been violated at many places in the States situated on west coast of India.

The current practice of installation of coastal aquaculture farms within 500 m HTL violates the fundamental right and livelihood of people in the coastal States.

The States of Kerala, Karnataka, Maharashtra and Gujarat have neither formulated nor adopted any guidelines in consonance with CRZ Notification, Ministry of Environment and Forests (MEF), Government of India for scientific control and management of the shrimp farms in the respective States. These States must formulate and adopt legislative Acts for proper management and regulation of existing shrimp farms in the respective States.

The State Government of Goa has enacted a bill dated 17-11-1994 in order to regulate, promote and manage the shrimp farms in this State, in a scientific manner. However, this bill is not in consonance with the MEF notification dated 19-2-1991 as it allows the construction of aquaculture units within 500 m of HTL of the sea. The bill is limited to the guidelines pertaining of the allotment of lands for the entrepreneurs.

The cost of eco-restoration of the coastal fragile area must be borne by the individual entrepreneur of the commercial aquaculture farms in keeping with the Polluter Pays Principle.

No commercial coastal aquaculture activity should be undertaken even beyond 500 m HTL unless a comprehensive and scientific environmental impact assessment (EIA) study has been conducted by the entrepreneur, and the environment management plan (EMP) approved by the respective State Department of Environment, Pollution Control Board, Shore Development Authority, and also by the Ministry of Environment and Forests.

Commercial aquaculture farms are planned to be installed near the cultivated lands in all the States of west coast. Salt water from the farms results in damage to the productivity of the adjoining lands.

Groundwater also gets contaminated due to seepage of impounded water from the aquaculture ponds.

Desertification of cultivable land can result in increased saline intrusion on west coast.

Due to commercial aquaculture farms, there is a loss of :

- mangrove ecosystems,

- casuarina plantations,

- grazing grounds for cattle,

- potable water to contiguous population,

- fish catch,

- fishing nets,

- agricultural produce,

- economic loss due to non-approachability of fishermen to seashore directly.

The designs of the aquaculture farms are inadequate. No provision has been made for wastewater treatment facility enabling recycling and reuse of wastewater.

Prohibition on conversion of agricultural lands and salt farms into commercial aquaculture farms must be enforced with immediate effect.

Wild seed collection from creek and sea must be prohibited. Seed must be procured from hatcheries.

An eco-restoration fund must be created by collecting the stipulated fees from the owners of aquaculture farms. In addition, one per cent of total export earnings per annum must also be collected from commercial aquaculture farm owners and used for rejuvenation of coastal ecosystem with special reference to plantation of mangroves and common ecosensitive zones. The wastewater treatment system with reuse and recycle must be installed by all units. The smaller units can form a cooperative and treat their water through common effluent treatment plant. The aquaculture units must be closed down if the wastewater treatment system is not functioning to its design efficiency.

Drainage canals must be constructed around the existing ponds to collect seepage from the pond which will prevent the intrusion of saline water into the adjoining agricultural fields and residential areas. The design and construction of the drainage canal/bund must be undertaken scientifically based on the topographical features of the area. This will avoid the flooding of the area with saline water, and will help in restoration of hygienic and sanitary conditions in the nearby residential areas."

The two NEERI Reports clearly indicate that due to commercial aquaculture farming there is considerable degradation of the mangrove ecosystems, depletion of casuarina plantations, pollution of potable waters, reduction in fish catch, and blockage of direct approach to the seashore. Agriculture lands and salt farms are being converted into commercial aquaculture farms. The groundwater has got contaminated due to seepage of impounded water from the aquaculture farms. Highly polluted effluents are discharged by the shrimp farms into the sea and on the sea coast.

32. A report titled "Expert Committee Report on Impact of Shrimp Farms Along the Coast of Tamil Nadu and Pondicherry" has been placed on the record. Justice H. Suresh, a retired Judge of the Bombay High Court and A. Sreenivasan, Joint Director of Fisheries (retd.), Dr A.G.K. Menon, an Ichthyologist, Mr V. Karuppan, IAS (retd.), Dr M. Arunachalam, Lecturer, Centre for Environmental Sciences, Manommaniam Sundarauar University, Tamil Nadu and Dr K. Dakshinamoorthy, a medical surgeon constituted the "expert committee" (Suresh Committee). Although the investigation by the Suresh Committee was done at the instance of "complaint against shrimp industries" but keeping in view the status of the Committee members and the factual data collected and relied upon by the Committee it would be useful to examine the same. The Suresh Committee visited various villages in Tamil Nadu and Pondicherry and gave its findings based on the evidence collected by the Committee. Some of the findings of Suresh Committee are as under :

> "The farmers of Perunthottam told us that they have sold nearly 140 acres of their own lands to the Bask Company and 40 acres to the Bismi Company. Evidence was also given to us showing in the lands purchased by Bask Farms, where three or two crops were being cultivated. It also revealed that the percentage of yield was as much as 60%. Details regarding this are found in Annexure 15. The Bismi Company has erected a pipeline till the boundary of the farm for draining sea water. It is yet to be connected to the sea.

The Bask Company is situated at a distance of 150 m from the Scheduled Caste households. Bask Aqua Farm is situated within 500 m from the sea and the distance of Bismi Aqua Farms is just 25 m from the sea. During our visit, we found Bask Farms engaged in construction of prawn farms on agricultural lands that had been purchased (Photos Nos. 23 and 24) ... Representative of Perunthottam Village also shared before the Expert team that the yield obtained from the fields adjacent to prawn farms were affected. Moreover the villagers have lost their access to potable water as the water tables have become alkaline due to the seepage of sea water from the prawn farms. Bask farms have been using groundwater for nearly two years' crop. The Managing Director confirmed this before the Expert team."

The Committee visited Pichavaram Vedaranyam on 13-7-1995/15-7-1995 and observed as under :

"It was observed that the palmyran trees in this area which is the most drought-resistant tree has dried after the onset of prawn farms in this area. Majority of the coconut trees have dried up and few remaining have stopped yielding fruits.

The unanimous opinion of the people is that most of the mangrove species are on the decline. These mangroves serve as a source of fuel wood for domestic purposes, grazing ground for animals, waterway for locals and tourists and an important habitat for fisheries are increasingly polluted because of the effluent discharged by the shrimp farms. They also brought to our notice the greater value of the mangrove as a stabiliser of the coast and how, because of this being disturbed by the destruction of the palmyran, coconut and casuarina groves, coastal erosion has become common."

Regarding visit to Pudhupettai, the Committee stated as under :

"We visited Pudhupettai on 14th July in order to get a first-hand knowledge about the impact of Farisa Aqua Farm details of which were narrated by the Pudhupettai representative to the Expert team on 13th July at Nagai. We saw the pucca construction of the Farisa farm's jetty into the sea to enable the pumping of the sea water. This clearly is acting as a hindrance for the free mobility of the fishing community and their access to sea and land. ... All these three farms are situated within 25 m from the sea. Further these farms are closely situated to the dwelling houses also. Coastal Enterprises is situated at a distance of 20 m, the Farisa Aqua Farm at a distance of 250 m and Blue Base Aqua Farm at a 20 m from the dwellings of Perumalpettai the next fishing village from Pudhupettai. There is a fourth enterprise namely Abhirami Aqua Farms which owns about 150 acres of wetland has not commenced work as yet. ... Pipes have been laid to discharge effluent either to the sea, or adjoining dry lands belonging to the village or to the water channel used by villages for bathing. Effluent is also being discharged close to the dwelling houses. In particular, 'effluent is being collected right in front of my house' said Kalvikarasi a resident of Pudhupettai Village who made a representation to the Expert team on July 13th. She said that 'Drinking water in the village is now turning salty'. ... The advantages of shore seine net fishing is the abundant catch of "Anchovy" fish which has commercially viable market. The construction of permanent jetties has eliminated the 'shore seine net fishing. Shore seine net fishing needs uninterrupted coastline and it has become an impossibility in Pudhupettai. About 10 shore seine nets are idle in the village. The construction of pipe to discharge effluent is a permanent one. By construction of the permanent jetties, the natural sand dunes in the village were destroyed. These sand dunes are a natural cyclone barrier. Hence a threat of cyclone is imminent since these natural cyclone barriers are destroyed.

