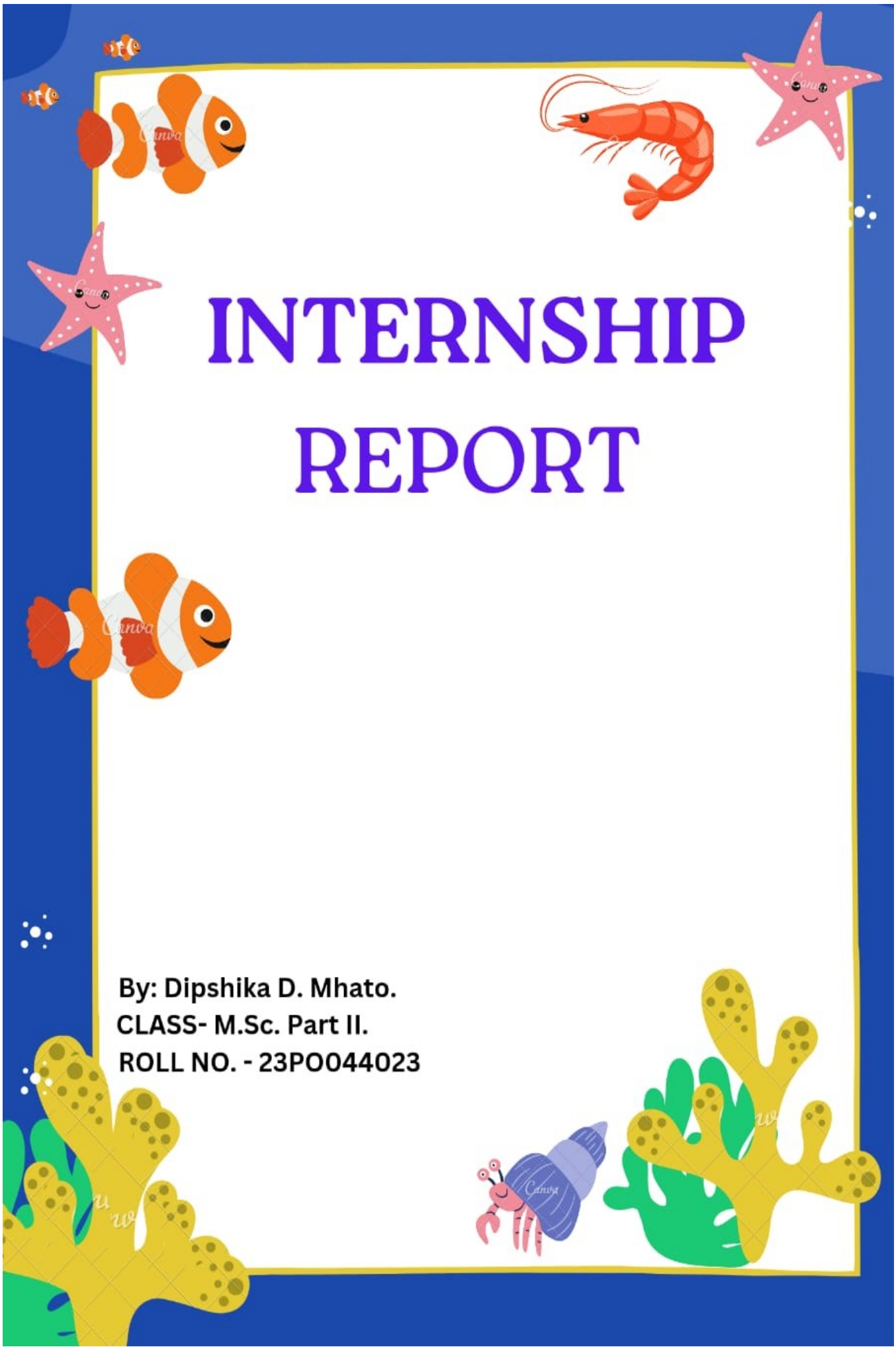

INTERNSHIP REPORT

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INTRODUCTION

Aquaculture: The farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants. Farming implies some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated, the planning, development and operation of aquaculture systems, sites, facilities and practices, and the production and transport.

