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A Detail Study of Whole Process of Coastal Aquaculture in Raigad District, Maharashtra, India

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Abstract: Due to the increasing population and industrialization in the coastal areas, the pressure on the coastal resources is expected to increase in future. Industrial development in the Konkan region has altered, disturbed and destroyed the coastal ecosystem as well as sensitive habitats of aquatic animals. One of the prime industries responsible for this disturbance is Aquaculture. Brackishwater aquaculture needs sea water and mud flat as a main source hence these activities are developed in the vicinity of estuaries. Also to construct the ponds for the farming, mangrove forests have been reclaimed which are the important to protect coastlines and are the important for the protection of biodiversity. This industry is expanding and changing the existing coastal ecosystem without considering the suitability and capacity of the coastal land. This uncontrolled development definitely causes a huge coastal degradation as well as threat and negative impact on the coastal environment and biodiversity. Thus, considering all these factors, the study aimed to analyse the process of aquaculture and to record the environmental impacts due to it. For this coastal region of Raigad district have been chosen as the area has higher extent of clustered aquaculture farms. It reveals that global efforts are needed to save environment as well as to promote the aquaculture in an eco-friendly and sustainable manner.

Key-words: Aquaculture, coastal shrimp farming, uncontrolled increase.

I. Introduction

Aquaculture is a type of agriculture which includes cultivation and marketing of aquatic organisms in enclosed ponds. It is the farming of aquatic organisms under controlled or semi - controlled conditions. It is considered to be the large-scale husbandry of rearing of aquatic organisms for commercial purposes. But it can be more than a potential means of reducing our need to import fisheries products. It has a potential to increase number of jobs and commercial fishing and is a source of protein for the future. All of these can be achieved effectively by aquaculture. The goal of aquaculture is to increase production with minimum input costs for getting higher profits.

Sea food or fisheries are intended for higher source of protein for world's growing population. Aquaculture is set to become an important source of sea food products and is already becoming an important factor in world's fish market. India ranked second place in Asia for the Aquaculture production and development. In spite of environmental damages due to improperly run aquaculture projects, practices like right management and precautions can help aquaculture farms to operate with minimal

environmental impact. Some government organizations are also supporting aquaculture activities i.e. MPEDA (Marine product development authority), CAA (Coastal Aquaculture authority), NFDB (The national fisheries development board), NBFGR (The bureau of fish genetic resources), SIFT (State fisheries department) etc.

Fish farming which is also known as aquaculture is one of the rapidly growing industries of the world (FAO, 2009). It has a potential to increase number of jobs and commercial fishing and is a source of protein for the future. All of these can be achieved effectively by aquaculture. In spite of environmental dangers due to improperly run aquaculture projects, practices like right management and precautions can help aquaculture farms to operate with minimal environmental impact. The reason behind aquaculture industry lagging behind other industries is that it is a relatively new industry, lack of new techniques and technologies and it is not environmental friendly.

II. Study Area

The area under study is Rajpuri and Mhasala creek and Adhe creek on Maharashtra coast. Mhasala creek is located on the southern shore of Raigad district and extends between 180 8' N and 180 15' N latitudes. The total length of this creek is 30km.The Mhasala creek is basically an arm of the main creek called Rajpuri creek. Rajpuri is a tidal creek system joined by river Mandad from north and Mhasala creek from south. Tidal water in Rajpuri and Mhasala creek penetrates upto Mhasala to a distance of 30 km. The entrance of Mhasala creek can be roughly identified near Turumbadi, whereas the entrance of the Rajpuri creek is 5km seaward of Dighi and Dande. The creek is bordered by mud and mangrove swamps on its seaward margin. The geomorphic map of the creek prepared from 1:50000 S.O.I. toposheet which shows the topographic positions and extent of various sedimentary environments in the creeks.