> The construction of pipelines ending in the sea for pumping in sea water has damaged nearly 10 nets worth Rs. 60,000. Details of nets damaged is given in Annexure 19. The Coastal Enterprises Ltd. has encroached upon the burial ground of Pudhupettai and Blue Base Aqua Farms has encroached upon the burial ground of Perumalpettai."

The Committee visited the Pulicat Lake area on 16-7-1995. The findings of the Committee are as under :

> "Ecologically the Tamil Nadu part of Pulicat Like is important since it has the only opening of the lake into the sea thus functioning as the migratory route of these spawning animals like prawns, fish and mud crabs. The mud flats of Pulicat Lake harbour a number of winter migratory birds. We were told that the water fowl sanctuary at Pulicat is slowly being destroyed. ... We observed that prawn farms are located all around the wetland. In the northern region of the lake prawn farms are situated even in the lakebed. Maheshwari Export India Ltd. is constructing a prawn farm across the Pulicat lakebed, clearly violative of the Tamil Nadu Aqua Culture Regulation Act. We also noticed water being pumped out from the lake into the prawn farms.
>
> According to Dr Sanjeeva Raj, Pulicat Lake has two bird sanctuaries namely Yedurapattu and Nelapattu. It is estimated that nearly 10-15 thousands of Flamingoes and other rare birds visit Pulicat Lake for four months only for feeding all the way from Rann of Kutch. Other water birds like Pelicans, Cormorants, Egrets and Herons breed at Nelapattu and feed at this Pulicat Lake. At Yedurapattu, Painted Storks, Pelicans, and Upon Bills also feed here. In 1993 it was estimated that there were 10,000 to 15,000 Flamingoes. By 1994 this has been reduced to less than 1000. The reason for this can be attributed to the effluent from prawn farms which kills the organisms on which the Flamingoes feed. The depletion of natural feed could have caused this reduction. ... The Tamil Nadu Forest Department is establishing a third sanctuary in the southern tip of Pulicat Lake. We were told that due to the noise of oil engines, bulldozers and other disturbances by the prawn farms many birds especially Painted Storks have deserted this lake.
>
> Dr Sanjeeva Raj also states that Pulicat is ecologically very sensitive and fragile. The east coast is vulnerable to cyclones. With the hundreds of prawn farms along be coast excavating sand along the coastline every possibility existed for inviting the sea to enter and destroy the water table. Further, prawn farms destroy sand dunes and vegetation and in times of tidal waves sea water could enter in a big way.
>
> Further, Dr Sanjeeva Raj said that Pulicat Lake is fairly shallow with an average depth of about 1.5 m. It can be described as a saucer. The

pumping of water by aquafarms will result in an artificial drying up of the lake. Added to this the road from Sulurpet that has been constructed for reaching the Sriharikotta rocket launching site through the lake has obstructed free flow of water. It is generally claimed by the prawn farm owners that the land on the eastern side of the road is not the part of Pulicat Lake and hence prawn farms can be constructed. This is false as all this land area is part of Pulicat Lake. The tragedy is that if prawn farms are erected on the higher side of the lake, the effluent from the prawn farms will flow back into the lake causing serious damage to marine and estuarine biota. ... Pasiapuram Rajiv Gandhi Nagar has a dalit hamlet Edamani. This hamlet had a water tank which provided water to the nearby 35 villages. The source of water was the village groundwater. But due to the impact of the adjoining farm the water became saline making it unsuitable for consumption.

An eminent danger by the prawn companies is to the village called Jamila Badh. This village has 150 Muslim families (fishermen). They were originally living in the land on which the Sriharikotta Space Research Station is built. These families were relocated by the Government, promising jobs and providing free housing site near Pulicat Lake. They built their own huts at the cost of Rs. 5000 each. These huts today face serious flood threat since on both sides of the village two prawn enterprises have obstructed Ponneri Lake water to flow into the sea. This obstruction due to the construction of prawn farms floods the village. From 1991 till date every year water reaches the boundary of the village and before it could enter inside nearly 2000 village people manually divert the water to the sea. Though the village people have made representation and protested to the owners, they use their economic and political power to scare the fishing people and make them live in a permanent state of fear. People also told us that they are affected by itching, scabies, and fever which could be due to the discharge of effluent."

The Committee's observations regarding Karaikal District, Pondicherry are as under :

"As quoted by the Pondicherry Science Forum, 'Karaikal region has only 20 kms of coastal stretch. This coastal stretch is of environmental significance as the area and its environs have creeks and lagoons, beaches with dunes, coastal plains, natural reeves, flood plain and is also the tail end of the Cauvery river basin. Karaikal is considered as the granary of Pondicherry and has main irrigation canals like Nini Kattalai Pidari Kattalai and Arasapuram'.

The groundwater reserves of Karaikal are frightfully meagre but for the only sweet water aquifer at about 10 to 20 feet deep there is no other potable aquifer. This water source cannot be exploited continuously since

it takes time to recharge and poses danger of sea water intrusion. Only manual hand pumps are being used to tap this water at present.

It is in this context Karaikal is posed with the serious danger of losing this sweet water aquifer as most of the small prawn farms are in the process of deriving water during the high tides from the rivers like Mullaiyar, Thirumalairayananar, Arasalar Nandalar and Pravidayanar and also use groundwater for shrimp culture. This continuous withdrawal of freshwater will alter surface water resources. So, there is no possibility for the recharging mechanisms as the wetlands near these river basins are converted to aquafarms and these wetlands have lost their function of absorbing rain water and recharging the aquifer zones."

The conclusions reached by the Suresh Committee under various headings indicating the impact of shrimp culture farming on environment are reproduced hereunder :

"(a) Effluent Pollution

As shrimp culture using high protein feeds is a highly polluting activity, presently 78,000 tonnes feed is used in India in shrimp culture. This is bio-degradable, if properly treated. It leaves behind responded solids (organic) and the decomposition liberates inorganic N and P. 77.5% of N and 86% of P from the feed are worked and enter the pond environment. 1 ton of P. monodon production results in a pollution load of 56.3-48.1 kgs N and 13.0-24.4 kgs P. (Phillips et al 1993, ICLARM. Conf. Proc. 81 1/1 198).

Excess amounts of P and N are detrimental to environment [Rumseg 1994 SACMONID XVII (4) : 10-14]. These lead to 'hyper eutrophication' resulting in massive algal blooms and oxygen depletion which are harmful to aquatic life. These blooms such as 'Red tide' cause fish mortality. The effluent quality during harvesting the shrimp pond is : total nitrogen 1900-2000 ppm, total 0 40-110 ppm and organic carbon 7.3-13.7 ppm. The impact of this is the reduced oxygen, hyper nitrification, alteration of community structure, sedinextation, changes in besithic communities etc. (Phillips et al 1993).