Inland aquaculture produced most farmed fish (51.3 million tonnes, or 62.5 percent of the world total), mainly in freshwater, compared with 57.7 percent in 2000. The share of finfish production decreased gradually from 97.2 percent in 2000 to 91.5 percent (47 million tonnes) in 2018, while production of other species groups increased, particularly through freshwater crustacean farming in Asia, including that of shrimps, crayfish and crabs. In 2018, shelled molluscs (17.3 million tonnes) represented 56.3 percent of the production of marine and coastal aquaculture.

Fed aquaculture (57 million tonnes) has outpaced non-fed aquaculture, the latter accounting for 30.5 percent of total aquaculture production in 2018 compared with 43.9 percent in 2000, although its annual production continued to expand in absolute terms to 25 million tonnes in 2018. Of these, 8 million tonnes were filter-feeding inland-water finfish (mostly silver carp and bighead carp) and 17 million tonnes aquatic invertebrates, mostly marine bivalve molluscs.

Marine bivalves and seaweeds are sometimes described as extractive species; they can benefit the environment by removing waste materials, including waste from fed species, and lowering the nutrient load in the water. Culture of extractive species with fed species in the same mariculture sites is encouraged in aquaculture development.

As the demand for seafood has increased, technology has made it possible to grow food in coastal marine waters and the open ocean. Aquaculture is a method used to produce food and other commercial products, restore habitat and replenish wild stocks, and rebuild populations of threatened and endangered species.

There are two main types of aquaculture—marine and freshwater. NOAA efforts primarily focus on marine aquaculture, which refers to farming species that live in the ocean and estuaries.

SHRIMP FARMING

Farmed shrimp accounts for 55% of the shrimp produced globally. Most shrimp aquaculture occurs in China, followed by Thailand, Indonesia, India, Vietnam, Brazil, Ecuador, and Bangladesh, and it has generated substantial income in these developing countries. Farming has made shrimp more accessible to an eager, shrimp-loving public in the US, Europe, Japan, and elsewhere. Investors seeking profits have intensified farming methods with industrialized processes, sometimes at significant cost to the environment.

SHRIMP CULTURE AT ROSLYN FARM

I did my internship at Roslyn Farm which is located in Amona Village of Bicholim Taluka. In this farm, they culture white leg shrimp or *Penaeus vannamei*. The culture of this shrimp in Amona was started in 2018 and it is still practiced till date. The culture starts post monsoon and extends till late summer that is from January to May. The farm contains 9 big ponds of area 1 hector each. It uses brackish water which is taken from the nearby flowing river.

There are some advantages of *Penaeus vannamei* for which this species is being cultured.

- *Penaeus vannamei* has the potential to grow as fast as *P. monodon* (at up to 3 g/wk) up to 20 g under intensive culture conditions.
- They are amenable to culture at very high stocking densities of up to 150/m2 in pond culture, and even as high as 400/m2 in controlled recirculated tank culture.
- Tolerates a wide range of salinities, from 0.5-45 ppt, is comfortable at 7-34 ppt, but grows particularly well at low salinities of around 10-15 ppt.
- *P. vannamei* is very tolerant to low temperatures (down to 15°C) enabling them to be cultured in the cold season.

Roslyn farm's owner name is Mr. Anil Mahadev Sinari, who is residing in the same village. He is doing this business in his own property. According to him, culturing the shrimp is very profitable business if it is done with proper care and by following all the SOPs. The staff is very friendly and cooperative.

OBJECTIVE

To work as an intern for the shrimp farming project and to gain knowledge of the various parameters, methods and techniques for growing Penaeus vannamei, as well as various factors that affects the growth of shrimps and profit of this business in market.

METHOD

1. Site Selection

Selection for a suitable site is a critical activity and must be carefully determined before establishing of a shrimp farm. There are several factors involved during site selection.