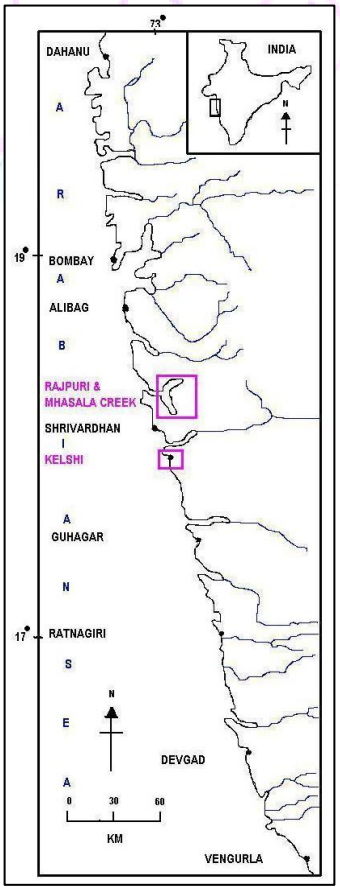

Fig. 1 Location Map

III. Database and Methodology

The objective of the present study was to study the technique of coastal fish farming. The study is carried out with the help of both primary as well as secondary data. Primary data is collected through field study and GPS whereas secondary data is collected through toposheet and satellite images. The basic data was collected directly from field from the in charge of that system. The assessment was done on the basis of field observations and interview of the personnel. All the ponds were surveyed one by one and information about prawns, their feed, growth and ideal environment required for them was collected. The study is based on intensive fieldwork, observations and information related to coastal fish farming in the study area has been recorded. The present study is based on literature searches and analysis of primary and secondary data gathered from satellite images, toposheet and field observations. To identify increasing aquaculture activities in the study area Landsat ETM 2004, 2005 and LISS III 2010, 2011 and 2014 satellite data sets are used. The survey of India (SOI) topographical maps 47 – B/15, 47 – F/3, 47 – F/4 with scale 1:50000 have been used. The map of that are was prepared from the location of each pond with help of GPS (Global Position System) and a map of the ponds was prepared. The instruments, which are used in the farming process, include clinometers, aerators, and instruments for measuring the dissolved oxygen and soil and water pH. In all three sites, namely Rowala, Majgaon and Vadawali, were studied from Mhasala creek area and one site was selected form Adhe creek near Kelshi.

The assessment was done on the basis of field observations and an interview of personnel. A questionnaire was prepared to know the exact process of aquaculture. Water and soil samples were collected from the farm and recorded in the field. Each pond was studied with the in charge of the each site and got detailed information about the culture process of prawn farming. Field location was marked by using GPS and map was prepared. Geomorphic map of the area was prepared in the field. Reactions and views of local people were noted.

Aquaculture process in the study area: The detail process of aquaculture activity has been studied to record the environmental impact. The process is as follows:

Table 1: GENERAL FARM DAILY REPORT

PARAMETERS	TIME OF READING	PONDS			
		1	2	3	4
Days	-	79	79	79	79
Temperature	6 a.m.	22	22	22	22
	9 p.m.	24	24	24	24
pH	6 a.m.	7.6	7.6	7.9	8.0
	9 p.m.	7.7	7.8	8.1	8.1
Dissolved oxygen	6 a.m.	4.3	5.3	4.8	5.9
	9 p.m.	5.2	6.0	6.3	7.5
Salinity	10 a.m.	34	34	34	34
Water color	10 a.m.	Gray Black	Gray Black	Gray Black	Gray Black
Water depth	10 a.m.	1.28	1.08	1.33	1.15
Water exchange	-	-	-	-	-
Feed code / type	-	3	3	3	3

Feed per day (kgs)	-	37.45	40.4	41.3	38.4
Cumulative feed	-	750.4	812.4	534.8	543.3
Fertilizers/ chemicals	6 a.m.	Fish oil	Fish oil	Fish oil	Fish oil
	10 p.m.	Liv.52	Liv.52	Liv.52	Liv.52
Remarks					

Table 2: NORMAL POND PREPARATION METHOD FOR SEEDING

DAYS	ACTIVITY
DAY 1	Application of Calcium Hydroxide (Lime)
DAY 2	Application of Calcium Hydroxide (Lime)
DAY 3	Application of Calcium Hydroxide (Lime)
DAY 4	Pumping up to 50 – 60 cms to all ponds. For example Pond 1 – 7
DAY 5	Pumping up to 50 – 60 cms Pond nos. 1 – 7
DAY 6	Pumping up to 50 – 60 cms Pond nos. 1 – 7
DAY 7	Draining
DAY 8	Draining
DAY 9	Draining and allowing to dry
DAY 10	Allowing to dry
DAY 11	Allowing to dry
DAY 12	Filling pond with water up to 80 cms (Pond no. 1)
DAY 13	Filling pond with water (Pond no. 2)
DAY 14	Filling pond with water (Pond no. 3) Apply bleaching powder to Pond no. 1
DAY 15	Filling pond with water (Pond no. 4) Apply bleaching powder to Pond no. 2
DAY 16	Filling pond with water (Pond no. 5& 6) Apply bleaching powder to Pond no. 3
DAY 17	Filling pond with water (Pond no. 7) Apply bleaching powder to Pond no. 4
DAY 18	Top up Pond no.1 Apply bleaching powder to Pond no. 5 & 6
DAY 19	Top up Pond no.2 Apply bleaching powder to Pond no. 7
DAY 20	Top up Pond no.3 Apply zeolite Pond no. 1 & 2
DAY 21	Top up Pond no.4 Apply biogreen Pond no. 1 , Apply zeolite Pond no.3
DAY 22	Top up Pond no.5 & 6 Apply biogreen Pond no.2 Apply zeolite Pond no.4
DAY 23	Top up Pond no.7 Apply biogreen Pond no. 3 , Apply zeolite Pond no.5 & 6
DAY 24	Apply biogreen Pond no. 4 , Apply zeolite Pond no. 7