Further 'Self-pollution' results from feed wasted, which becomes unmanageable (Imre Csavas 1994. Shrimp News International, March-April 1994). Organic wastes, solid matter, dissolved metabolites like ammonia, carbon dioxide are produced. Decomposing organic matter depletes oxygen from water. Admittedly being biodegradable the effluents consume oxygen and so denude the water of its oxygen. When there is oxygen deficit, fish avoid such low oxygen zones and move further away to oxygen saturated zones and when there is oxygen depletion fish die en masse. Fishing village near whose coast shrimp ponds have come up - fish

have become scarce and the artisanal fishermen have to go further away from shore to catch fish. Population of fish and their diversity decrease. ... With regard to farm effluents being treated and discharged into the sea and other water bodies, we did not see or hear about any such scientific process of effluent treatment having been set up by prawn farms. In M/s Bask Farms we were shown two partially dry sedimentation tanks. We saw untreated effluents from M/s Amalgam Shrimp Farm being discharged into the beach (not even into the sea causing degradation of the beach shore with dark brown, foul-smelling organic matter, which is a health hazard. The Joint Director, MPEDA itself has stated that most of the farms have not set up effluent treatment systems.

(b) Salinisation

The dominant species of shrimp cultured is Penaeus monodon, the tiger prawn and next comes the white prawn, P. indicus. Both are marine prawns. P. monodon grows best at salinities of 10-20 ppt (20% but tolerates slightly higher or lower salinities. P. indicus requires higher salinity 20-30 ppt. Thus sea water is the primary medium of growth. Sea water of salinity 85-86 ppt is taken into the ponds. The growing period ranges from 120-150 days. Sea water is periodically replaced. Sea water remaining in the pond for a long period seeps into neighbouring areas where agriculture is practiced and salinizes the soils which therefore lose their productivity for crops and become unfit for agriculture. Even assuring that the 500 m zonation is enforced it will not solve the problem of salinisation. Agriculture lands, inwards (towards inland) of shrimp ponds will become saline and the chain reaction will continue. ... Many shrimp industries assert that they are taking only sea water for shrimp culture and do not use groundwater. Sea water has a salinity around 35 ppt. It has mostly Penaeus monodon, the tiger shrimp. This needs a salinity in the range of 15-20 ppt for optimum growth. So the shrimp producers have necessarily to dilute it to bring down the salinity by adding freshwater. Let along groundwater, we have even seen river water being pumped near Poompuhar into shrimp ponds. ... Salinization is not only possible but has actually happened all over the world. The Bhagwathi Institute of Environment and Development, analysed numerous samples of water adjacent to shrimp farms in Sirkali Taluk, T.N. and found that in most of them chlorides exceeded the permitted limits even by over 100 times for e.g. 15265 mg/1 in drinking water source near Suryakumar Shrimp Co., Mahendrapalle. In Kurru Village, Nellore District, drinking water became saline after four shrimp farms were established and 800 people of this village had no drinking water (Vandana Shiva, 1994, 'Social and Environmental Impact of Aquaculture'). Dr Alagarswami, Director CIBA identifies salinization of drinking water, wells, dwelling units adjoining agriculture lands and aquifers as critical issues in Shrimp culture. (National Workshop on Transfer of Technology for sustainable

shrimp farming, M/s Swaminathan Foundation, Madras, January 9-10, 1995). Dr V. Gopalakrishnan, former FAO expert says 'salt water seepage problem appears to be genuine and such area should be avoided for establishing new shrimp farms' (Fish and Fisheries, Newsletter No. 4 January 1995). Dr Sanjeeva Raj noted that in Pulicat Lake, saltwater from prawn ponds was known to be seeping into drinking water tables (COPDANET NEWSLETTER winter 1994). ... We have noted the salinization of drinking water in Pudukuppam, Naicker Kuppam, Poompuhar, Perunthottam, Pudupet, etc. in Sirkali Taluk caused by large shrimp units and also in a very acute manner in Pattinamarudur, Tuticorin, VOC District which is sandwiched between two large farms viz. LTL and MAC Aqua Farms Ltd.

(c) Feed and Wastes

In a moderate 3 t/ha yield of shrimp, 4-6 t/ha feed is applied while for a yield of 5 t/ha it is 15 t/ha. The magnitude of putrescible organic matter from these wastes is enormous. Hence, the practice of discharging such effluents into common water bodies needs to be strongly discouraged because of the strongly polluting effect (Mackintosh, D.J. INFOFISH, International 6/92, 38-41). Feed wastes are more toxic than sewage and this is a sufficient ground for banning industrial shrimp culture. ... The Team found that Amalgam Marine Harvests was blatantly discharging the effluents into the foreshore narrow sandy beach at Pudukuppam. This has spoiled the aesthetic appearance of the beach. The area is dark brown in colour and foulsmelling. This will pose a serious hazard to public health. The wastes also enter 'Uppanar' stream hardly 5 m away from discharge point. This is illegal and affects the health of villagers. Settleable solids silt up the ponds and canals. Over-accumulation of detritus leads to profusion of protozoa, and ciliates, which cover the body of fish. Respiratory diseases, loss of appetite, black gill disease, shell disease, foul smell of internal parts, tail rot etc. are caused by such unhealthy pond conditions. The quality of effluents discharged into the environment are so poor that biological methods will not be sufficient to treat them. Most of the environmental troubles are caused by the industrial shrimp. The coastal zone used for culturing aquatic organisms is only a narrow strip on the continental shelf and on the low-lying flatlands. Hence the very fragile nature of the coastal ecosystem is getting destroyed.

(d) Fertilizers and Therapeutants

Large quantities of feeds are being used and fertilizer applications are generally minimal. Lime is regularly used but continued use of lime impoverishes the soil. It also hardens the soil.

However, it is the use of therapeutants that is highly destructive of the environment. A very incisive account of the use of drugs in aquaculture is available from P. de. Kinklein and C. Michael (INFOFISL International 4/92 : 45-48 1992) and an exhaustive report is provided by Fred P. Meyer, an authority on the subject. (Review in Aquaculture Sciences Ve 1 (4) : 693-710 1989). However the use of drugs has only aggravated the damage to environment. Sulpha drugs, Tetracyclines, Quinolones, Nitrofurans, Macrolids (for e.g. Erythromycin), Chloramphenicol, and dozens of similar drugs are in use. Organophosphorus compounds like Dichlorvas are also used. Formalin, malachite, green copper sulphate, quaternary ammonium compounds, lodophores, chloramine-I etc. are used as sanitizers.

Viruses cannot be treated by any of the drugs. Renibacterium SP is also resistant to drugs. Chemotherapy leads to transit of drugs and their long persistence. Rebase of drugs or their metabolites into the environment affects the non-target organisms. Use of steroids (Di-dehyl stilboestrol) to fatten shrimp in ponds has carcinogenic effect on humans. Use of Chloramphenicol has unpredictable risks for human beings. Effluent treatment and self-recovery are hampered by the drugs by suppressing saprophytic bacteria involved in purification processes. Soils accumulate drug residues.

(e) Loss of Mangroves and Biodiversity

We observed that removal or destruction of these important mangrove habitats for establishing shrimp farms is becoming increasingly common along the coast of Tamil Nadu. From the photographs (Nos. 40-45 showing the destruction of mangroves-bunds are already built), it is evident that there are several shrimp farms on the banks of Pitchavaram mangrove forests, a valuable habitat. For the farms, water intake from the habitat will lead to virtual dryness of the habitat and the loss of biodiversity in this valuable realm. It is evident that the consequences are felt by the existing farms (Palmyarh and coconut trees in nearby farms are withering - Photographs Nos. 46 and 47). The destruction of the mangroves (Photos Nos. 40-42) for shrimp farm will be a major cause for the loss of habitat diversity along the coastline of Tamil Nadu. We are going to lose a valuable gene pool and thus conservation of mangrove genetic resources from the activities of shrimp industry is a mater of primary urgency.