A. **Topography and Climatic Condition:** Topographically, the best areas for shrimp culture are those with average natural ground elevations of about 1-3 m above mean sea level or at least 1 m above the highest high tide level to allow drainage and harvesting.
B. **Accessibility:** The farm must have good accessibility either by road or water, and communication systems throughout the year in order to facilitate supervision and transport of materials and products.
C. **Electricity:** Availability of relatively cheap and reliable power source is a major consideration in site selection. It is advisable to have a back-up electricity generator as a secondary power source.
D. **Security:** Areas free from security risks result in favorable working conditions, productivity and less extra costs.
E. **Availability of Labor and Other Factors**: The availability of labor, equipment and commercial feed and supplies ensure smooth operations and successful crop.
F. **Water Supply**: Site should have good pollution free water supply of both freshwater and brackish water. Water quality parameters required for maximum feed efficiency and maximum growth of Penaeus monodon are given below:

Water Parameters	Optimum level
Dissolved Oxygen	3.5-4 ppm
Salinity	10-25 ppt
Water Temperature	26-32 (°C)
pH	6.8-8.7
Total nitrite nitrogen	1.0 ppm
Total ammonia (less than)	1.0 ppm
Biological Oxygen Demand (BOD)	10 ppm
Chemical Oxygen Demand (COD)	70 ppm
Transparency	35 cm
Carbon dioxide (less than)	10 ppm

G. Soil Conditions: The type of soil is the most critical in site selection, since the shrimp will spend most of their time on the pond bottom during the culture period. Usually, clay or loam-based soil containing more than 90% clay and pH between 6.5-8.5 is preferable. Sites with sandy or silty soil should be avoided due to their porous nature that may lead to erosion, seepage of water and easy infiltration of waste into the soil.

2. Pond Construction

A shrimp pond should be designed according to the characteristics of the selected site and the culture system. There is no unique design, but optimum and functional farm layout plan and design should be based on the physical and economic conditions prevailing in the locality.

(i) Shape: The shapes of pond that are found to be effective for shrimp culture are rectangular, square and circular. A well-designed pond is one that would allow circulation of the water such that wastes will be accumulated at the center of the pond.

(ii) Size: Smaller ponds are easier to manage but the construction and operation can be costly. Ponds of 0.5-1.0 ha. are commonly used in intensive culture and 1-2 ha for semi-intensive culture.

(iii)Dikes: Earthen dikes, with or without lining, are found to be the most economical. Dikes should be designed to impound higher than 1 m depth of water and must be high enough to prevent flooding during the rainy seasons and the highest high tide.

(v) Gates for Inlet and Outlet: Each shrimp pond should have at least one gate for filling and draining water. However, a typical pond of 0.5-1 ha usually consists of two gates having similar structure for the inlet and outlet gates.

(vi)Waste Dumping Area; A shrimp farm should provide 5-10% of the area for dumping of the wastes. Wastes from the pond must be collected carefully and dumped into this area without discharging to nearby areas, which will contaminate the natural resources.

(vii)Buildings: Accommodation, storage, shop and guardhouses may be built in the farm as required. It is advised that accommodation for workers should be set up at various points around the farm for security purposes and to allow the ponds to be adequately monitored.

3. Pond Management

Pond Preparation: Before a pond can be stocked for a new crop, the excessive wastes, which accumulate in the pond during the previous crop, must be removed and the soil and water conditioned.

Pond Cleaning: The cleaning of a pond or removal of the wastes, especially the organic and phosphatic wastes that have accumulated in the pond bottom could be, accomplished by drying, liming and ploughing.

There are two methods for cleaning a pond according to the possibility of the pond to be dried:

Dry Method: This method is used when the pond bottom can be dried completely. The pond is drained and left to dry in the sun for a period of 10-30 days. Then the waste is removed, either manually or mechanically, and transported to the waste dumping area.