IV. Detail process of aquaculture

Process of aquaculture includes following steps:

1. **Crack drying or cleaning of ponds: -** First and foremost process is pond drying and cleaning. This process includes uprooting unwanted shrubs form the pond area. This is called as “Crack drying”. This process required at least on month.

2. **Mineralization or supplement liming:** This is very important process in aquaculture as with the help of liming pH value will be maintained. Generally, 7.5 to 8.5 pH is needed. It depends upon the nature of region i.e. acid or sulphate region and upon the bottom of the pond. Soil pH is needed 6 to 6.5. But at the Rowala site there is a low pH problem. Soil pH is only 3 to 3.5. To increase pH sea water is

added into the pond water. This site also faces the problem of salination (35 ppt) which hampers the growth. To decrease pH gypsum is used and mixture of jaggary and rice floor is added in water. The process of mixing is called as "Fermentation" to increase pH lime is used.

3. **Filling water: -** In this process ponds are filled with water at high tide level and with the help of pumping all ponds are filled with water through the feeder channel. Feeder channel has net which prevents the entrance of other fish or aquatic organisms into the pond. At the time of water filling chlorination and bleaching is done to lessen the bacteria. If in rainy season water level increases then pumps are used to lessen the access water.

4. **Adding seeds for production: -** After pond is filled with water, seeds are added to the pond for prawn's production. In general practice seeds are stocked just before rainy season and hot summer are avoided for proper growth. After addition of seeds, careful attention is given with proper observation of their growth. Day to day pH of water and soil, prawns size and infection against diseases are checked. Generally for 1 sq.m 10 seeds are stocked.

5. **Food for prawns: -** Different types of foods are given to prawns depending on their size and days of culture. For feeding rope and boat feeding methods are used. Feeds are helpful for shrimp to regulate the digestive process, to improve utilization of feed, to reduce the incidences of diseases, to prevent bacterial infections leading to better survivability and farm efficiency, to stimulate immunity prevents stress and rejuvenates the growing shrimp to face environmental challenges to achieve optimum productivity. Different feed types include Probiofeed, Probiopond, Stimmune, Pond Dtox, Geomix etc.

6. **Blooming: -** In this process growth of planktons is increased to maintain water quality which automatically controls pH value. Planktons also provide natural feed to the prawns. Planktons along with algae avoid transparency of water thereby helping in the growth of prawns from environmental effects.

7. **Sampling: -** is done using check tray for checking the sizes of prawns. Area wise sampling is also done to check the health of prawns.

8. **Harvesting: -** is done using drain channel which has bag net to prevent the drain of the production. Prawns are then collected in trays and immediately transferred for freezing. Care is taken while handling prawns to prevent the prawns from damage. Standard weight of the prawns is 40 to 50 grams. If weight is less than 25 grams then those prawns are sold to highest bidder in local market. In harvesting only 80% production is achieved as 20% are losses due to diseases and infections, improper growth and death of prawns inside mud. White spot syndrome (WSS) is a viral infection of shrimp. The disease is highly lethal and contagious, killing shrimps quickly. The disease is caused by a family of related viruses.

9. **Processing and packing: -** includes checking the quality of prawn's that is bacterial infections in prawns, proper head neck alignment, checking of black spots on entire body, muddy smell from their body due to their burrowing nature. Packing of prawns which pass through above quality process. The companies like Naik sea food, Hostar, Casel roch are for packing and processing.

10. **Export: -** Finally prawns are exported to different countries.