(f) Loss of Biodiversity in Cauvery Flood Plain and Delta

The stagnation of water in this lower reaches is due to the illegal damming at several places along the course and the obstruction of feeder canals and distributors to the main river. Once considered a best estuary and the delta

of Cauvery are now vanished (Photo No. 48 showing the ill-fated Cauvery). Also in the lower reaches in Nagai District, Tamil Nadu, low land drains regulator has been used for their effluent release (Photo No. 49) showing the block and the PWD feeder canals are either blocked by the farm owners or using as drainage for effluent release by Amalgam Marine Harvests Ltd. at Pudukuppam (Photo No. 50) from the farms. These canals and drains once used as a freshwater resource for bathing and rechargers for the wells for the fisherfolk in several villages now become saline because of the cessation of flow (example : Pudukuppam Village of Sirkali Taluk District; Pudupettai Village Tharangampadi Taluk). ... Seed collection of Penaeus monodon (tiger prawn) by children is a regular practice in these canals now. During their collection of seeds the children picked only the tiger prawn seeds and threw away all other shrimp and fish seeds, thus depleting the estuarine and coastal fishery resources. One child gets paise 0.10 for the tiger prawn seed and one earns about Rupees one hundred (Rs. 100 per day and 40-50 children are engaged in seed collection). This involves child labour and depletion of fishery resources and the loss of biodiversity in coastal and deltaic regions of Cauvery. Nursery grounds for shell and fin fishes are lost in this ancient river delta.

(g) Threatened Wetlands of National and International Importance

The marshy swamps of Vedaranyam are now as threatened habitats with the formation of shrimp culture all along the brackish water zones and in the marshy swamps. ... Another wetland of national importance, which is being threatened is Pulicat Lake. Report A (1992) by the Ministry of Environment and Forests, Government of India clearly stressed the need of conserving these wetlands of national importance. ... In the Government of India Report Pulicat Lake has been identified as an important lagoon (p. 8 of the Report). This fragile ecosystem has been under great threat by the industrial shrimp farming. In the main brackish water area, construction of bunds is going on (Photos Nos. 55 to 66). From the photographs it is evident that the marshy land with its typical marshy vegetation is the only area left and almost all the marshy areas are being lost because of the upcoming shrimp culture ponds. These areas of marshy vegetation act as spawning/nursery grounds for a variety of estuarine/marine invertebrates, and fishes. These areas also provide wildlife habitats to several migrant birds.

(h) impact on Agriculture

Dr Alagarswami, Director CIBA identifies 'indiscriminate conversion of agricultural lands into shrimp culture' as a critical issue. Most shrimp farmers in coastal areas have converted agricultural lands into shrimp ponds. More relevant is the fact that shrimp industry causes salinisation of crop lands. Sea water (Salinity around 35 ppt i.e. 35%) is pumped into the

shrimp ponds. The growing period is from 120-150 days. This long detention of saline water in the shrimp ponds seeps into the adjacent crop lands and salinizes them resulting in reduction of productivity or even barrenness. Then this 'Unproductive' land (so declared by the shrimp industries) is converted into shrimp ponds.

We are concerned that conversion of paddy fields to shrimp ponds is already adversely affecting local rice production. In all the places we visited in NOM District Pattinamarudur of Tuticorin, Pulicat of Chengai MGR Districts etc.; most of the shrimp ponds ar constructed on fertile agricultural land or on marginal lands whereon crop is raised. Owing to the recent shortage of Cauvery water (dispute between T.N. and Karnataka) the yield of crops has been affected. Taking advantage of this, shrimp industries have been buying up agricultural land through inducement, persuasion and high pressure on revenue authorities. Salinization of soil and water adjoining the shrimp farms is very well documented for Perunthottam Village. As per the cultivation record for land purchased by M/s Bask Farms we see clearly that the lands purchased were fertile agricultural lands with an average of two crops having a 60% harvest yield.

(i) Denial of Potable Water

'Nagai, Q.M. districts of Tamil Nadu, the erstwhile granary of South' is today threatened with pollution, ecological imbalance and land alienation because of the arrival of large number of private companies and transnational corporations that have been investing heavily in shrimp firms etc. (Mukul Sharma : Interpress service 11-11-1994). Drinking water in the vicinity of shrimp farms has become saline, wherever such farms were operated. Shrimp culture may increase salinity through facilitating the flow of saline water inland and discharge of saline effluent (Phillips, Kwei Lin and Beveridge 1993.) Water samples from 7 villages in Sirkazhi near the shrimp farms were analysed by Bhagwathi Environment Development Institute at Dindigul. It was found that the water from borewells and handpumps was unpotable (See Annexure). The villages affected were Mahendrapatti, Neithavasal, Pudukuppam, Eranyimedu, Keelaiyur, Thirunagari, Nirajimedu etc. This was also confirmed by the Bhartiya Mazdoor Sangh in Kurru Village. Nellore District where all the freshwater wells became saline and unpotable after 4 shrimp farms were established. The proof of this was the fact that the District Collector, Nellore ordered the supply of drinking water through tankers, to these villages. Dr P. Sanjeeva Raj (COPDANET NEWS LETTER winter 1994) also found that salt water from shrimp ponds seeped into drinking water sources. Dr Vandana Shiva, after visiting some villages recorded that 'shortage of drinking water and deterioration of its quality have resulted in the neighbourhood of shrimp farms'.

> Protection of groundwater sources may be viewed as non-tradeable capital, as once contaminated, they may prove impossible to rehabilitate. (Mark Evarard 1994).
>
> As per the study done by BEDI, water sample from a drinking water well in Naikarkuppam had a TDS of 2164 mg/1 and a chloride content of 993 mg/1 in addition to excessive quantities of Mg and Ca. Samples collected from a drinking water handpump near Shriram Shrimp Farm now Amalgam Farms had an exceedingly high TDS of 35778 mg/1, hardness of 7506 mg/l which is as bad as sea water. Unacceptably high Ca, Mg and sulphate were recorded. Another handpump near the same farm had a TDS of 1466 mg/l and a chloride content of 656 ppm which are unpotable.
>
> Drinking water from a handpump near the shrimp farm of Coastal Enterprises Ltd. had a TDS of 7694, chloride of 3879, hardness of 2470 mg/l and so was unpotable."

33. The three reports discussed above give a rather depressing scenario of the shrimp industry. While the production increases and export earnings of the industry are well publicised, the soil-economic losses and environmental degradation affecting the well-being of coastal population are hardly noticed. The traditional production systems are being replaced by more intensive ones. This has been encouraged by increasing demand from high income countries. Shrimp yield per hectare in many areas increased within a few years from an average 100 kgs/ha per harvest to an average of 1000 kgs/ha/crop for semi-intensive shrimp farms and to between 2000 and 10,000 kgs/ha/crop for intensive type of production. The social and environmental costs of the expending shrimp industry are closely interrelated. Pollution and other types of natural resource degradation induced by shrimp farming have been considerably, highlighted in the NEERI Reports and other material quoted and discussed by us. Social and environmental changes resulting from expending shrimp industry in coastal areas are largely due to the conversion into shrimp farms of the lands, waters and forests which were earlier dedicated to other uses. In fact, shrimp farms are developing at the expense of other agriculture, aquaculture, forest uses and fisheries that are better suited in many places for meeting local food and employment requirements. Intensive and semi-intensive types of shrimp production hardly seems to meet these requirements.