Wet Method; In areas where the pond cannot be dried completely, pressure washing can be used to flush out the wastes. This method takes a shorter time and is more efficient than the dry method. Flushing should be continued until the acid and dark anaerobic layer in the soil are removed.

Liming: Once the pond is cleaned, it is then filled with water and left overnight before flushing out to remove debris and elevate the pH. This process should be repeated until the pH of the water remains above 7, and only then the lime is applied. The types of lime to be used depend on the water pH. The lime requirement of a pond depends on the soil pH.

Eradication of Predators: After liming, the pond should be filled to the maximum depth through a screen with fine mesh to prevent the predators and competitors from entering the pond. These animals, including fish, crustaceans and some invertebrates, may compete for food, prey on the shrimp or carry diseases and parasites.

Fertilization: The pond must be fertilized with either organic or inorganic fertilizer to stimulate the plankton bloom in order to provide shade to the pond bottom and utilize the nitrogenous and phosphate wastes within the pond.

Aeration: A 0.5-1.0 ha pond would require, four aerators installed at the corners of the pond, approximately 3-5 m from the bottom of the dike and positioned at an angle

that will encourage the maximum water flow within the pond. The type of aerator to be used depends on the depth of the water.

5. Stocking

Seed selection: Selection of good quality seed for stocking into a pond is the first important step of the shrimp grow-out management. The following parameters should be taken into consideration in purchasing shrimp seed for stocking.

(i) Size; Seeds of PL 15-20, indicated by the appearance of 4-6 spines on the rostrum, are recommended for stocking in a pond. The healthy PL should have the muscle-to-gut ratio in the sixth abdominal segment of about 4:1 or the thickness of the gut should be about the thickness of the muscle.

(ii) Morphology: The post larvae should have normal appearance of trunk, appendages and rostrum. The abdominal muscle must be clear, no discoloration or erosion on any parts of the body, the gut should be full of food, and the muscle should fill the carapace.

(iii) Color: Post larvae with the presence of pigment cells in the uropods should be used since this indicates the stage of development. PL that will have high survival and growth rates will be light gray, brown to dark brown and black in colour. Signs of red or pink coloration are normally related to stress.

(iv) Behavior: Healthy seed swim straight, respond rapidly to external stimuli such as a tap on the side of the basin, actively swim against the current when the water is stirred, and cling to the sides rather than aggregate or be swept down into the center of the container when the current has subsided.

(v) External Fouling; Seeds should be free from external parasites, bacteria and other fouling organisms. The presence of these organisms indicates unhealthy conditions, which will affect growth and survival of the PL.

(vi) Pathogen Free: Seed should be checked for the presence of viral occlusion bodies. Seed with large numbers of occlusions indicate stress conditions and will not so vigorous in the pond.

Stocking Density: The stocking density between 10-20 PL/m2 is usually practiced in a semi-intensive culture. In an intensive culture, a well-managed pond with consistent good water quality can stock up to 25-30 PL/m2 at 1.2 m water depth and up to 40-50 PL/m2 at 1.5 m water depth or deeper.

Technique of Stocking: Proper stocking techniques will prevent unnecessary mortality of seed. The following methods have shown excellent results.

(i) Transportation: Seed are normally transported in plastic bags. The bags are usually filled up to 1/3 with water, oxygenated and then placed inside styrofoam boxes. If the transportation is longer than 6 hours, small bags of ice should be added into the boxes to reduce the water temperature and maintain it at 20-22oC.

(ii) Acclimation; To eliminate stress, the seed should be maintained in water of constant salinity for at least 1-week prior to transfer. The adjustment of salinity by about 3 ppt daily is advisable. Acclimation of seed to the water pH and temperature of the pond must be rendered upon arrival. Two common techniques are used for gradual acclimation of seed to the water conditions in the pond. The first method is accomplished by placing the seed and water from the transported bag into a tank at the side of a pond containing an equal volume of well-aerated pond water. The seed will be kept for 0.5-1 hr before being siphoned into the pond. The second method, the most favorable one, is to float the plastic bag in the pond until it has reached equilibrium. The bags are opened one by one and pond water is added gradually to an equal volume. After a further 30 min of acclimatization, the seed are released directly into the pond by distributing them throughout the area of the pond or into a nursing system. The actual numbers of seed at stocking can be estimated by counting the PL individually in 3-5 bags with a spoon or small net to attain the average number in each bag and multiplied by the total number of bags.