GENERAL DESIGN OF AQUACULTRUE PONDS

PLATFORM USED FOR WALKING

FERMINTATION OF RICE FLOOR AND JAGGARY

ADDING MIXTURE OF RICE FLOOR AND

JAGGARY TO POND

FEED FOR PRAWNS

WORKERS WORKING IN THE FIELD

PONDWISE SEED STOCKING

1 Hector = 10,000 sq.m

1 sq.m. = 10 seeds or pieces

PRAWNS OF 80 DAYS GROWTH PERIOD

TRANSFFRING PRAWNS TO ANOTHER POND

CHECKING GROWTH OF PRAWNS WITH CHECK TRAY

V. Results and Discussions

Existing aquaculture activity in the region shows that the ponds should be rectangular because they are easy to build and little space is wasted between ponds and also for the proper aeration. Also ponds should not be very close to each other as due to closeness, organic pollution takes place. There should be slope towards the drain gate, as it helps easy draining of wastewater. The main chemicals used in this farming are lime and chlorine. The normal pond preparation method for seeding includes application of calcium hydroxide (Lime), Pumping of water, draining and pond drying, filling pond with water up to 80 cms, applying bleaching power, applying zeolite and biogreen and stocking etc.

In this farming, water and soil pH, dissolved oxygen, temperature, salinity, water depth and quantity of feed are important elements. Water pH is always maintained between 7.5 to 8.5. If it is less than 7.5, then the water is considered as acidic water. The acidity of water can be lowered by using agricultural lime. At night dissolved oxygen is low. It is increased by using the aerators. Aeration is the addition oxygen (O_2) to water. Low oxygen levels lead to poor growth of marine life so oxygen must be increased by the aerators. Water is normally replaced within 10 or 15 days. Temperature is very important element in the system because it affects the growth of aquatic organisms. It is about 22^0C to 24^0C at Adhe and Kanade farm project. The feed of the each day is governed by the feed of the previous day.

If the living medium (water) is polluted, the first victim is the cultured aquatic shrimp or fish, whereas an agricultural crop can grow well even if the surroundings are polluted. Aquaculture is therefore called a self – cleaning industry. No other farming can be as safe as aquaculture when it comes to producing food for human consumption.

The coastal aquaculture (Trident Aqua and Kanade Aqua Projects) are profitably managed projects. The average pond size is 1 hectare (10117.14 sq.m). The water level is 20 cm and water pH is maintained at 7.5. Their traditional production density is 5 per sq.m and professional density is 25 per sq.m. Normally within 140 to 150 days the growth of the prawn seeds are completed.

Fish farms are controlled and studied every day. All the water quality parameters such as temperature, salinity, dissolved oxygen, water depth, and fertilizers and checked at 6 a.m., 10 a.m., and 6 p.m., daily. If the dissolved oxygen is lowered it is increased by using the aerators. The level of the temperature is low in the morning and high in the evening. Very high temperature affects the prawn growth. Salinity is also increased by adding seawater and decreased by adding the freshwater to the pond. But in all of these advantages the main problem in coastal farming is the salinity of land when percolates in nearby agricultural lands or farms. All these problems are caused only due to the lack of proper awareness of failure of healthy management practices.

In the aquaculture initial investment is high but if maintained properly it will returns high monetary gain. Aquaculture with activities like agriculture, horticulture, dairying and poultry, aquaculture stands out strikingly in terms of eco-friendliness. This is because it deals with the most dynamic and sensitive environment on earth i.e. water, for very sensitive live animals and plants. Unlike the terrestrial plants and animals, aquatic animals are completely involved in the medium in which they live. The prawns involved in aqua farming suffer from disease like “White Spot”. If farmer fails to maintain a clean and hygienic environment of the ponds it drastically hampers the prawn producing thereby causing deaths of prawns and losses to the industry. Adoption of environmentally friendly technologies is only remedy for solving environmental problems caused by aquaculture.

VI. Suggestions

Aquaculture is one of the activities within the coastal environment, which has direct or indirect effect on the marine ecosystem and other resources. However, since aquaculture gives employment, it should be developed in the context of wise resource use and the environment. Following suggestions are recommended for the effective and sustainable development of aquaculture on Konkan coast:-

1. There should be proper selection of aquaculture site.

2. Master Plan is needed to be prepared.

3. Stocking of the seeds should be as per government rule and overstocking to be avoided.

4. Effective drainage system should form an integral part of farm with the provisions to remove harmful pollutants from the water before it is released into the nearby environment.

5. Specific areas for aquaculture should be allocated within estuary to develop aquaculture activity, considering the socioeconomic factors, environmental sustainability and environmental impact.

6. The use of mangrove areas for shrimp culture should be regulated.

7. Use of chemicals should be minimum.

8. Monitoring of the aquaculture systems by experts should be made mandatory to the aqua-farmers.

The ultimate goal should be the development of natural resource in a manner that ensures a sustainable increase in the level of social and individual welfare of local people.

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