34. Mangrove forests constitute an important component of coastal ecosystems. They thrive in tidal estuaries, salt marshes and muddy coastlines. Conversion of mangrove to shrimp farms significantly reduces the natural production of wild capture shrimp as well as other fishes. Moreover, their production role for low-lying coastal regions is rapidly diminishing by their replacement by shrimp ponds. The Sundarbans, which constitute one of the biggest mangrove areas in the world, covered in the early 1990s about 12,000 sq kms in India and Bangladesh. In the West Bengal part of Sundarbans large mangrove areas have been replaced by the shrimp ponds.

35. The increasing need for land by shrimp entrepreneurs has meant a dramatic rise in land prices in many areas. After the installation of shrimp farms near village lands, prices rise astronomically. Local farmers can no longer afford to purchase land, while indebted farmers are tempted to sell their holdings. Much of the coastal land recently converted into shrimp farms was previously used for food crops and traditional fishing.

36. The United Nations Research Institute for Social Development in collaboration with the World Wide Fund for Nature International has conducted a study and published a report dated 19-6-1995 called 'Some Ecological and Social Implications of Commercial Shrimp Farming in Asia". The report is prepared by Solon Barraclong and Andrea Finger-Stich (the UN Report).

37. The UN Report gives the following picture regarding polluted waters and depleted fisheries :

> "Polluted waters and depleted fisheries : Shrimp farms use both sea and freshwater to replenish their ponds. This brings them into competition with other users of these water resources. In areas where commercial shrimp ponds have been constructed there is frequently insufficient freshwater left to meet customary needs for irrigation, drinking, washing or other household and livestock related uses, and water supplies may be contaminated, or both. Groundwater salinization has been reported in several places. This often means that people - most of the time women - have to bring water from more distant wells. In a village in Tamil Nadu (Nagai-Quaid-Millet District, Pompuhar region), for example, women have to walk two to three kilometres to fetch drinking water that previously was available nearby before the expansion of shrimp farms on about 10,000 hectares (Bhagat, 1994). In Andhra Pradesh, a case study conducted by Vandana Shiva reports that, in Nellore District, there was no drinking water available for the 600 fisherfolk of the village of Kurru due to aquaculture farms salinizing groundwater. She adds that 'after protest from the local women, drinking water was supplied in tankers' (Mukul, 1994). ... Local stocks of native fish and crustaceans are being depleted in many places because of the removal of mangroves which served as nurserybeds, and also as a result of indiscriminate overfishing of wild shrimp fry [over 90 per cent of randomly caught fry are often wasted (Gujja, 1994)]. Natural fisheries are also frequently damaged by pollution caused by overloads of nutrients, sediments and chemicals from shrimp farms. In another Indian coastal village, Ramachandrapuram, fishermen reported that the value of their average catch of shrimp used to be Rs. 50,000 per catamaran per month, but after one year of operation of nearby aquafarms their catch was ten times smaller (Mukul, 1994). In the Chokoria part of the Sundarbans of Bangladesh, fishermen report an 80 per cent drop in fish capture since the destruction of the mangroves and building of dykes for shrimp farming (Sultna, 1994). Frequently, fisherfolk protest because their traditional access to the coast has been

restricted or because stocks of wild crustaceans and fish have disappeared."

38. All the reports referred to by us clearly indicate that the expansion of modern shrimp ponds in the coastal areas has meant that local fishermen could only reach the beach by trespassing at great risk on shrimp farms or by taking a long detour. Local people have not only lost access to their fishing grounds and to their sources of riverine seafoods and seaweeds, but they also have to relinquish social and recreational activities traditionally taking place on their beaches. The UN Report gives the following picture regarding natural resource degradation as a result of shrimp farming :

> "In areas densely covered with intensive shrimp farms, however, the industry is responsible for considerable self-pollution and particularly for bacteriological and viral contamination. Each hectare of pond produces tons of undigested feed and# ##faecal wastes for every crop cycle. This induces the growth of phytoplankton, protozoa, fungus, bacteria and viruses (like the Vibrio group growing in shrimp# ##faeces and in large part responsible for the 1988 collapse of Taiwan's production) (Lin, 1989). The overuse of fertilizers and of veterinary and sanitary products such as antibiotics adds to the water pollution problem. It also contributes to the decreasing resistance of the shrimp stock. Where intensive shrimp farms are densely spaced, waste-laden water tends to slosh from one pond to another before it is finally discharged into the sea. Shrimp producers are extremely concerned about assured supplies of clean water as it is vital for their immediate economic returns.
>
> Large amounts of sedimentation in intensive shrimp ponds is posing serious disposal problems for shrimp farmers. From 100 to 500 tons of sediment per hectare per year are apparently accumulating. Since only some 10 tons of feed is used to produce about 5 tons of shrimp per hectare per year, this raises questions about where such incredible quantities of sediment come from (Rosenberry, 1994a : 42). Ponds are cleaned after each crop cycle and the sediments are often discarded in waterways leading into the sea, or they are sometimes used to build dykes. Their putrefaction inside and outside the ponds causes foul odour, hypernutrification and eutrophisation, siltation and turbidity of water courses and estuaries, with detrimental implications on local fauna and flora. ...
>
> Biodiversity Losses : The impacts of semi-intensive and intensive shrimp aquaculture on biodiversity ('the totality of genes, species and ecosystems in a region') are multiple. This is because of the land area they cover; the water they pollute; the water circulation systems they alter; the wild fish and crustacean habitats they replace; the risks they pose of disease transfer; the impacts of released raised shrimp on the genetic diversity and

> resilience of indigenous shrimp and possibly also their negative impacts on other native fauna and flora. ...
>
> Health Hazards : Health hazards to local populations living near or working in shrimp farms have been observed in several places. For instance, in Tamil Nadu (Quaid-e-Milleth District near Pondicherry) an approximately 1500 acre large shrimp farm has been reported to have caused eight deaths from previously unknown diseases within a period of two months following the installation of the aquaculture farm (Naganathan et al., 1995 : 607). There are numerous hazards to public health along the shrimp production chain from the farmers through the various processors to the often distant consumers. The workers employed on shrimp farms handle several potentially dangerous chemicals, and may be exposed to unsanitary working conditions."

According to the UN Report - intensive ponds have a maximum life of only 5 to 10 years. Abandoned ponds can no longer be used for shrimp and there are few known alternative uses for them except some other types of aquaculture. Apparently they can seldom be economically rehabilitated for other uses such as crop land. The extent of abandoned areas by the shrimp industry has been indicated by the UN Report in the following words :

> "After a production cycle of about four or five months, shrimp ponds under intensive use are cleaned and disinfected and the polluted sludge is removed and often disposed of unsafely. This treatment, however, does not usually suffice to maintain the ponds' productivity for more than five to ten years (Ibid., Annex III/12). Entrepreneurs then move to other areas because of pollution and disease. This mode of production has been called 'rape and run' (Csavas, 1994b). The altered milieu of these abandoned ponds inhibits the spontaneous regeneration of vegetation and their use for agriculture, forestry, other aquaculture or related fishing activities. These abandoned areas do not appear in worldwide estimates of areas used for shrimp farming, which for 1993 were estimated to include 962,600 hectares, of which 847,000 hectares were in Asia. In December 1994 these areas were estimated to have increased worldwide to 1,147,300 with 1,017,000 hectares in Asia (Rosenberry, 1993 and 1994). Globally, areas affected by the industry's practices over the last decade are probably at least one-third larger, or even more if the total infrastructures surrounding the ponds are accounted for."

The UN Report pithily sums up the "conflicts and externalities" as under :

> "A major portion of the conflicts arising from the expansion of shrimp farming are the result of environmental and social degradation that is not included in the costs of shrimp production. Where the industry assumes no responsibility for damages to other groups arising from its activities,

> economists call them 'externalities'. For example, abandoned ponds are usually virtually unusable for other purposes for indefinite periods without costly rehabilitation, which is seldom undertaken. Mangrove destruction, flooding of crops, salinization or pollution of land and water associated with the expansion of shrimp farming all affect the local people depending on these resources."