6. Feed and Feeding: Cost of feed constitutes a major part of the production cost and accounts for 50% to 70% of the total variable cost. The use of feeds will improve shrimp production and increase profits. The availability of nutrients from feeds depends on the type and quality of the raw material used, the formulation, the feed processing, feed storage conditions and the feeding management. Therefore, feed and feeding practices for semi-intensive or intensive shrimp farming require a basic understanding of nutrition and feed requirements.

7. Harvesting and Handling

Successful harvesting can be achieved if the shrimp can be harvested in good condition within a short period of time. The harvesting technique should not damage or excessively contaminate the shrimp with waste. Rapid harvesting will reduce the risk of bacterial contamination and the shrimp will still be fresh when reaching the processor.

Methods of Harvesting

Two methods of harvesting are generally practiced on farms. These are either by draining the pond and catching the shrimp in a bag net or by netting the shrimp within the pond.

For the first method of harvesting, ponds and outlets should be appropriately designed and be able to completely drain the pond within 4-6 hrs. A bag net should be able to be fixed to the outlet to collect the shrimp that are carried by the out flouring water. The best time for harvesting is early in the morning and it should be completed before mid-morning. In ponds that can only be drained at low tide, the harvest should be conducted whenever possible. The shrimp should be regularly removed from the harvesting bag in small quantities to prevent damage. When netting the shrimp within the pond, either a small electric net or a large seine net can be used. The water level of the pond should be reduced to 0.5-0.75 m deep and workers will need to go inside the pond for netting. This method is less advantageous the pond bottom will be disturbed, thus causing contamination of the shrimp. It is also slower and may take a long time to complete.

8. Timing of Harvesting and Selling

The timing of harvesting depends on the condition of the shrimp in the pond and also the market price. Shrimps are sampled by a cast net from different areas of the pond to determine their average body weight and general condition. The proportion of soft shell shrimp should not be more than 5% at the time of harvest. This proportion could be obtained by scheduling the harvest halfway between two moultings. The time of moulting is indicated by the presence of exuviae in the pond.

PICTORAL EVIDENCE

Ploughing on dry soil using tractor

Expose soil layer to sunlight

Liming process

Chaining process

Zooplankton / phytoplankton production

Set up for plankton production attached with aerietor

CONCLUSION

We the students of M.Sc. Zoology Part II, Goa University had to go for one month internship programme under the cluster system. So as my cluster is Aquaculture I had chosen to go for Shrimp Farming. I have completed my internship at Roslyn Farm which is situated in my own Village.

During the whole month, I got to learn many processes that are involved in shrimp culture practice. Actually, this culture requires 6-7 months for the whole process to get completed. But since we had only one month I could witness few processes which include ploughing the dry soil using tractor, than exposing that soil to dry for about 10 – 30 days in sunlight.

Once the pond is cleaned, the liming process was done. The lime was spread on the entire soil of each pond for the eradication of predators. Then water is taken in each pond with the help of water inlet pipe. Once the water has filled in pond again the wet liming process was done.

Next process which I had seen was fertilization of the pond. Both zooplanktons and phyto planktons were grown in the tank containing 200 litres of water. The tank was attached with the aerator for better growth of the planktons. They were grown in tank by using planktons powder, yeast, sugar, etc.

I got to learn different factors that affects the growth of shrimp such as various diseases which includes white mouth dieses, cotton shrimp, etc. they have even told me the ways to tackle them.

And lastly, it was cleared that shrimp farming can be very profitable business due to its high demand in the market. Any person with knowledge of aquaculture and with little investment can do high profit business if you do it with patience and by keeping all the required things in mind.