39. Alagarswami has divided the shrimp-farm technology into six types. We have already quoted the relevant paragraph 5.1.2 of the report. Although different experts have given different nomenclature to different types of shrimp farm technologies, we are of the view that the types indicated by Alagarswami in his report are based on the functioning of the shrimp culture industry in India and as such are acceptable. Keeping in view the NEERI Report and other material quoted and discussed by us, we are of the view that the traditional and improved traditional types of shrimp-farm technologies - defined by Alagarswami - are environmentally benign and pollution free. Other types of technologies - extensive, modified-extensive, semi-intensive and intensive - create pollution and have degrading effect on the environment and coastal ecology. Such type of shrimp farms cannot be permitted to operate.

40. We may refer to constitutional and statutory provisions which mandate the State to protect and improve the environment. Article 48-A of the Constitution of India states that "the State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country". Article 51-A of the Constitution imposes as one of the fundamental duties on every citizen, the duty to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures. The Environment (Protection) Act, 1986 (the Act) was enacted as a result of the decisions taken at the United Nations' Conference on Human Environment held at Stockholm in June 1972 in which India participated. The Indian delegation was led by the then Prime Minister of India. The Statement of Objects and Reasons to the Act is as under :

> "The decline in environmental quality has been evidenced by increasing pollution, loss of vegetal cover and biological diversity, excessive concentrations of harmful chemicals in the ambient atmosphere and in food chains, growing risks of environmental accidents and threats to life support systems. The world community's resolve to protect and enhance the environmental quality found expression in the decisions taken at the United Nations' Conference on Human Environment held in Stockholm in June 1972. The Government of India participated in the Conference and strongly voiced the environmental concerns. While several measures have been taken for environmental protection both before and after the Conference, the need for a general legislation further to implement the decisions of the Conference has become increasingly evident."

Sections 2(a), 2(b), 2(c) and 2(e) of the Environment Act are as under :

"2. Definitions. - In this Act, unless the context otherwise requires, -

(a) 'environment' includes water, air and land and the inter-relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property;

(b) 'environmental pollutant' means any solid, liquid or gaseous substance present in such concentration as may be, or tend to be, injurious to environment;

(c) 'environmental pollution' means the presence in the environment of any environmental pollutant;

* * *##

(e) 'hazardous substance' means any substance or preparation which, by reason of its chemical or physico-chemical properties or handling, is liable to cause harm to human beings, other living creatures, plants, micro-organism, property or the environment;"

Sections 7 and 8 of the Environment Act are as under :

"7. Persons carrying on industry, operation, etc., not to allow emission or discharge of environmental pollutants in excess of the standards. - No person carrying on any industry, operation or process shall discharge or emit or permit to be discharged or emitted any environmental pollutant in excess of such standards as may be prescribed.

8. Persons handling hazardous substances to comply with procedural safeguards. - No person shall handle or cause to be handled any hazardous substance except in accordance with such procedure and after complying with such safeguards as may be prescribed."

41. Section 15 of the Act makes contravention of the provisions of the said Act punishable with imprisonment for a term which may extend to five years or with fine which may extend to one lakh rupees or with both. If the failure or contravention continues beyond a period of one year after the date of conviction, the offender shall be punishable with imprisonment for a term which may extend to seven years. The effluents discharged by the commercial shrimp culture farms are covered by the definition of environmental pollutant, environmental pollution and hazardous substance. The NEERI Reports indicate that the effluents discharged by the farms at various places were in excess of the prescribed standards. Unfortunately, no action is being taken by the authorities under the Act.

42. Hazardous Wastes (Management and Handling) Rules, 1989 (the Rules) have been framed under the Act. Rule 2(i) of the Rules defines "hazardous wastes" to mean

categories of wastes specified in the Schedule appended to the Rules. Waste Category No. 12 under the Schedule to the Rules is as under :

> "SCHEDULE
>
> [See Rules 3(i), 3(n) and 4]
>
> Categories of Hazardous Wastes
>
> #----------Waste Categories Types of wastes Regulatory Quantities---------- ---------- 1 2 3----------Waste Category No. 12 Sludges arising from Irrespective of any treatment of wastewaters quality. containing heavy metals, toxic organics, oils, emulsions and spent chemicals and incineration ash."##

43. Rule 5 of the Rules makes it obligatory for every occupier generating hazardous wastes to obtain authorisation as provided under the said rule. Rule 5(4) requires the State Pollution Control Board not to issue any authorisation unless it is satisfied that the operator of a facility or an occupier, as the case may be, possesses appropriate facilities, technical capabilities and equipment to handle hazardous waste safely.

44. Mr Mehta has vehemently contended that the shrimp culture farms are discharging highly polluting effluent which is "hazardous waste" under the Rules. Mr Mehta relying upon the NEERI Reports and other reports placed on record has contended that none of the farms have obtained authorisation from the State Pollution Control Boards.

45. The Water (Prevention and Control of Pollution) Act, 1974 (the Water Act) has been enacted to provide for the prevention and control of water pollution and maintaining or restoring of wholesomeness of water. The Statement of Objects and Reasons of the Water Act, inter alia, state as under :

> "The problem of pollution of rivers and streams has assumed considerable importance and urgency in recent years as a result of the growth of industries and the increasing tendency to urbanization. It is, therefore, essential to ensure that the domestic and industrial effluents are not allowed to be discharged into the water courses without adequate treatment as such discharges would render the water unsuitable as source of drinking water as well as for supporting fish life and for use in irrigation. Pollution of rivers and streams also causes increasing damage to the country's economy."

Sections 2(j) and 2(k) of the Water Act are as under :

> "2. Definitions. - In this Act, unless the context otherwise requires, -

(j) 'stream' includes -

(i) river;

(ii) water course (whether flowing or for the time being dry);

(iii) inland water (whether natural or artificial);

(iv) subterranean water;

(v) sea or tidal waters to such extent or, as the case may be, to such point as the State Government may, by notification in the Official Gazette, specify in this behalf;

(k) 'trade effluent' includes any liquid, gaseous or solid substance which is discharged from any premises used for carrying on any industry operation or process, or treatment and disposal system, other than domestic sewage."

46. Section 25 of the Water Act provides that no person shall, without the previous consent of the State Board establish any industry, operation or process, or any treatment and disposal system which is likely in discharge sewage or trade effluent into a stream or well or sewer or on land. There is nothing on the record to show that the shrimp culture farm owners are even conscious of the statutory provisions which require them to obtain the necessary consent/authorisation from the Pollution Control Boards concerned.

47. There are other legislations like Fisheries Act, 1897, Wild Life Protection Act, 1972 and Forest Conservation Act, 1980 which contain useful provisions for environment protection and pollution control. Unfortunately, the authorities responsible for the implementation of various statutory provisions are wholly remiss in the performance of their duties under the said provisions.

48. At this stage we may deal with a question which has incidentally come up for our consideration. Under para 2 of the CRZ Notification, the activities listed thereunder are declared as prohibited activities. Various State Governments have enacted coastal aquaculture legislations regulating the industries set up in the coastal areas. It was argued before us that certain provisions of the State legislations including that of the State of Tamil Nadu are not in consonance with the CRZ Notification issued by the Government of India under Section 3(3) of the Act. Assuming that be so, we are of the view that the Act being a Central legislation has the overriding effect. The Act (the Environment Protection Act, 1986) has been enacted under Entry 13 of List I Schedule VII of the Constitution of India. The said entry is as under :

"Participation in international conferences, assessment and other bodies and implementing of decisions made thereat."

The preamble to the Act clearly states that it was enacted to implement the decisions taken at the United Nations' Conference on the Human Environment held at Stockholm in June 1972. Parliament has enacted the Act under Entry 13 of List I Schedule VII read with Article 253 of the Constitution of India. The CRZ Notification having been issued under the Act shall have overriding effect and shall prevail over the law made by the legislatures of the States.

49. This Court in Vellore Citizens' Welfare Forum v. Union of India [(1996) 5 SCC 647 : JT (1996) 7 SC 375], has dealt with the concept of "sustainable development" and has specifically accepted "The Precautionary Principle" and "The Polluter Pays Principle" as part of the environmental laws of the land. The relevant part of the judgment is as under : (SCC pp. 657-60, paras 10-14)

> "The traditional concept that development and ecology are opposed to each other is no longer acceptable. 'Sustainable Development' is the answer. In the international sphere, 'Sustainable Development' as a concept came to be known for the first time in the Stockholm Declaration of 1972. Thereafter, in 1987 the concept was given a definite shape by the World Commission on Environment and Development in its report called 'Our Common Future'. The Commission was chaired by the then Prime Minister of Norway, Ms G.H. Brundtland and as such the report is popularly known as 'Brundtland Report'. In 1991 the World Conservation Union, United Nations Environment Programme and Worldwide Fund for Nature, jointly came out with a document called 'Caring for the Earth' which is a strategy for sustainable living. Finally, came the Earth Summit held in June 1992 at Rio which saw the largest gathering of world leaders ever in the history - deliberating and chalking out a blueprint for the survival of the planet. Among the tangible achievements of the Rio Conference was the signing of two conventions, one on biological diversity and another on climate change. These conventions were signed by 153 nations. The delegates also approved by consensus three non-binding documents namely, a Statement on Forestry Principles, a declaration of principles on environmental policy and development initiatives and Agenda 21, a programme of action into the next century in areas like poverty, population and pollution. During the two decades from Stockholm to Rio 'Sustainable Development' has come to be accepted as a viable concept to eradicate poverty and improve the quality of human life while living within the carrying capacity of the supporting ecosystems. 'Sustainable Development' as defined by the Brundtland Report means 'Development that meets the needs of the present without compromising the ability of the future generations to meet their own needs'. We have no hesitation in holding that 'Sustainable Development' as a balancing concept between ecology and development has been accepted as a part of the customary international law though its salient features have yet to be finalised by the international law jurists.

Some of the salient principles of 'Sustainable Development', as culled out from Brundtland Report and other international documents, are Inter-Generational Equity, Use and Conservation of Natural Resources, Environmental Protection, the Precautionary Principle, Polluter Pays Principle, Obligation to Assist and Cooperate, Eradication of Poverty and Financial Assistance to the developing countries. We are, however, of the view that 'the Precautionary Principle' and 'the Polluter Pays Principle' are essential features of 'Sustainable Development'. The 'Precautionary Principle' - in the context of the municipal law - means :

(i) Environmental measures - by the State Government and the statutory authorities - must anticipate, prevent and attack the causes of environmental degradation.

(ii) Where there are threats of serious and irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

(iii) The 'onus of proof' is on the actor or the developer/industrialist to show that his action is environmentally benign.

'The Polluter Pays Principle' has been held to be a sound principle by this Court in Indian Council for Enviro-Legal Action v. Union of India [(1996) 3 SCC 212 : JT (1996) 2 SC 196]. The Court observed : (SCC p. 246, para 65)

'... we are of the opinion that any principle evolved in this behalf should be simple, practical and suited to the conditions obtaining in this country'.

The Court ruled that : (SCC p. 246, para 65)

'... once the activity carried on is hazardous or inherently dangerous, the person carrying on such activity is liable to make good the loss caused to any other person by his activity irrespective of the fact whether he took reasonable care while carrying on his activity. The rule is premised upon the very nature of the activity carried on'.

Consequently the polluting industries are 'absolutely liable to compensate for the harm caused by them to villagers in the affected area, to the soil and to the underground water and hence, they are bound to take all necessary measures to remove sludge and other pollutants lying in the affected areas'. The 'Polluter Pays Principle' as interpreted by this Court means that the absolute liability for harm to the environment extends not only to compensate the victims of pollution but also the cost of restoring the environmental degradation. Remediation of the damaged environment is part of the process of 'Sustainable Development' and as such the polluter is liable to pay the cost to the individual sufferers as well as the cost of reversing the damaged ecology.

The Precautionary Principle and the Polluter Pays Principle have been accepted as part of the law of the land. Article 21 of the Constitution of India guarantees protection of life and personal liberty. Articles 47, 48-A and 51-A(g) of the Constitution are as under :

'47. Duty of the State to raise the level of nutrition and the standard of living and to improve pubic health. - The State shall regard the raising of the level of nutrition and the standard of living of its people and the improvement of public health as among its primary duties and, in particular, the State shall endeavour to bring about prohibition of the consumption except for medicinal purposes of intoxicating drinks and of drugs which are injurious to health.

48-A. Protection and improvement of environment and safeguarding of forests and wildlife. - The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country.

51-A. (g) to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures.'

Apart from the constitutional mandate to protect and improve the environment there are plenty of post-independence legislations on the subject but more relevant enactments for our purpose are : The Water (Prevention and Control of Pollution) Act, 1974 (the Water Act), the Air (Prevention and Control of Pollution) Act, 1981 (the Air Act) and the Environment Protection Act, 1986 (the Environment Act). The Water Act provides for the constitution of the Central Pollution Control Board by the Central Government and the constitution of the State Pollution Control Boards by various State Governments in the country. The Boards function under the control of the Governments concerned. The Water Act prohibits the use of streams and wells for disposal of polluting matters. It also provides for restrictions on outlets and discharge of effluents without obtaining consent from the Board. Prosecution and penalties have been provided which include sentence of imprisonment. The Air Act provides that the Central Pollution Control Board and the State Pollution Control Boards constituted under the Water Act shall also perform the powers and functions under the Air Act. The main function of the Boards, under the Air Act, is to improve the quality of the air and to prevent, control and abate air pollution in the country. We shall deal with the Environment Act. In the latter part of this judgment.

In view of the above-mentioned constitutional and statutory provisions we have no hesitation in holding that the Precautionary Principle and the Polluter Pays Principle are part of the environment law of the country."

50. We are of the view that before any shrimp industry or shrimp pond is permitted to be installed in the ecology fragile coastal area it must pass through a strict environmental test. There has to be a high-powered "Authority" under the Act to scrutinise each and every case from the environmental point of view. There must be an environmental impact assessment before permission is granted to install commercial shrimp farms. The conceptual framework of the assessment must be broadbased primarily concerning environmental degradation linked with shrimp farming. The assessment must also include

the social impact on different population strata in the area. The quality of the assessment must be analytically based on superior technology. It must take into consideration the inter-generational equity and the compensation for those who are affected and prejudiced.

51. Before parting with this judgment, we may notice the "Dollar" based argument advanced before us. It was contended before us by the learned counsel appearing for the shrimp aquaculture industry that the industry has achieved singular distinction by earning maximum foreign exchange in the country. Almost 100 per cent of the produce is exported to America, Europe and Japan and as such the industry has a large potential to earn "Dollars". That may be so, but the farm-raised production of shrimp is much lesser than the wild-caught production. The UN Report shows the world production of shrimp from 1982 to 1983 as under :

#"TABLE 1 World Production of Shrimp---------- Thousands of metric tons----------Year Farm-raised Wild-caught Total----------1982 84 1652 17361983 143 1683 18261984 174 1733 19071985 213 1908 21211986 309 1909 22181987 551 1733 22841988 604 1914 25181989 611 1832 24431990 633 1968 26011991 690 2118 28081992 721 2191 29121993 610 2100 2710"----------##

It is obvious from the figures quoted above that farm-raised production of shrimp is of very small quantity as compared to wild-caught. Even if some of the shrimp culture farms which are polluting the environment, are closed, the production of shrimp by environmentally friendly techniques would not be affected and there may not be any loss to the economy specially in view of the finding given by NEERI that the damage caused to ecology and economics by the aquaculture farming is higher than the earnings from the sale of coastal aquaculture produce. That may be the reason for the European and American countries for not permitting their sea coasts to be exploited for shrimp culture farming. The UN report shows that 80% of the farm-cultured shrimp comes from the developing countries of Asia.

52. We, therefore, order and direct as under :

> 1. The Central Government shall constitute an authority under Section 8(3) of the Environment (Protection) Act, 1986 and shall confer on the said authority all the powers necessary to protect the ecologically fragile coastal areas, seashore, waterfront and other coastal areas and specially to deal with the situation created by the shrimp culture industry in the coastal States/Union Territories. The authority shall be headed by a retired Judge of a High Court. Other members preferably with expertise in the field of aquaculture, pollution control and environment protection shall be appointed by the Central Government. The Central Government shall confer on the said authority the powers to issue directions under Section 5 of the Act and for taking measures with respect to the matters referred to in clauses (v), (vi), (vii), (viii), (ix), (x) and (xii) of sub-section (2) of

Section 3. The Central Government shall constitute the authority before 15-1-1997.

2. The authority so constituted by the Central Government shall implement "the Precautionary Principle" and "the Polluter Pays Principle".

3. The shrimp culture industry/the shrimp ponds are covered by the prohibition contained in para 2(i) of the CRZ Notification. No shrimp culture pond can be constructed or set up within the coastal regulation zone as defined in the CRZ notification. This shall be applicable to all seas, bays, estuaries, creeks, rivers and backwaters. This direction shall not apply to traditional and improved traditional types of technologies (as defined in Alagarswami Report) which are practised in the coastal low-lying areas.

4. All aquaculture industries/shrimp culture industries/shrimp culture ponds operating/set up in the coastal regulation zone as defined under the CRZ Notification shall be demolished and removed from the said area before 31-3-1997. We direct the Superintendent of Police/Deputy Commissioner of Police and the District Magistrate/Collector of the area to enforce this direction and close/demolish all aquaculture industries/shrimp culture industries, shrimp culture ponds on or before 31-3-1997. A compliance report in this respect shall be filed in this Court by these authorities before 15-4-1997.

5. The farmers who are operating traditional and improved traditional systems of aquaculture may adopt improved technology for increased production, productivity and return with prior approval of the "authority" constituted by this order.

6. The agricultural lands, salt pan lands, mangroves, wetlands, forest lands, land for village common purpose and the land meant for public purposes shall not be used/converted for construction of shrimp culture ponds.

7. No aquaculture industry/shrimp culture industry/shrimp culture ponds shall be constructed/set up within 1000 mts of Chilka Lake and Pulicat Lake (including Bird Sanctuaries namely Yedurapattu and Nelapattu).

8. Aquaculture industry/shrimp culture industry/shrimp culture ponds already operating and functioning in the said area of 1000 mts shall be closed and demolished before 31-3-1997. We direct the Superintendent of Police/Deputy Commissioner of Police and the District Magistrate/Collector of the area to enforce this direction and close/demolish all aquaculture industries/shrimp culture industries, shrimp

culture ponds on or before 31-3-1997. A compliance report in this respect shall be filed in this Court by these authorities before 15-4-1997.

9. Aquaculture industry/shrimp culture industry/shrimp culture ponds other than traditional and improved traditional may be set up/constructed outside the coastal regulation zone as defined by the CRZ Notification and outside 1000 mts of Chilka and Pulicat Lakes with the prior approval of the "Authority" as constituted by this Court. Such industries which are already operating in the said areas shall obtain authorisation from the "Authority" before 30-4-1997 failing which the industry concerned shall stop functioning with effect from the said date. We further direct that any aquaculture activity including intensive and semi-intensive which has the effect of causing salinity of soil, or the drinking water or wells and/or by the use of chemical feeds increases shrimp or prawn production with consequent increase in sedimentation which, on putrefaction is a potential health hazard, apart from causing siltation, turbidity of water courses and estuaries with detrimental implication on local fauna and flora shall not be allowed by the aforesaid Authority.

10. Aquaculture industry/shrimp culture industry/shrimp culture ponds which have been functioning/operating within the coastal regulation zone as defined by the CRZ Notification and within 1000 mts from Chilka and Pulicat Lakes shall be liable to compensate the affected persons on the basis of the "Polluter Pays" principle.

11. The Authority shall, with the help of expert opinion and after giving opportunity to the polluters concerned assess the loss to the ecology/environment in the affected areas and shall also identify the individuals/families who have suffered because of the pollution and shall assess the compensation to be paid to the said individuals/families. The Authority shall further determine the compensation to be recovered from the polluters as cost of reversing the damaged environment. The authority shall lay down just and fair procedure for completing the exercise.

12. The Authority shall compute the compensation under two heads namely, for reversing the ecology and for payment to individuals. A statement showing the total amount to be recovered, the names of the polluters from whom the amount is to be recovered, the amount to be recovered from each polluter, the persons to whom the compensation is to be paid and the amount payable to each of them shall be forwarded to the Collector/District Magistrate of the area concerned. The Collector/District Magistrate shall recover the amount from the polluters, if necessary, as arrears of land revenue. He shall disburse the compensation awarded by the authority to the affected persons/families.

13. We further direct that any violation or non-compliance of the directions of this Court shall attract the provisions of the Contempt of Courts Act in addition.

14. The compensation amount recovered from the polluters shall be deposited under a separate head called "Environment Protection Fund" and shall be utilised for compensating the affected persons as identified by the Authority and also for restoring the damaged environment.

15. The authority, in consultation with expert bodies like NEERI, Central Pollution Control Board, respective State Pollution Control Boards shall frame scheme/schemes for reversing the damage caused to the ecology and environment by pollution in the coastal States/Union Territories. The scheme/schemes so framed shall be executed by the respective State Governments/Union Territory Governments under the supervision of the Central Government. The expenditure shall be met from the "Environment Protection Fund" and from other sources provided by the respective State Governments/Union Territory Governments and the Central Government.

16. The workmen employed in the shrimp culture industries which are to be closed in terms of this order, shall be deemed to have been retrenched with effect from 30-4-1997 provided they have been in continuous service (as defined in Section 25-B of the Industrial Disputes Act, 1947) for not less than one year in the industry concerned before the said date. They shall be paid compensation in terms of Section 25-F(b) of the Industrial Disputes Act, 1947. These workmen shall also be paid, in addition, six years' wages as additional compensation. The compensation shall be paid to the workmen before 31-5-1997. The gratuity amount payable to the workmen shall be paid in addition.

53. The writ petition is allowed with costs. We quantify the costs as Rs. 1,40,000 (Rupees one lakh forty thousand) to be paid by the States of Gujarat, Maharashtra, Orissa, Kerala, Tamil Nadu, Andhra Pradesh and West Bengal in equal shares of Rs. 20,000 each. The amount of Rs. 1,40,000 realised from the seven coastal States shall be paid to Mr M.C. Mehta, Advocate who has assisted us in this case throughout. We place on record our appreciation for the assistance rendered by Mr Mehta.